DETERMINANTS OF TELEHEALTH ADOPTION IN THE INDIAN HEALTHCARE DOMAIN: AN EXPLORATORY STUDY

A Thesis submitted by

Avijit Chowdhury

For the award of

Doctor of Philosophy

2021

Dedicated to

my parents

The late Mrs Benu Chowdhury

The late Professor Arun Kumar Chowdhury

&

my parents-in-law

Mrs Krishna Chatterjee

The late Mr Debabrata Chatterjee

**ABSTRACT**

India is a developing country with a large landmass and a huge socio-culturally, economically and ethnically diverse population. The healthcare system for such a diverse and complex country entails challenges and difficulties in execution and outreach. Here, the emerging area of telehealth could afford a place for itself in providing healthcare and health education to a large section of people residing in areas where there is an acute shortage of healthcare professionals. Almost seventy percent of the population in India are in rural areas. The infrastructure in India, similar to other developing countries, is erratic and differs throughout the country.

Similarly, the information and communications technology (ICT) infrastructure in India is developed in urban areas, whereas there are insufficient ICT facilities in rural areas. As telehealth depends on the utilisation of ICT infrastructure, it is essential to conduct a study to find out the determinants of ICT adoption in the Indian telehealth environment. Moreover, as evident from relevant literature, telehealth is in a nascent stage in India, with most of the projects currently at a pilot study level. As such, it would be practical to conduct the study from an organisational point of view because the organisational adoption of ICT will eventually foster the implementation of telehealth in the domain of Indian healthcare. The study focuses on developing a theoretical framework of ICT adoption in the Indian telehealth environment, as limited research has been conducted in this area.

This research study followed a three-step procedure to establish and confirm the determinants of telehealth adoption by healthcare professionals in India. The first step included an extensive literature review relating to telehealth and ICT adoption in healthcare domains worldwide and a review of technology adoption models relevant to healthcare domains. The literature review helped derive the relevant constructs of ICT and telehealth adoption in healthcare domains worldwide. Further, a preliminary conceptual framework was developed with the significant constructs that formed the base of the next step. The second step was a qualitative, in-depth, open-ended, semi-structured interview of Indian healthcare professionals based on the information and constructs derived from the literature review and the preliminary conceptual framework. The interviews helped refine the preliminary conceptual framework to

generate hypotheses and the research model, which was then tested in the third stage of the research. The third step was a paper and online mode survey generalising the healthcare professionals' perceptions, expert feedback and relevant literature over a large population, to help establish and confirm the constructs. Accordingly, twelve interviews were conducted in a few states of India and the perceptions of the healthcare professionals were later analysed to arrive at the research model to generate hypotheses. Further, the hypotheses were tested over a large population in a few states of India, through a survey, by statistical testing to establish, reject and confirm the significant constructs influencing telehealth adoption for Indian healthcare professionals. Appropriate ethical approvals were obtained in all stages of the research.

The qualitative interviews were first audio-recorded and later transcribed by the researchers. The transcription was then analysed in three stages of manual coding, Leximancer coding and NVivo coding to establish rigour and validity in developing the research model. Both deductive and inductive reasoning were followed in the qualitative analysis phase. The survey results were analysed with statistical software SPSS to test, establish, reject and confirm the constructs of the research model and find the relationship among the variables. Finally, SPSS-AMOS and Smart PLS were utilised to run the CB based and PLS based structural equation modelling to generate and validate the final theoretical framework of telehealth adoption in the Indian healthcare domain.

The results indicate that Healthcare Practices, Healthcare Facilities and Usefulness are the significant enablers or drivers of telehealth adoption by Indian healthcare professionals (HCPs). The barriers to telehealth adoption were found to be the lack of standardised guidelines, policies and procedures, which have been termed as State Leadership in this research. Further, State Leadership involves promoting the awareness of the inherent benefits of telehealth to remove the primary challenges of inaccessibility to healthcare facilities and deployment of uniform healthcare. This is particularly relevant for the rural and remote parts of India.

The rapid improvement in ICT infrastructure in developing countries can help overcome technology barriers. Further, a national standard for telehealth practice can open ample opportunities culminating in healthcare reform and transformation for better health outreach, access and health awareness development.

The most significant contribution of the research is that it identified the enablers (drivers) and the barriers to telehealth adoption in Indian healthcare. Governmental and non-governmental organisations can use the final theoretical framework to foster and implement telehealth, especially in rural and remote regions of India, where there is a lack of sufficient healthcare facilities and a shortage of healthcare professionals. Notably, this research identified that telehealth could be utilised in times of emergency and natural disasters where healthcare information can be disseminated quickly and efficiently for the initial assessment of the healthcare needs of the affected population.

The limitations of the research are that it tested the research model on healthcare professionals only. Further research can be conducted by governmental and non-governmental organisations on the patient-centric adoption of telehealth. Further, research on adoption perceptions of healthcare professionals and patients relating to specialised telehealth equipment, such as digital stethoscopes and health care applications on smartphones, can be conducted.

## CERTIFICATION OF THESIS

This Thesis is entirely the work of Avijit Chowdhury except where otherwise acknowledged.

The work is original and has not previously been submitted for any other award, except where acknowledged.

Principal Supervisor: Associate Professor Abdul Hafeez-Baig

Associate Supervisor: Professor Raj Gururajan

Student's and supervisors' signatures of endorsement are held at the University.

## ACKNOWLEDGEMENTS

I sincerely acknowledge the support, help and cooperation received by me while completing my PhD. I would especially like to thank and express my gratitude to my principal supervisor, Associate Professor Abdul Hafeez-Baig, who has constantly guided me in the right direction. His support and guidance will have an everlasting impact on my future journey. I would also like to thank and express my gratitude towards my associate supervisor, Professor Raj Gururajan, who always helped me at the right time, and without his help I could not have continued my PhD.

Special thanks to the editor of my thesis, Ms Elizabeth Cuskelly, who has done an excellent job editing my thesis. As a non-native user of English, her help was invaluable to me.

I also extend my thanks to Mrs Kathryn Schmacker, Senior Graduate Research Student Officer, GRS, for her timely help in administrative issues. I also extend my thanks to all the GRS, Library, ICT services, Administrative staff and other Academic staff members of USQ for their support.

I would also like to thank Dr Eddie Thangavelu, Learning Advisor, who provided valuable input during my COC and final thesis submission and helped me connect to my editor. I would like to thank Dr Salifu Yusif for his help in the initial phases of quantitative data analysis. I also extend my thanks to Associate Professor Derek Ong Lai Teik, who has provided valuable input for quantitative data analysis. I also extend my thanks to the panel members of my COC, Dr Xujuan Zhou, Senior Lecturer, Dr Subrata Chakraborty, Senior Lecturer, UTS, and Professor Patrick Danaher, for their valuable input during COC for progressing further in the research.

I express my special gratitude to Swami Atmeshanandaji of Vedanta Centre, Brisbane, who connected me to several participants and organisations. I would also like to respectfully remember Late Swami Varisthanandaji of RKMSH, Varanasi, who encouraged and helped with data collection. I also express my special thanks and regards to Dr Atul Singh, Varanasi, who invaluably helped me in collecting data. I also extend my thanks to Mr Chandan Chowdhury, who helped me in collecting data. I would also like to mention Dr Rahul Ganguly, Senior Lecturer, Charles Sturt University, for constantly encouraging and supporting me in my journey. Special thanks to Dr Dharini Krishnan for extending her help to conduct interviews. I would also like to thank Professor Mirza Akmal Sharif, Madina Teaching Hospital, Faislabad, for his valuable input and help.

I could not say more about my wife Madhumita, who constantly supported and stayed beside me all the time. I humbly acknowledge the support received from my mother-in-law; without her encouragement, doing my PhD would have been impossible.

I would like to thank and express my gratitude to Dr Hashem Abed Allah Sowan Al-Shurafat, Assistant Professor, The Hashemite University, Jordan, who constantly encouraged me in my journey as a friend and colleague. I would like to give special mention to Mr Mohammad Musaddiqul Haque, Mr Nafiz Ahmed, Dr Md Motiur Rahaman, Mr Rajan Dev Nath, Mr Bidhan Nath, Dr Vasundhara Rani Sood, Mr Vikas Sood, Master Vrishan Sood, Dr Srinivas Phani Kavuri and Mr Nirmal Acharya for support, encouragement and entertainment during this period. I also acknowledge Ms Bonnie Green as a wonderful colleague in my PhD journey. I thank Mr Abhishek Sharma for being a wonderful friend, colleague and fellow researcher from the Swinburne University of Technology, Melbourne.

I also humbly acknowledge the support received from the USQ International Fees Research Scholarship for my PhD studies.

## LIST OF PUBLICATIONS DURING THE PHD CANDIDATURE

1) Chowdhury, A, Hafeez-Baig, A, Gururajan, R & Chakraborty, S 2019, 'Conceptual framework for telehealth adoption in Indian healthcare', 24th Annual Conference of the Asia Pacific Decision Sciences Institute: Full papers, Asia-Pacific Decision Sciences Institute (APDSI), pp. 230-9.

2) Chowdhury, A, Hafeez-Baig, A, Gururajan, R & Sharif, MA 2020, 'The Adoption of Mobile Technologies in Healthcare: The Perceptions of Healthcare Professionals Regarding Knowledge Management Practices in Developing Countries', in C Stephanidis, et al. (eds), HCI International 2020 – Late Breaking Papers: Interaction, Knowledge and Social Media, 22nd HCI International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Lecture Notes in Computer Science, 1 edn, Springer International Publishing, Cham, vol. 12427, ch 5, pp. 68-76.

3) Chowdhury, A., Hafeez-Baig, A., Gururajan, R., McCubbin, A., Sharif, M.A., and Shah, MJ 2021, Role of Image quality in telehealth: adoption challenges in the subcontinent. Pacific Asia Journal of the Association for Information Systems: Special Issue - Mobile Decision Support and Analytics for Healthcare: Citizen, Organization, Governmental and Technological Perspectives (Accepted for publication)

4) Chowdhury, A, Hafeez-Baig, A, Gururajan, R. 2021 'Development of a Survey Instrument to Explore Telehealth Adoption in the Healthcare Domain', in S Yamamoto & H Mori (eds), HCI International 2021 – Human Interface and the Management of Information: Information-Rich and Intelligent Environments, 23nd HCI International Conference, HCII 2021, Washington DC, USA (Virtual Event), July 24–29, 2021, Proceedings, Lecture Notes in Computer Science, 1 edn, Springer International Publishing, Cham, vol. 12766, ch 16, pp. 208-225.

TABLE OF CONTENTS

**LIST OF FIGURES**

**LIST OF TABLES**

# CHAPTER 1 INTRODUCTION

## 1.1 Chapter overview

This chapter presents an overview of the healthcare environment prevailing in India and the ICT infrastructure present in India to support such activities. Further, analysis of relevant telehealth definitions helps formulate the research parameters, as well as justifying the context of the research. The chapter is divided into nine sections. Section 1.1 is the chapter overview, introducing the audience to the layout of this chapter. Section 1.2 introduces the research on telehealth adoption in the Indian healthcare domain to the audience. Section 1.3 discusses the background of the research, setting the motivational tone of the research. Section 1.4 discusses the healthcare domain in India, underlying the challenges faced by it. Section 1.5 notes the different telehealth definitions propagated by various scholars and combining them creates the operational research definition. Section 1.6 discusses the aims and objectives of the research, setting the focus of the research and leads to the research questions in the next section (Section 1.7). Section 1.8 covers the justifications for this research on the determinants of telehealth adoption in Indian healthcare. Section 1.9 provides a summary of the subsequent chapters in this thesis.

## 1.2 Introducing the research on telehealth adoption in the Indian healthcare domain

The foundation of telecommunication in healthcare settings at the global level began with the advent of telegraphy in the early twentieth century. Warnings of disaster and emergency were transmitted to the ships belonging to the naval forces and merchant navy (Farnham, 2006). Telehealth commenced its journey in the seventh decade of the twentieth century when two healthcare projects in the USA delivered healthcare services at a distance. The first project involved television communication between a psychiatric teaching centre and an isolated state hospital for diagnosis, treatment, education and collaborative research (Benschoter et al., 1965). The second project was involved in delivering medical advice to patients at Logan International Airport Medical Station, Boston from Massachusetts General Hospital, through utilising audio-visual methods (Murphy Jr. & Bird, 1974). Thus, telehealth is not a technology itself; neither is it a distinct branch of medicine and not new in the healthcare context (Craig & Patterson, 2005). Telehealth pools high fidelity electronics, information and communications technology (ICT), and other related technology and applications for delivering healthcare services and providing education to patients and healthcare professionals, at a distance (Wootton, 2009). The Arkansas Medical Board define a "proper physician-patient relationship" to include "a face-to-face examination using real-time audio and visual telemedicine technology that provides information at least equal to such information as would have been obtained by an in-person examination" (Arkansas State Medical Board, 2016).

The Government of India had well recognised the prospect of telehealth as a device of healthcare delivery in India at the beginning of the new millennium. Telehealth initiatives were established with the participants being Department of Information Technology of the Ministry of Communications and Information Technology, Indian Space Research Organisation (ISRO), various state governments, and several premier level medical colleges, scientific and technological education and research organisations (Telemedicine Society of India, 2017).

ICT can act as a medium for delivering information and knowledge through socio-economic classes and geographic territories (Chandwani & De, 2015; Dodel, 2015; Ganapathy, 2014). Therefore, utilising ICT for implementing telehealth can conceivably permit the transferability of health services to distant territories, thereby enhancing accessibility, affordability and quality of healthcare services (Chandwani & Dwivedi, 2015). Further, telehealth characterises itself as a distant delivery of health-related services through the transfer of audio, video and graphical information via telecommunication networks, including consultative and diagnostic services along with enablement of planning, coordination, collaboration and education (Mishra et al., 2012). Currently, a combination of government and private telehealth programs are catering to a section of Indian society such as Apollo Hospitals, in collaboration with ISRO, All India Institute of Medical Sciences (AIIMS), Narayana Hrudayalaya, etc. (Telemedicine Society of India, 2017). Further, the underlying challenge for Indian healthcare lies in the fact that a large part of India has shortages in human healthcare resources (Bodavala, 2002).

Telehealth is utilised for diagnosing, treating and preventing ailments and wounds; health-related instruction and training; research and investigation of public health programmes and administering healthcare services. Telehealth is anticipated to renovate healthcare through reforming and restructuring the policies and procedures prevailing in the healthcare organisations and systems. Current researchers investigating the cost-effectiveness of telehealth programmes are of the opinion that telehealth can lessen the cost of healthcare services, thereby effecting affordable and accessible healthcare services (Torre-Díez et al., 2015). One contemporary Indian research study found that the majority of patients who were treated through the telehealth facility in the AIIMS, New Delhi are of the opinion that it is time-saving and cost-effective and particularly beneficial for rural patients (Meher & Kant, 2014). Nevertheless, the inherent benefits of ICT have been unrealised globally (Lal, 2017).

Since telehealth depends on the utilisation of ICT infrastructure, it is essential to conduct a study to find out the determinants of ICT adoption in the Indian telehealth environment. Moreover, as evident from relevant literature, telehealth is in a nascent stage in India, with most of the projects currently in a pilot study level. As such, it would be practical to conduct the study from an organisational point of view because the organisational adoption of ICT will eventually foster the implementation of telehealth in the domain of Indian healthcare. Furthermore, as few healthcare organisations have a telehealth infrastructure and set-up to cater to Indian society it is important to know the perceptions of healthcare professionals within the organisations on telehealth adoption. This research study focuses on developing a theoretical framework of ICT adoption in the Indian telehealth environment, as limited research has been conducted in this area.

### 1.3 Background

Telehealth infrastructure is already existing in India (Chandwani & Dwivedi, 2015; Meher & Kant, 2014). In India, online consultations regarding medical advice, nutrition, pre-surgical consultation and patient education are the potential and emerging areas of telehealth, with pan-country outreach apart from the primary care telemedicine centres focussed on rural areas (Al-Mahdi et al., 2015; Brindha, 2013; Gupta, 2013; Prasad et al., 2010; Sivagurunathan et al., 2015). There are government and private initiatives to cater to the section of people who live in remote areas or live in such areas which have a deficiency in developing a proper healthcare system. The telehealth scenario, though promising, has not yet achieved growth and development in infrastructure to cater to large numbers of people or areas (Marcelo et al., 2015). Hu et al. (2002) observed that telehealth technology is an important and exciting technological innovation that has potential for bringing about a paradigmatic shift in healthcare service delivery and collaboration. Furthermore, Mathur et al. (2017) concluded in their research that telehealth could be utilised at its farthest in the domain of public healthcare. The authors also observed that the role of telehealth could be extended to promotion of health including improvement of knowledge, beliefs and attitudes of the medical consumers. Further, a review of the available literature suggests the following:

- Lack of Theoretical Framework considering geographic differences, cost, socio-cultural issues and stakeholders (Chandwani & De, 2015; Chandwani & Dwivedi, 2015; Dodel, 2015; Ganapathy, 2002; Standing et al., 2011).
- Suggested research on ICT adoption in healthcare considering local environment (Carati & Margelis, 2013; De Rosis & Seghieri, 2015; Elder & Clarke, 2007; Ganapathy, 2002).
- Limited research on Indian Telehealth Technology Adoption (Chandwani & Dwivedi, 2015; Dasgupta & Deb, 2008; Durrani & Khoja, 2009; Ganapathy, 2002; Iyer, 2014; Kumar & Ahmad, 2015; Marcelo et al., 2015; Pal et al., 2002).
- Studies inadequate in population or response (Durrani & Khoja, 2009; Ghia et al., 2013; Gschwendtner et al., 1997; Iyer, 2014; Mairinger et al., 1996).
- Need for studies on ICT Adoption in telehealth environment from organisational perspective (Carati & Margelis, 2013; Chandwani & Dwivedi, 2015; Ganapathy, 2014; Pak et al., 2008).

## 1.4 Healthcare in India

India is a diverse country and almost sixty five per cent of its population, which is about 889 million of a total population of 1.37 billion, are residents of rural and remote areas (Business Standard, 2013) where healthcare services are very limited or not available (Deogaonkar, 2004). Regardless of the current success in the economic arena, many more inquest for India lies in tackling social challenges. Social challenges include poverty, illiteracy, lack of sanitation, gender inequality and lack of healthcare for all. The challenges of healthcare in India includes distance to nearest healthcare services facility, geographical barriers and resilient topography in some regions

(Balarajan et al., 2011). The healthcare system in India has been troubled for a long time by disparities in deployment. Moreover, just like the disparities in deployment, there are financing disproportions. An amount of five per cent of the Indian Gross Domestic Product (GDP) is assigned for health, which is infinitesimal as equated to other arenas, whereas 25 per cent of the GDP goes to defence. The government actually spends two per cent of this amount on healthcare (Rathi, 2017).

Notwithstanding progress, inaccessibility to healthcare in India is related to inequalities that are allied to socio-economic standing, geography, and gender. High out-of-pocket expenditure further enhances this inequality with large numbers of households providing for the financial burden of healthcare. This exacerbates poverty, with approximately 39 million people additionally falling into poverty each year due to such healthcare expenditure obligations. The crucial challenges for the accomplishment of equity in delivery of healthcare services, healthcare financing equity and securing healthcare financial risk in India should be recognised. The identified challenges comprise an inequity in resource distribution, insufficient physical access to dedicated healthcare services and healthcare professionals, high out-of-pocket healthcare expenditures, increase in healthcare spending and behavioural issues that influence the demand for convenient healthcare (Balarajan et al., 2011) .

Notwithstanding improved healthcare outcomes in relation to time, they are continuously influenced by the factors of education, gender, prosperity, caste and geography. Numerous imbalances in healthcare stems from a varied range of social, economic and political factors or reasons, which significantly alter the delivery of healthcare services amongst masses. Unfair distribution of the primary social goods, including power, and resources being the main reasons to foster health inequality, the social determinants of health need to be identified (Marmot et al., 2008).

In brief, the healthcare system in India can be summarised in the following way.

- Diverse country with varied geographic terrain and huge population
- 889 million are residents of rural areas (about 65%)
- Healthcare services are very limited or not available in some of these areas
- Shortage of healthcare professionals

(Balarajan et al., 2011; Bodavala, 2002; Business Standard, 2013; Deogaonkar, 2004; Marmot et al., 2008; Rathi, 2017)

The primary challenges faced by the Indian healthcare system are:

- Inaccessibility (Acharya & Rai, 2017)
- Deployment (Balarajan et al., 2011; Rathi, 2017)

In light of the above evidence garnered from available literature, the successful adoption of telehealth could help to lessen the burden of the primary challenges of inaccessibility and deployment of healthcare services in India (Ganapathy, 2014).

### 1.4.1Telehealth initiatives in India

#### 1.4.1 (a) Government initiatives in telemedicine

Department of Information Technology (DIT), Government of India, is the primary coordinator for implementing telehealth around India. As a primary coordinator, DIT has initiated 75 nodal centres throughout India (Choudhury, 2016).

In the state of West Bengal in Eastern India, some telehealth projects had been undertaken in collaboration with Webel Electronic Communication Systems Ltd (Webel ECS), a Department of Information Technology, Government of West Bengal organisation. Indian Institute of Technology (IIT), Kharagpur, was responsible for developing the relevant technology. The Government of West Bengal recognised that telehealth could play a vital role in developing and improving the existing public healthcare systems, particularly for the rural, hilly and semi-urban areas. As low bandwidth public switched telephone network (PSTN) lines are the only mode of communication in most of the rural areas, the telehealth system was required to be designed to consider such technologies and also include other communication technologies such as a very small aperture terminal (VSAT), integrated services digital network (ISDN) and leased lines. The scope of the project was to cover diseases such as tropical diseases, radiology, paediatrics, orthopaedics, general medicine, cardiology, neurology, oncology, HIV and dermatology. The project included imparting training and education to the health professionals including doctors and paramedics. The project also incorporated the creation, maintenance and analysis of a database and statistics of patients, medical records, continuous upgradation of technology / systems and continuing medical education for health practitioners (Mathur et al., 2017; Telemedindia, 2011b).

The following projects have been under development or being completed at seven referral hospitals and 10 Nodal hospitals:

The current projects of Webel ECS Ltd also includes research and development (R&D) based telemedicine projects. The first one is for HIV Paediatrics at the Anti-Retroviral Therapy (ART) Centre, Calcutta Medical College & Hospital, named as "Web enabled Medical Information Access using Handheld Devices in a Wireless environment for Telemedicine Applications (WEBEMIA) for Paediatric HIV Patients". The other project being a web-based telemedicine R&D project named "Deployment of a Web-enabled e-Healthcare System for Neonatal Patient Care Services" (eNCPS) (Telemedindia, 2011a).

The Northeastern Space Applications Centre (NESAC) was established in the year 2000, in collaboration with Indian Space Research Organisation (ISRO), Department of Space, Government of India, and the North Eastern Council. In 2004, a project named ISRO-NEC Telemedicine Project was conceptualised to utilise satellite communication through Very Small Aperture Terminal (VSAT). Seventy-two telemedicine regional nodal centres were planned to be ordained in the northeastern states of Sikkim, Arunachal Pradesh, Mizoram, Nagaland, Meghalaya, Tripura and Assam, spanning all districts situated in the seven northeastern states of India. Moreover, as these states were underdeveloped in infrastructure and healthcare services, the establishment of connection between the district hospitals and the specialised tertiary care hospitals through a telemedicine network could have proved to be beneficial in the delivery of healthcare services. Currently, out of the planned seventy-two nodal regional telehealth centres twenty-five have been established and the remaining forty-seven telehealth centres are in the course of commissioning. Furthermore, apart from these regional nodal centres, Army Telemedicine Network has been established in March 2008, in collaboration with the Indian Army with currently six centres being commissioned (Telemedindia, 2011a). The telehealth centres in the northeastern states of India are listed in the appendices.

ISRO has also collaborated with other hospitals in the north-east region of India under a different network for improved healthcare services at minimal cost using contemporary technology. These hospitals connect to super-speciality and speciality hospitals such as All India Institute of Medical Science, New Delhi; Narayana Hrudalaya, Bangalore; Amritha Institute of Medical Science, Cochin; Sri Ramchandra Medical College & Hospital, Chennai; Sanjay Gandhi Post Graduate Institute of Medical Science, Lucknow; Tata Memorial Centre, Mumbai; Fortis Hospital, Noida, etc. Todate, thousands of consultations has been carried out benefitting patients as well as healthcare professionals in the northeastern region (Telemedindia, 2011a). These hospitals are listed in Appendices.

The Northeastern Space Applications Centre (NESAC) has also set up Village Resource Centres (VRC) all over the northeastern states of India, including Tripura. These VRCs are facilitators of telemedicine, as well as providing tele-education and a host of other interactive services. The VRCs, particularly in Tripura, have become trend setters in providing telemedicine services to over thirty thousand patients till March 2013 through three referral hospitals and seventeen nodal hospitals. These centres are interconnected through the telemedicine network using 512 kbps to 2 mbps for data transfer and management (Dasgupta & Deb, 2008).

The Centre for Development of Advanced Computing (C-DAC) and Regional Cancer Centre in Trivandum, jointly started Kerala Oncology Network (Onconet-Kerala) in the year 2001. Onconet-Kerala was a telemedicine project to delve into the role of telemedicine in timely diagnosis of cancer in early stages, therapeutics, management of pain and follow-up counselling and treatment (Onconet, 2017).

### 1.4.1. (b) Private initiatives and online consultations

In India there have been private and individual efforts to provide telemedicine services in the rural areas focussing on primary healthcare, as well as consulting in urban areas. Various healthcare professionals including physicians, surgeons, dietitians, dentists and physiotherapists have started to provide online consultations in the urban areas, at least in the initial level of consultation. The online consultations have a broad outreach at a pan-India level (Brindha, 2013; Sivagurunathan et al., 2015). As such, future study of telehealth adoption in specific healthcare domains may extend the viability of such efforts.

### 1.5 Research definitions

#### 1.5.1 (a) ICT infrastructure in telehealth

Infrastructure is the foundation or framework that supports a system or organisation. In computing, ICT infrastructure is composed of physical and virtual resources that support the flow, storage, processing and analysis of data (Gichoya, 2005). Infrastructure may be centralised within a data centre, or it may be decentralised and spread across several data centres that are either controlled by the organisation or by a third party, such as a colocation facility or cloud provider (Hanafizadeh et al., 2009). ICT infrastructure encompasses all the devices, networks, protocols and procedures that are employed in the telecommunications or information technology fields to foster interaction amongst different stakeholders including computer hardware (servers and related workstations), network connectivity with accessories and all necessary equipment (Dodgson et al., 2006).

Blount and Gloet (2015) have itemised the ICT infrastructure, which enables a telehealth service to deliver efficiently. The technology and equipment in use are internet access, high speed broadband, landline phone, desktop computer, docking station, laptop, tablet, double monitor screen, telephone headset, smartphone, camera, printer, portable printer, fax machine, phone headset, modem, computer camera, Bluetooth, specialised software, blood glucose machines, scales, pulse oximeters, sensors and alarms. Furthermore, the researchers also noted the significance of communication through the support of ICT infrastructure amongst client - telehealth workers – management – organisation. A robust, round the clock ICT infrastructure support plays an essential part in the delivery of telehealth service by the workers.

#### 1.5.1 (b) Definition of telehealth, telemedicine, telecare, ehealth and mhealth

Various authors have defined telehealth as data transmission, through voice, image and video, which might comprise mobile and web technologies to prevent, promote and deliver curative healthcare at a distance (Dyk, 2014). The author also distinguished between telehealth and telemedicine as to the latter providing only curative service.

As such, telemedicine is a part of telehealth. In this respect, it can be argued that telecare is also part of telehealth though not a part of telemedicine because of its sole intention to deliver preventive care (Wade et al., 2017). It was also noted that ehealth (not limited to delivering healthcare at a distance) is used interchangeably with telehealth. Further, mhealth (using mobile technology) cuts across categories of telehealth, telemedicine, telecare and ehealth (Dyk, 2014). Carati and Margelis (2013), while framing the national strategy for telehealth, have defined telehealth as healthcare and related processes, or medical education, enabled using ICT over a distance to minimise the shortfall, gap or lack of skill in healthcare resources.

A decade wise definitions have been selected to formulate a new conceptual definition of telehealth for the purpose of this research.

> *"A microwave (short wavelength and high frequency) communication system between medical institutions providing teleconferencing activities for educational programs and staff meetings"* (Baltzer et al., 1981).
>
> *"Telemedicine can be broadly defined as the use of telecommunications technologies to provide medical information and services. Although this definition includes medical uses of the telephone, facsimile, and distance education, telemedicine is increasingly being used as shorthand for remote electronic clinical consultation"* (Perednia & Allen, 1995).
>
> *Performing clinical consultations through the use of any electronic medium in real time (video) or store-and-forward (e-mail)* (Wyatt & Liu, 2002)
>
> *"Healthcare and related processes or medical education, enabled using ICT over a distance to minimise the shortfall, gap or lack of skill in healthcare resources"* (Carati & Margelis, 2013).
>
> *"Data transmission, through voice, image and video, which might comprise mobile and web technologies to prevent, promote and deliver curative healthcare at a distance"* (Dyk, 2014).
>
> *"Telehealth is defined as the remote provision of healthcare services and education by means of information and communications technology"* (Charness et al., 2016).

> *"A cost-effective alternative to the more traditional face-to-face way of providing medical care"* (CMS, 2016b). *Further,* CMS (2016a) *endorsed the view that telehealth actually provides a face-to-face provision.*

Synthesising the above definitions a new definition has been formulated for the purpose of this particular research as follows:

> *"Telehealth can be defined as a cost-effective adoption of ICT by healthcare organisations and healthcare professionals, to provide universal healthcare regarding medical advice, diagnosis, treatment, care, education and training, from a distant location, removing the barriers of inequalities and inaccessibility to healthcare."*

The formulated definition itself includes the various aspects of telehealth such as telemedicine, m-health, online consultations and even audio-video consultations and receiving and viewing reports through online medium.

### 1.6 Aims and objectives

The aim of the research is to identify the determinants of telehealth technology adoption by Indian healthcare organisations. The main aims of the research are enumerated as follows:

1) To establish/discover/identify the determinants of telehealth technology adoption by Indian healthcare organisations.
2) To build a theoretical framework for adoption of ICT in Indian telehealth environment.

The following objectives are categorised for achieving the aim of the proposed research.

1) To synthesise the constructs for adoption of ICT in the telehealth environment by healthcare organisations worldwide, through a review of relevant literature in the domain of healthcare in India and around the world.

2) To build up a preliminary conceptual framework as a guideline to conduct exploratory research on Indian telehealth organisations.
3) To employ qualitative methods to explore the factors and codify the factors into themes to form hypotheses and theoretical framework.
4) To employ quantitative methods to test and confirm the hypotheses and classify the factors into drivers or barriers to adopting telehealth technology by Indian healthcare organisations.
5) To create a tested and confirmed Theoretical Framework for Telehealth Adoption in India.

### 1.7 Research Questions:

What are the determinants of telehealth adoption in the Indian healthcare domain?

#### 1.7.1 Sub Questions:

1) What are the enablers (drivers) of telehealth adoption in the Indian healthcare domain?
2) What are the barriers to telehealth adoption in the Indian healthcare domain?
3) What is the relationship between the determinants of telehealth adoption in the Indian healthcare domain?
4) What is the perceived theoretical framework for telehealth adoption in the Indian healthcare domain?

### 1.8 Justifications

Prior research on adoption of ICT in Indian telehealth environment identified the factors of ICT adoption, but in a limited manner (Chandwani & Dwivedi, 2015; Dasgupta & Deb, 2008; Kumar & Ahmad, 2015; Marcelo et al., 2015; Mathur et al., 2017). The researchers focussed on discussing the overall Indian telehealth environment instead of conducting a full-fledged research on ICT adoption in the Indian telehealth environment. The determinants of ICT adoption in the Indian telehealth environment established through these studies were either systematic or narrative reviews. The above-mentioned researchers' scope was limited in such a way that the determinants for telehealth technology adoption by Indian healthcare organisations was identified in an inadequate manner, as it was not tested empirically. The identified determinants also need to be tested through different methodologies, such as qualitative and quantitative analyses using primary data. Also, a lack of theoretical framework for telehealth adoption process compels a need for building the same. As such, to achieve the goal of establishing the determinants of telehealth adoption relevant to the Indian healthcare domain, it is essential to build up a theoretical framework through a systematic review of relevant literature on ICT adoption in the global healthcare domain, and by employing qualitative and quantitative methodologies to conduct an empirical research on telehealth adoption.

As such, it can be concluded that limited research has yet been done to clearly identify the driving forces behind the adoption of telehealth technology by Indian healthcare organisations. An exploratory sequential research study will help identify and establish the determinants, as well as build up a theoretical framework of technology adoption for the Indian telehealth environment.

The research will be limited to two to five states of India wherein a cross-sectional study will be conducted, in selected organisations providing telehealth services, depending on convenience. Nonetheless, as India is a geographically diverse and a large populous country, it is a hard task to cover all the geographical regions. Also, it is evident from the literature review that telehealth services is in a nascent stage in India. As such, the selection will depend on convenience as well as availability of telehealth services in a geographical region of India. The presence of a certain level of health and ICT infrastructure will also play a determining role in selecting the organisations.

### 1.9 Summary of thesis chapters

### Chapter 1 Introduction

The introduction chapter initiated the research by defining telehealth and setting the background of the research. The chapter then discusses the healthcare domain in India within which the telehealth environment sustains. It then sets out the definitions of ICT Infrastructure and distinguishes telehealth, telemedicine, telecare, eHealth and mHealth. The chapter also outlined the research aims and objectives. Then the chapter concludes by setting out the research questions and justifications for the research.

### Chapter 2 Literature Review

The literature review chapter synthesised the existing literature on technology adoption, ICT in healthcare and telehealth adoption globally and in India. A review of Information Systems (IS) models was also conducted to determine a unified theory or framework to conduct the research. The determinants of telehealth adoption were identified and categorised into enablers (drivers) and barriers. The literature review found gaps in the literature to conduct the research, and a preliminary conceptual framework was developed further to guide the research into qualitative and quantitative stages.

### Chapter 3 Research Methodology

The research methodology chapter sets out the research philosophy, research stances, and design of the research. Further, the chapter justifies the exploratory research design and mixed-methods approach in healthcare chosen for this research. The research methodology sets out the sample size, population, strategies, and techniques which would be utilised to conduct the qualitative and quantitative stages. The research methodology also sets out the qualitative and quantitative data analysis plan. Also, the research methodology states the ethical clearance requirement, which had been obtained from the USQ human research ethics committee, before progressing into the qualitative and quantitative stages.

### Chapter 4 Qualitative Data Collection

The qualitative data collection chapter justifies the interview strategies and techniques involved to carry out the semi-structured interviews in the Indian healthcare domain. The chapter justifies the interview modes and also sets out the protocol for conducting the interviews of Indian healthcare professionals (HCPs). The chapter also develops an interview guide to conduct the semi-structured interviews. The main aim of the chapter was to develop and justify the protocols, strategies, techniques, and procedures before collecting the qualitative data, i.e., how the qualitative data would be collected from Indian HCPs.

### Chapter 5 Qualitative Data Analysis

The qualitative data analysis chapter described how the qualitative data was collected in the Indian healthcare context. The chapter then sets out how the qualitative data (in the form of recorded semi-structured interviews) was stored and transcribed to generate a rich data set. The chapter then proceeds to analyse the data set by manual methods and Computer-Assisted Qualitative Data Analysis Software (CAQDAS). Manual coding, Leximancer 4 coding, and NVivo Pro 12 coding were used to arrive at the themes finally. The themes were aligned with the literature to develop the hypotheses to progress the research further into the quantitative stage, to generalise and reconfirm the perceived determinants. The qualitative findings generated eleven perceived determinants of telehealth adoption in India which are healthcare practices (HP), usefulness (USFL), patient awareness (PA), healthcare facilities (HF), HCP awareness (HCPA), competitiveness (CA), technology motivators (TM), technology issues (TI), organisational issues (OI), state leadership (SL), and communication issues (CI).

### Chapter 6 Quantitative Data Collection

The quantitative data collection chapter sets out the protocol for collecting quantitative data in the Indian healthcare domain. The chapter also distinguished the different quantitative data collection approaches and justified the drop-and-collect survey method through pen/pencil-paper and online medium. The strategies and techniques to be adopted were outlined. A survey instrument was developed from the hypotheses generated by qualitative findings and literature review.

### Chapter 7 Quantitative Data Analysis

The quantitative data analysis chapter first enumerated how the quantitative data was collected by administering the survey instrument in the Indian healthcare domain. Then the chapter proceeds to explain data storage procedures, raw data transfer to a spreadsheet and the statistical analysis software (IBM SPSS Statistics v27), data cleaning, detection of outliers, and assessing other assumptions before the data set was subjected to predictive modelling. Subsequently, principal component analysis (PCA) was conducted to reduce the dimension and explore the factor structure. Afterwards, correlation analysis, simple linear regression, and multiple linear regression models were developed to reconfirm and generalise the perceived determinants. HF, USFL, and SL were found to be the most significant determinants for telehealth adoption in the Indian healthcare domain.

**Chapter 8 Structural Equation Modelling**

The structural equation modelling chapter deployed high-level statistical analyses by utilising the variance based or partial least squares based structural equation modelling (PLS-SEM), confirmatory factor analysis (CFA) and covariance based structural equation modelling (CB-SEM). SmartPLS 3.3.3 and IBM SPSS Amos v27 were used for PLS-SEM, CFA and CB-SEM. PLS-SEM reconfirmed the determinants, with HF, USFL, and SL being the significant determinants. The PLS-SEM results were similar to the multiple linear regression predictive model developed in the earlier chapter. CFA and the CB-SEM causal model reconfirm another determinant HP, in addition to the determinants reconfirmed by the multiple linear regression and PLS-SEM predictive and path models, respectively.

**Chapter 9 Discussion**

The discussion chapter integrated the qualitative and quantitative findings and explored the findings to align with the existing literature. The discussion chapter subsequently answered the RQ and the four RSQs. While the qualitative findings answered the RQ and RSQ 1 and RSQ 2, the quantitative findings answered the RSQ 3 and RSQ 4. Following are the RQ and RSQs answered by the discussion chapter.

> ***RQ:*** *What are the determinants of telehealth adoption in the Indian healthcare domain?*
>
> ***RSQ 1:*** *What are the enablers (drivers) of telehealth adoption in the Indian healthcare domain?*
>
> ***RSQ 2:*** *What are the barriers to telehealth adoption in the Indian healthcare domain?*
>
> ***RSQ 3:*** *What is the relationship between the determinants of telehealth adoption in the Indian healthcare domain?*
>
> ***RSQ 4:*** *What is the perceived theoretical framework for telehealth adoption in the Indian healthcare domain?*

## Chapter 10 Conclusion

The conclusion chapter concluded the thesis on the determinants of telehealth adoption in the Indian healthcare domain by enumerating the implications, contributions, limitations, future research directions, and recommendations for the research. The thesis concludes that HP, HF, USFL, and SL are the most significant determinants in the Indian healthcare domain and that the findings of this research could be utilised for policy making decisions both at state and federal government levels and by the private healthcare organisations in India.

# CHAPTER 2 LITERATURE REVIEW

## 2.1 Chapter Overview

The previous chapter was introductory and provided the background settings of the need for research on telehealth adoption in Indian healthcare. The previous chapter discussed the current state of affairs of the Indian healthcare domain and the challenges faced by a complex healthcare environment. The discussion provided insight on the Indian healthcare environment, healthcare inaccessibility, healthcare inequalities and, last but not least, topographic challenges. The previous chapter also formulated the research definitions as well as provided the research scope and justifications. The discussion appropriately justified the need to establish the determinants or factors responsible for accepting and adopting telehealth in the Indian healthcare domain. It also set out the need for highlighting the challenges of telehealth adoption in the Indian healthcare domain.

A comprehensive literature review during the preliminary stages of the research was undertaken as a guide to carry forward and conduct primary research in the Indian telehealth environment (Webster & Watson, 2002). Therefore, the current chapter will focus on reviewing published peer-reviewed studies on the adoption process and ICT Adoption in healthcare domains globally. The literature review then moves on to review the significant studies on the determinants which were responsible for the acceptance and adoption of telehealth globally and in India. The purpose of the literature review was to study the global literature on ICT adoption in healthcare and telehealth and find the existing gaps in the research conducted on telehealth adoption in different countries and India. The review also prepared a preliminary conceptual framework which formed the basis of progression into the primary data collection (qualitative and quantitative) stages of this research.

Sections A, B, C and D divide the chapter into four parts. The first section provides a review of technology and ICT adoption studies in healthcare, including telehealth. Section B provides a review of ICT adoption models relevant to healthcare. Section C provides a synthesis of the literature review. The final section presents a preliminary conceptual framework upon which the later qualitative and quantitative stages of this research developed.

## 2.2 Introduction

Technology and ICT adoption in different industries and domains have long been the focus of information systems research. Healthcare domains globally started accepting and adopting technology and ICT for improving their efficiency and mass outreach, with the introduction and rapid advancement of technology and ICT. Additionally, the adoption was to reap the benefits embedded in the technologies itself (Chandwani & De, 2015). Telehealth is itself not a technology but a technique to deliver healthcare services at a distance (Loane & Wootton, 2001). Loane and Wootton (2001) further observed that the contemporary use of the term telehealth, instead of telemedicine, is due to the changed perspective of health. Health now entails an extended societal focus rather than just a limited focus on medicine. This extended societal focus of health has made the adoption process for healthcare ICT more complicated. As such, the study of contemporary healthcare ICT adoption includes societal factors as well, rather than only studying the clinical, technological and organisational factors. This research focusses on the perceived determinants of telehealth adoption in Indian healthcare. The following sections willreview technology adoption, ICT adoption and telehealth adoption in healthcare domains globally and synthesize the factors or determinants that have significantly influenced the adoption process. The challenges or barriers, if any, for the adoption process will also be highlighted.

## 2.3 Section A: Review of technology and ICT adoption studies in healthcare

### 2.3.1 Technology and ICT Adoption

The term adoption is a long-studied phenomenon in the information systems literature. Whenever the introduction of new technology has happened in human history, the process of adoption, acceptance, de-adoption and successful implementation was measured in various ways by researchers. The studies were either to find out the factors responsible for its adoption or to find out the challenges associated with the implementation and adoption process. The studies range from technology and ICT adoption in agricultural sectors (Ragasa, 2012), small and medium-sized enterprises (SME) sectors (Ragasa, 2012) to various other sectors, such as web-based self-service technology adoption in the hospitality industry (Lee, 2016), radio-frequency identification (RFID) technology adoption in manufacturing industry (Wang et al., 2010) and safety technology adoption in the automobile industry (Cantor et al., 2006).

The list is not exhaustive and various other studies exist on the technology and ICT adoption in various industries and sectors. Examples are of e-governance adoption in government (Al Athmay, 2015) and education (Karavasilis et al., 2010). These researchers mostly studied the determinants or factors responsible for technology and ICT adoption in various industries from an organisational perspective. The complex nature of the healthcare industry and its universal usage and applications compels the researchers to go beyond organisational perspectives and study the societal, environmental, political, legal, technological, knowledge and innovation characteristics of adoption. Therefore, understanding the process and stages of adoption is essential to study the adoption process in different cultural and socio-economic settings. Rogers (1995), in his diffusion of innovation theory, categorised the adopters into five categories. They are innovators, early adopters, early majority, late majority and laggards.

### 2.3.2 Telehealth Adoption studies (including technology and ICT adoption in healthcare)

The determinants of ICT Adoption in the healthcare domain has been widely researched by authors such as Chang et al. (2015). The researcher's study on the implementation of Telehealth Systems in Taiwan stressed the investments in ICT Infrastructure. Further, the research study established the positive significance of the constructs of service availability, usefulness, ease of use, attitude, subjective norm, behavioural control and behavioural intentions. A study in Europe by De Rosis and Seghieri (2015) observed a huge gap in adoption of ICT in the European Primary Healthcare Sector. The study enumerated the geographic differences regarding ICT Adoption between Southern and Central-Eastern Europe. The study pointed out the drivers which can expedite the adoption process. The drivers noted were policies, actions, improvement of appropriate usage and cost of personal computer. Apart from policy and investments, organisational behaviour and networking aspects were also considered. Elder and Clarke (2007), on behalf of The International Development Research Centre, Canada, conducted an analysis of Telehealth projects in developing countries of Africa and Asia, and highlighted the challenges of understanding the building of appropriate local technical and institutional capacities. More barriers which were highlighted in the study were e-readiness, availability of ICT equipment and infrastructure, cost of access and a facilitating regulatory environment. The analysis further triggered the viability of telehealth projects in solving health problems in developing countries. The authors were of the view that cost-benefit analysis and measuring health outcomes could answer this question. The other barriers noted in this research, for ICT adoption in Telehealth projects of Africa and Asia, were understanding the local environment, illiteracy, localisation issues, access to mobile telephony and internet. Carati and Margelis (2013) prepared a vision document on behalf of the Australasian Telehealth Society, where they identified the drivers of telehealth technology adoption as target, purpose and efficiency. Further, the authors stressed the identification of barriers of adoption of Telehealth technology and also the demand of consumers for telehealth services. Chandwani and De (2015) stressed that the interaction between the logic of choice and the logic of care determines the evolution of the structure and adoption of ICT introduced in a healthcare environment. The researchers identified the need for further research into the interference of ICT and changing logics of healthcare institutions with respect to telehealth, e-health and HIS. The authors scrutinised the impact of ICT on healthcare from an institutional angle. The researchers also envisaged further investigation on the role of internet and social media in providing care. Other drivers, noted by the study for further research, are knowledge sharing and evolution of relationships between the healthcare professionals and between the healthcare professionals and patients. The authors also stressed further research on gender and socio-cultural drivers for adoption of ICT in the healthcare domain. Future research incorporating behavioural sciences and communication studies for investigating the determinants of ICT Adoption in healthcare were encouraged in the research. Dodel (2015) noted that a lack of theoretical framework creates one of the main barriers in ICT Adoption. The author suggested the independent variables of access, usage and appropriation to be included in testing ICT related hypotheses in different fields of study. Doarn et al. (2008) identified key societal factors for wider adoption and use of telehealth and e-health. These factors are ageing population, unhealthy lifestyles, environment/climate change, shortage of highly skilled medical personnel, consumerism driving demand, disparity, economy, diversity in religion and language, societal norms, war on terrorism and changes in generational needs. These identified factors act as drivers as well as some creating hindrances and slowing down the ICT adoption process in telehealth. Faber et al. (2017) observed that size of hospital, organisational readiness including technical knowhow, and top management support are considerable ICT adoption factors in healthcare. Handayani et al. (2017), in their study of ICT adoption in the general hospitals of Indonesia, highlighted human characteristics as well as organisational characteristics, which influence ICT adoption. The human characteristics are compatibility, information security expectancy and self-efficacy. The organisational characteristics are management support, facilitating conditions and user involvement. The study also encouraged further research considering non-technological factors which affect ICT Adoption in healthcare. Zailani et al. (2014) conducted a survey of physicians and nurses in Malaysian public hospitals to explore the determinants of telemedicine acceptance. The researchers categorised the drivers of ICT Adoption in telemedicine as environmental, organisational factors, technological factors and individual factors. The authors also included the effect of health culture as an additional factor of ICT adoption. The constructs used in this theoretical framework were government policy, external supplier's capacity, project team's capacity, top management support, usefulness, ease of use, attitude, self-efficiency and organisational culture. The findings established the significance of the constructs in influencing the ICT Adoption in Malaysian telehealth environment. Hafeez-Baig and Gururajan (2010) identified a wide range of facilitators and inhibitors of adoption of wireless technologies in the Australian healthcare system. The most important of the facilitators are user friendly, benefits, current competence, alert clinicians, adverse event, advantages and remote monitoring. The inhibitors include unreliable, shortage of staff, health policy, coverage, confidentiality and awareness. Standing et al. (2011) identified several factors influencing adoption of telehealth, which is a combination of technological, social, group dynamics and managerial factors. Avison and Young (2007) pointed out the barriers of ICT Adoption in the UK Health System which are: lack of fit between ICT and work practices, environment and culture; lack of evaluation methods; poor project management; evaluation of pilot projects; organisational uncertainty; inappropriate organisational structure; disorganised nature of ICT / IS development in healthcare; high cost and profile of Health ICT / IS. The author also pointed out that the ICT/IS implementation has focussed on management rather than the clinical part. Adamson (2016) considered the relationship between the potential drivers of ICT in health projects, which are technologists, management and medical practitioners. The researcher opines that whilst technology adoption in healthcare is increasing and necessary, some factors complicate the behaviour of the technologists, management and medical practitioners. The factors noted are a globally ageing population, mass leaks and hacking of health data and unintentional consequences of human mechanisation. Wright et al. (2008) cautioned in their study that technological progress, without simultaneous evolution in ethics, practices and awareness, could complicate the behavioural aspects of the potential drivers of technology adoption. Hu et al. (2002) in their study of organisational adoption of telehealth technology in Hongkong established collective attitude as the foremost driver influencing adoption. Other variables to influence significantly were ease of use and service risks. Service benefits and technology safety settled to be minor factors in their study. Fleuren et al. (2004) highlighted several determinants of innovation within the healthcare organisation related to socio-political context, organisation, the adopting person/user/health professional, innovation and facilities needed to implement the innovation. Mairinger et al. (1996) obtained very poor response rates from physicians on a survey conducted in central Europe, though the results yielded some important drivers and barriers of telehealth adoption. The drivers were technical and computing knowledge, acceptance for diagnostic purposes by physicians and knowledge sharing willingness of the physicians. The barriers for telehealth adoption were scientific and legal requirement, additional workload, health insurance and funding related to telehealth services, as well as lack of information about real costs. Gschwendtner et al. (1997), in their research on telemedicine adoption by medical students, found that their interest in tele-learning is very high. Loane et al. (1998) conducted research on telehealth technology adoption from the consumers' perspective and found the benefits of personal experience, comfort using video link and saving time, are of positive significance. Sheng et al. (1999) conducted a case study in Hong Kong hospitals and the results reveal ignorance of decision making factors in the procedure of adopting telehealth technology. Tanriverdi and Iacono (1998) discussed different knowledge barriers such as technical, economic, organisational and behavioural, to telehealth technology usage and adoption. Paul et al. (1999) is of the view that addressing the technological barriers of telehealth adoption is primary and after that the other barriers such as legal, financial and professional arise. The findings from the research supported end-user and technical training as significant barriers but placed quality of video, system reliability and inconvenience of the use of equipment by physicians, as insignificant barriers to adoption. The other supported barriers by the research were a mismatch between technology and requirement, confidentiality and privacy issues and unsatisfactory sound quality. Dünnebeil et al. (2012) conducted a study in the German telemedicine environment and found that the most significant drivers are standardisation, IT utilisation, information security, process orientation, documentation and knowledge. Cilliers and Flowerday (2013) in their case study in South African telehealth highlighted the understanding of the value and benefits of health workers as drivers of telehealth adoption. The barriers noted were lack of knowledge and lack of awareness of telemedicine systems. Kijsanayotin et al. (2009) explored ICT adoption in community healthcare centres in Thailand and highlighted performance expectancy, effort expectancy, social influence and voluntariness to have profound influence on the ICT adoption of the health workers.

### 2.3.3 Telehealth Adoption studies in India (including technology and ICT adoption in healthcare)

Telehealth infrastructure already exists in India (R. K. Chandwani & Dwivedi, 2015; Meher & Kant, 2014). Online consultations regarding medical advice, nutrition, pre-surgical consultation and patient education are the potential and emerging areas of telehealth. This includes pan country outreach apart from the primary care telemedicine centres focussed on rural areas (Al-Mahdi, Gray, & Lederman, 2015; Brindha, 2013; Gupta, 2013; Prasad et al., 2010; Sivagurunathan, Umadevi, Rama, & Gopalakrishnan, 2015). There are goverment and private initiatives to cater to the section of people who live in remote areas or live in such areas that have a deficiency in developing proper healthcare system. The telehealth scenario, though promising, has not yet achieved growth and development in infrastructure to cater to large numbers of people or areas (Marcelo et al., 2015). Hu et al. (2002) observed that telehealth technology is an important and exciting technological innovation that has potential for bringing about a paradigmatic shift in healthcare service delivery and collaboration. Furthermore, Mathur et al. (2017) concluded in their research that telehealth could be utilised at its farthest in the domain of public healthcare. The authors also observed that the role of telehealth could be extended to promotion of health including improvement of knowledge, beliefs and attitudes of the medical consumers.

## 2.4 Section B: Review of ICT Adoption Models

Research on telehealth has been conducted from various perspectives, such as clinical practices (Ahmed et al., 2010; Ashburner et al., 2016; Bee et al., 2016; Jarvis-Selinger et al., 2008), ICT adoption studies (Hu et al., 2002; King et al., 2007), socio-technical perspectives (Nicolini, 2006; Stevenson et al., 2010), health economics (Darkins et al., 2015; Henderson et al., 2013) and management perspectives (Hendy et al., 2012). Various theories and approaches were introduced to justify this diverse research. However, these theories, frameworks or approaches directly influence the research questions and the outcomes of such research. If a theory is selected beforehand for understanding the adoption process, the constructs of the theory will influence the selection of questions and the measuring tools (Hsiao & Yang, 2011; Wade et al., 2017). Wade et al. (2017) recommended four points for consideration before uptaking a telehealth adoption research theory which has sufficient explanatory power. The four points of recommendation are:

**a) Planning** – Various theories need to be reviewed before commencing the research, but it is not essential to finalise the selection of theories for explanatory purposes.

**b) Research Questions** – Theories can be explored to fit the purpose of the research. A theory can play a significant role in exploring the theoretical constructs which explain the purpose of the research, particularly in telehealth research, where barriers and enablers of adoption are still undetermined. This approach will enable formulating targeted research questions to identify the barriers and enablers of telehealth adoption.

**c) Outcome Measures** – The tools for measuring adoption can be selected by reviewing various theories which use different techniques for measuring their unique constructs. Reviewing different theories may provide more options to select relevant measuring tools for the research.

**d) Discussion on findings –** At a later stage of the research, while discussing the findings, the selected theory can be revisited for explaining the results. Alternatively, the introduction of more theories is possible for a greater explanatory power.

The next sub-sections provide a brief review of different relevant IS theories. The theories will be briefly described, and the relevance of the theory will be reviewed concerning telehealth adoption.

### 2.4.1 Theory of Reasoned Action (TRA)

Fishbein and Ajzen (1975) evolved the Theory of Reasoned Action (TRA) as an improvement over Information Integration Theory (Ajzen & Fishbein, 1977; Anderson, 1981; Fishbein & Ajzen, 1975, 1976; Sheppard et al., 1988). The theory embedded two significant changes in constructs. Firstly, behavioural intention was added as another element in the process of persuasion. While Information Integration Theory (and several others such as Cognitive Consistency Theories, Functional Theory, and Social Judgement Theory) attempts to predict attitudes, TRA is explicitly concerned with behaviour. TRA also recognises that there are circumstances, or factors, that restrict the influence of attitude on behaviour. Therefore, TRA predicts behavioural intention, a compromise between stopping at attitude predictions and actually predicting behaviour. Because it separates behavioural intention from behaviour, TRA also discusses the factors that restrict the influence of attitudes (or behavioural intention) on behaviour.

The second change to Information Integration Theory is that Reasoned Action uses two elements, attitudes and norms (or expectations of others) to predict behavioural intent. Whenever human attitudes lead them to do one thing and the relevant norms advocate that they should do something else, both factors influence the behavioural intent. Specifically, Reasoned Action predicts that behavioural intent is created or caused by two factors: our attitudes and our subjective norms. As in the theory of information integration, attitudes have two components. Fishbein and Ajzen (1975, 1976) call this the evaluation and the strength of their belief. The second component, which influences behavioural intent, subjective norms, also has two components: normative beliefs (what people think others would want or assume them to do) and motivation to comply with them (how important it is to a person to do what they think others anticipate).

There are, therefore, a number of options to try to convince someone. The first group of options are similar to the strategies identified by the theory of information integration:

-Strengthen the belief in an attitude that supports a persuasive goal

-Strengthen the assessment of an attitude that supports a persuasive goal

-Weaken belief in an attitude that opposes a persuasive goal

-Weaken the assessment of an attitude that promotes a persuasive goal

-Create a new attitude with the strength of belief and evaluation to support persuasive goals

-Remind the audience of a forgotten attitude with the strength of belief and evaluation that underpins persuasive goals.

However, the addition of subjective norms creates a number of other options:

-Strengthen a normative belief that promotes persuasive goals

-Increase the motivation to conform with a norm that backs a persuasive goal

-Reduce the normative belief that opposes the persuasive objective

-Reduce the motivation to comply with the norm that opposes the persuasive objective

-Create a new, subjective norm to support the persuasive objective

-Recap the audience of a forgotten subjective norm that backs the persuasive goal.

Hence, the actuality that there are two influences on behavioural intentions, attitudes and norms gives one final possibility of persuading others: if one component (attitudes, norms) supports the persuasive goal more than the other, it makes that component more important than the other.

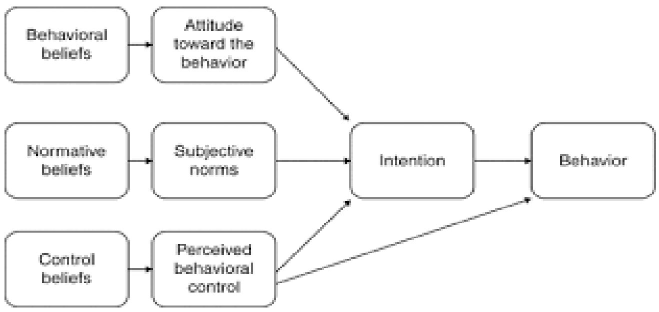



***Figure 1 Constructs of TRA, Source: Ajzen and Fishbein (1977); Fishbein and Ajzen (1975, 1976); Sheppard et al. (1988)***

In the telehealth environment, TRA was used to assess and understand the healthcare professionals' attitudes and intentions toward using neurological teleconsultations in Lisbon, Portugal (Araújo et al., 2000). The limited size of only 53 general practitioners yielded a weak predictor model wherein only the attitudinal factor proved to be significant (b = 0.469; p = 0.002). Subjective norm proved to be of insignificant value (b = 0.486; p = 0.007). Apart from this study, TRA was not used in any study in the telehealth environment due to its limited predictive ability in healthcare research.

### 2.4.2 Theory of Planned Behaviour (TPB)

Theory of Planned Behaviour (TPB) (Ajzen, 1985, 1987, 1991), being an extension of the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975, 1976), was developed in the social psychology field in order to understand diverse human behaviours. These models are often referred to as intention-behaviour theory since they consider intention as the direct precursor of behaviour. The TRA (Fishbein & Ajzen, 1975, 1976) postulates that the realisation of a given behaviour (B) is predicted by an individual intention (I) to perform that behaviour. The individual intention, in turn, consists of two antecedents: the behavioural attitude (AACT) and the subjective norm (SN). AACT is an assessment of the advantages and disadvantages associated with the performance of a particular behaviour. SN is the perception of the individual that significant others will approve or disapprove of the behaviour in question, weighted by the motivation of the individual to comply. However, some behaviours may not be totally under volitional control, which means that they require specific resources, skills or opportunities for an individual to perform them. As a result, the TPB (Ajzen, 1985, 1987, 1991) proposes to add the perception of behavioural control (PBC) – the person's assessment of barriers to conduct them and the perceived ability to overcome them – as a direct determinant of behaviour. In addition, the PBC can also act as an indirect determinant of behaviour by influencing intent.

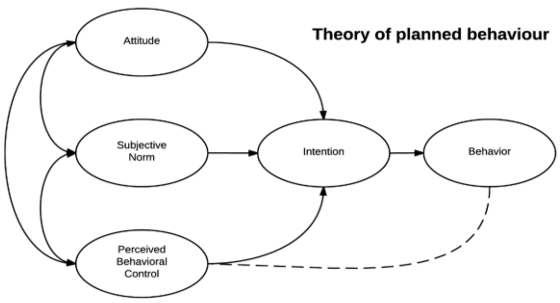



***Figure 2 Constructs of TPB, Source: Theory of Planned Behaviour (TPB) (Ajzen, 1985, 1987, 1991)***

Hu et al. (1999) has used TPB in their telemedicine adoption study in Hong Kong. The researchers observed that TPB has a moderate explanatory power ($R^2$=.37) in individual level telemedicine adoption by physicians.

### 2.4.3 Knowledge Transfer Theory

Significant debate has been held in the field of organisational studies on how knowledge is acquired and disseminated in organisations. The notion of 'knowledge transfer', which originated in the literature on organisational learning and knowledge management (Argote, 2012; Argote & Ingram, 2000), has featured prominently in health policy and management, particularly in the United States and the United Kingdom (Harrison et al., 2002). The concept of knowledge translation, which in health literature concerns the translation of research findings into more accessible terms to allow for transfer to organisational and/or clinical practice, has been enhanced (Nutley et al., 2007). The theories of KT share a rational and cognitive emphasis. They have been influential in management practices, including Business Process Re-engineering (Hammer, 1990) and Lean Management (Holweg, 2007), and are now widely informed by widespread responses to perceived common problems. Their adoption in health policy incorporates two key assumptions: first, that it is possible and desirable to develop 'best practise' solutions to organisational problems (Szulanski, 1996), either by recognising local 'best practise' or by conducting pilot projects to discover one; second, that knowledge in the form of 'best practise' can be disseminated across organisational settings, with the aim of developing 'best practise.' These assumptions are linked to the conceptualisation of policy, management and clinical activity as three discrete macro, meso and micro levels of organisation across which knowledge must be shared (Hanney et al., 2003; Walshe & Rundall, 2001). Knowledge sharing can have the advantages of reducing the costs of research and development (Cohen & Levinthal, 1990) and duplication of effort when it is effective (Epple et al., 1991). KT approaches also promise to facilitate standardised practice and improve quality assurance (Bate & Robert, 2002). In health services, the development of the field of 'implementation science' to facilitate translation and transfer of knowledge (Sobo et al., 2008, Soper and Hanney, 2007, Ward et al., 2009) indicates the strength of attachment to KT theories. However, a large and diverse interdisciplinary body of literature attests to the difficulties of the operationalisation of knowledge transfer, particularly in healthcare (Greenhalgh et al., 2009, Greenhalgh et al., 2004, Nicolini et al., 2008). Various explanations have been provided for this. Knowledge can be 'sticky' and therefore difficult to share with people outside of an immediate group or work setting (Szulanski, 1996, Szulanski, 2000). This may limit the 'absorptive capacity' of the organisation and the ability to maximise the benefits of internal knowledge (Cohen & Levinthal, 1990), leaving some practitioners unaware of the knowledge that exists within the organisation. Understanding how to support complex knowledge sharing processes between organisational groups can be crucial (Bresnen et al., 2003), especially if there is a lack of overall corporate social identity (Kane, 2010). Despite developments in KT theories, difficulties persist in 'non-linear' and complex settings, such as healthcare. Efforts have begun to identify alternative theoretical approaches (Greenhalgh and Stones, 2010, Kontos and Poland, 2009). Practice-based theories, including AT, have been developed to analyse knowledge and practice sharing in complex, dynamic contexts (Nicolini et al., 2003, Cetina et al., 2005) and are potential candidates for analysis and insight development.

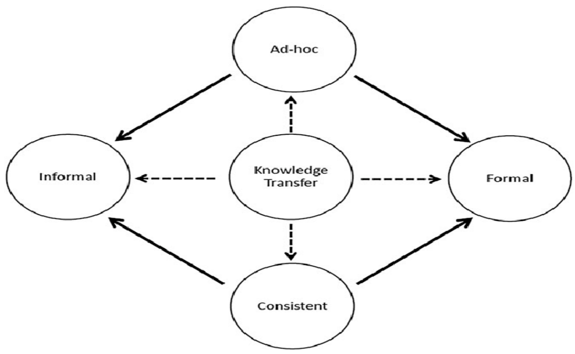



***Figure 3 Knowledge Transfer Process, Source: Alavi and Leidner (2001); Maier and Hadrich (2011)***

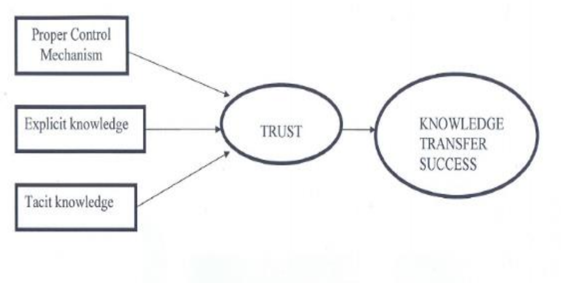



***Figure 4 Knowledge Transfer Success, Source: A Dwivedi et al. (2001); Dwivedi et al. (2002); Standing et al. (2018)***

### 2.4.4 Practice-based theories – Activity Theory (AT)

Practice-based theories share the view that organisational learning is collective, social and situated, and its product is not a commodity called knowledge (Nicolini et al., 2003). They reject the assumption that knowledge is an abstract and acontextual entity which can be transferred, readily or otherwise, between social settings (Lave, 1993). In this chapter we consider a particular practice-based theory, cultural historical AT (henceforth referred to simply as AT).

AT concerns the study of practices (Chaiklin, 2011) and considers knowledge – or knowing – to be achieved through participation in practice (Blackler, 1995). AT was introduced to organisational studies as one alternative to KT theories of organisational learning and knowledge management (Blackler, 1993).

AT focuses on an "object of activity" (Blackler, 2009). Put simply, the object of activity is the aim towards which people work collectively to meet an identified need (Chaiklin, 2011,; Engestrom, 1999). It encapsulates the mutual motivation around which people coalesce (Axel, 1997) and provides a focus towards which people from various organisational and professional backgrounds and roles may work together (Engestrom et al., 1999) in more or less stable groupings.

The analytical unit of AT is the activity system (Engestrom, 2001). This comprises the mutual aim of practice (the object), all those who are involved in working towards it (the subjects), the material and psychological tools used in the work, the rules which govern the work, the way people are organised to achieve their aim and the wider community of practitioners.

The complexity of much contemporary work results in people being involved in various projects simultaneously, which may have different aims. Thus, they participate in multiple activity systems (Blackler, 2009). The object-oriented focus of AT can reveal the range of overlapping activity systems involved in working towards any particular mutual aim. Therefore, it can accommodate (theoretically) the increasingly fragmented and distributed characteristics of contemporary work practices (Hutchins, 1993). The metaphor of "knots" reflects the more or less temporary entanglements of inter-organisational, inter-professional dimensions of work groupings (Engestrom, 2006).

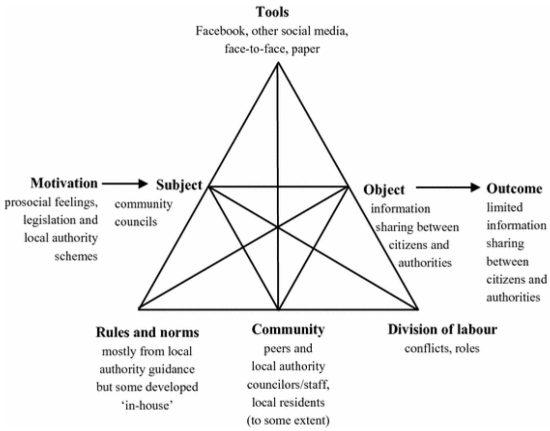



*Figure 5 Activity Theory, Source: Blackler (1993); Chaiklin (2011)*

### 2.4.5 Technology Acceptance Model (TAM)

This model proposes that the user's intention to take up technology is based on the two main concepts of ease of use and perceived usefulness and when used in telemedicine settings, it is generally found that these two concepts do correlate with intention (PJ Hu et al., 1999; Sobrepera et al., 2021). The limitation is that this model is concerned with intentions rather than actual use, therefore, this has been addressed by expanding the theory to the unified theory of acceptance and use of technology (UTAUT), as well as by making adaptations to the healthcare environment.

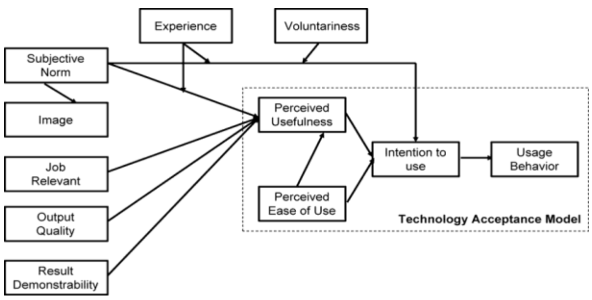



*Figure 6 Technology Acceptance Model, Source: Davis (1989); Davis (1993)*

### 2.4.6 Diffusion of Innovation (DOI)

Rogers (1995) defines the innovation-diffusion process as an "uncertainty reduction process" (p. 232), and he proposes characteristics of innovations that can assist in reducing uncertainty about the innovation. The attribute set includes five characteristics of innovations: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability. According to Rogers (1995), “perceptions of these characteristics predict the rate of adoption of innovations” (p. 219). Rogers argues that while there is a lot of diffusion research on the characteristics of adopter groups, there isn't much on the effects of perceived characteristics of innovations on adoption rates. According to Rogers (1995), the rate of adoption is "the relative speed with which an innovation is adopted by members of a social system" (p. 221). For example, the rate of adoption of an innovation can be measured as the number of people who adopt it over time. The perceived qualities of an innovation are significant predictors of adoption rates. According to Rogers, these five factors account for 49-87 percent of the variation in the rate of innovation adoption. Aside from these factors, the type of innovation decision (optional, collective or authority), communication channels (mass media or interpersonal channels), social system (norms or network interconnectedness) and change agents may all help predict the rate of innovation adoption. Personal and optional innovations, for example, tend to be adopted more quickly than those involving an organisational or collective innovation decision. According to Rogers, the best predictor of an innovation's rate of adoption is relative advantage.

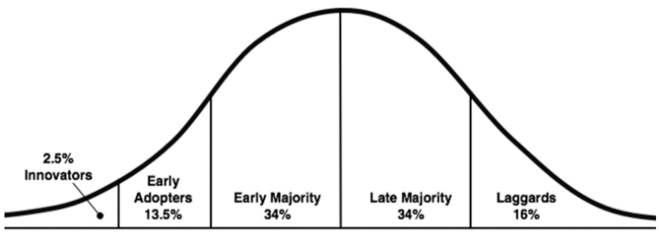



***Figure 7 DOI, Source: Rogers (1995)***

DOI has been used in telehealth environments to ascertain the levels of adoption, the barriers to adoption and the relative advantage which is congenial for adoption (Tanriverdi & Iacono, 1998; Walker & Whetton, 2002).

### 2.4.7 Unified Theory of Acceptance and Use of Technology (UTAUT)

The basic UTAUT model consists of several components or constructs that are hypothesized to relate to the intention to use IT. In turn, intention to use IT predicts IT use. Performance expectancy (PE) is defined as the degree to which an individual believes that using health IT will help him or her to attain gains in job performance. Venkatesh et al. (2003) integrated similar concepts from other models, namely, perceived usefulness, outcome expectancy, relative advantage, job-fit and extrinsic motivation, into this construct. In several previous acceptance studies, performance expectancy was shown to be a strong predictor of intention to use IT. Effort expectancy (EE) is defined as the degree of ease of use associated with health IT. The concept is similar to the perceived ease of use construct in TAM and the IDT model and the complexity of technology construct in the MPCU model. Although many previous studies have shown that effort expectancy was a significant influence on intention to use behaviour, some did not. The degree to which an individual believes that it is important others believe he or she should use health IT is defined as social influence (SI). The construct includes the idea that an individual's behaviour is influenced by how he or she believes others will perceive him or her as a result of using health IT. Venkatesh et al. (2003) integrated subjective norms in TRA, TAM2 and TPB, social factors in MPCU and image in IDT to this construct. The effect of social influence on intention to use technology has been shown to be significant in several previous acceptance studies.

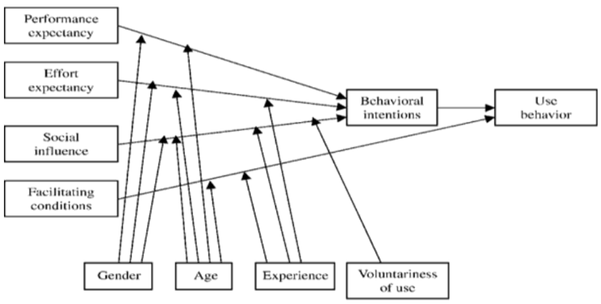



***Figure 8 UTAUT, Source: Venkatesh et al. (2003); Venkatesh et al. (2016)***

### 2.4.8 Task-Technology-Fit (TTF)

Task–technology fit (TTF) is an established information systems model that focuses on actual post-implementation technology use instead of intended pre/post-implementation technology use. The TTF model uses a work-centric viewpoint to evaluate how technology assists a person in performing his or her work tasks and postulates the importance of fitting technology with user tasks to achieve maximum workflow benefit (Goodhue & Thompson, 1995).

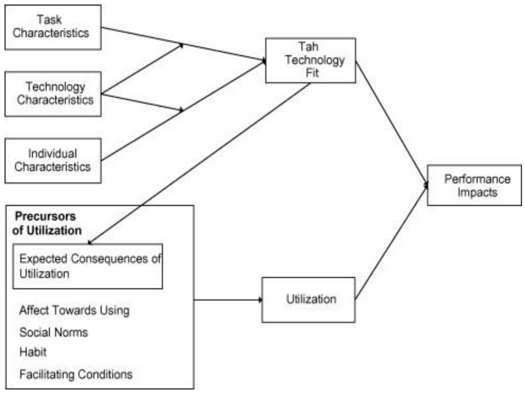



***Figure 9 TTF, Source: Goodhue and Thompson (1995)***

The constructs of this theory as applied to telehealth settings included coordination of care, coordination of research, information flow, problem-solving, interaction artifacts and interaction persons (Cady & Finkelstein, 2014).

### 2.4.9 Technology-Organisation-Environment Framework (TOE)

Technology-Organisation-Environment Framework (TOE) (Depietro et al., 1990) has been tested in organisational settings in various domains of ICT adoption including healthcare. TOE is a comprehensive framework (Hu et al., 2002) and yields a consistent conclusion or results regarding ICT adoption in the healthcare and other domains. This is supported by the research of (Ahmadi, Nilashi, & Ibrahim, 2015; Alaboudi et al., 2016; Brancheau & Wetherbe, 1990; Bretschneider, 1990; Cooper & Zmud, 1990; Fichman, 1992; Ghani & Jaber, 2015; Kimberly & Evanisko, 1981; Lian, Yen, & Wang, 2014; Zmud, 1982). The different knowledge and technological barriers, found through literature review (Adamson, 2016; Faber, Van Geenhulzen, & de Reuver, 2017; Paul, Pearlson, & McDaniel, 1999; Tanriverdi & Iacono, 1998; Zailani, Gilani, Nikbin, & Iranmanesh, 2014), are well represented through the TOE framework.

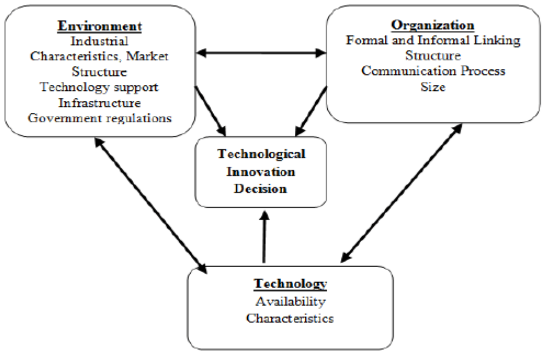



*Figure 10 TOE Framework, Source: Depietro et al. (1990); Hu et al. (2002)*

### 2.4.10 Normalisation Process Theory

In the last decade, there has been a lot of interest in the development and evaluation of complex interventions to improve health. Such interventions can only have a significant impact on health and health care if they are proven to be effective when tested, scalable and easily implemented. There has been a significant gap between research and implementation up to this point. The Normalisation Process Theory (NPT) examines the factors that influence the successful implementation and integration of interventions (normalisation). NPT can be used as a sensitisation tool, allowing researchers to think about implementation issues while developing and evaluating a complex intervention. NPT can assist in trial design by identifying potential issues with recruitment or data collection, as well as ensuring that the intervention has good implementation potential (Murray et al., 2010).

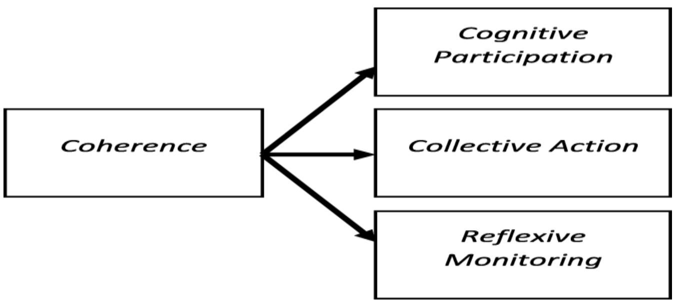



*Figure 11 Normalisation Process Theory, Source: (Murray et al., 2010)*

Normalisation Process Theory was developed from research within the telehealth environment. Usually, theories developed elsewhere are applied to telehealth, but in this case the original research concerned telemedicine services and was extended to e-health as an example of complex innovations in health systems. It has now been developed to the point where it is proposed as a general theory of innovation in healthcare. NPT is complex, with a matrix of concepts that describe the organisation of work, and the way new practices become routine, sustainable and integrated (Morrison & Mair, 2011).

### 2.4.11 Systems and Complexity Theory

The Complexity Theory has been applied in strategic management and organisational studies. Understanding how organisations or firms adapt to their environments and deal with uncertainty are examples of application areas. Organizations have complex structures because they are dynamic networks of interactions, not aggregations of individual static entities. They are adaptive in the sense that individual and collective behaviour mutate and self-organize in response to a change-initiating micro-event or set of events (Dodder & Dare, 2000; Suh & Ralph, 2005).

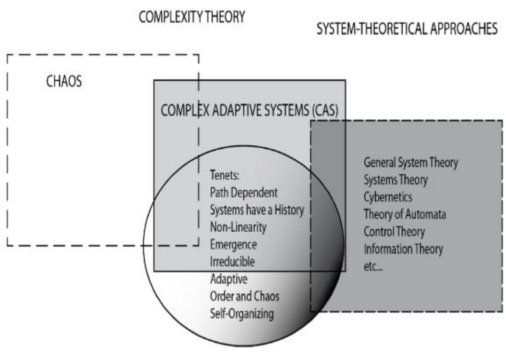



***Figure 12 Systems and Complexity Theory, Source: Dodder and Dare (2000); Suh and Ralph (2005)***

The theory has applications in healthcare regarding adaptions and practices in primary care, healthcare reform, healthcare costs and quality, preventive services, and framing policies to implement new models of healthcare (Sturmberg & Martin, 2013).

### 2.4.12 Selwyn's Digital Divide Theoretical Model

The Selwyn's Digital Divide Model is mostly user centric and focusses on the independent variables of access, usage, appropriation and outcome, along with a dependent variable of wellbeing (Dodel, 2015; Selwyn, 2002, 2004; Selwyn & Facer, 2007). The digital divide model assesses the mediating effects of culture, society and economic reasons on engagement with ICT as well as, it assesses the inequalities in ICT usage fostered by these mediating effects (Selwyn, 2004).

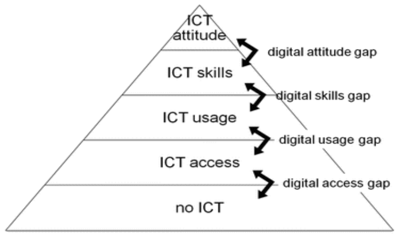



***Figure 13 The Digital Divide, Source: (Dodel, 2015; Selwyn, 2002, 2004; Selwyn & Facer, 2007)***

In telehealth environment, application of the theory can be found to explore the negative effects of digital divide among the elderly persons during the COVID-19 (SARS-CoV-2) pandemic(Van Jaarsveld, 2020). The theory has also been used to predict eHealth usage with discernment on digital divide (Kontos et al., 2014).

### 2.4.13 Socio-Technical Theory

This group of theories was constructed to better understand the behaviour of complex, adaptive, non-linear systems, in which it is difficult to discern straightforward causal relationships. Plsek and Greenhalgh (2001) applied these concepts to healthcare, concluding innovations were most likely to succeed when they are introduced gradually, led by locally self-organising groups and allow the most effective solution to emerge from a range of alternatives. Generally, the more complex the system, the less likely that a single external ‘solution’ will be effective. Since telemedicine is a complex intervention into an already complex system (changing referral pathways, professional roles and workflow), these theories give some insight into the difficulties of adoption.

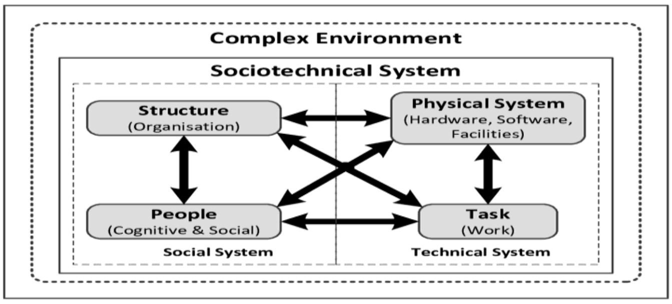



*Figure 14 Socio-Technical System, Source: Plsek and Greenhalgh (2001)*

## 2.5 Section C Synthesis of Literature

The information drawn from the literature review was synthesised to extract the determinants that had an impact on telehealth adoption. The initial determinants include awareness, cost factors, advantages and disadvantages, medical errors, information sharing, current state of technology, usefulness and role of wireless technology and technology awareness. On the basis of the literature review, the determinants were classified into drivers and barriers in general as shown in Table 1.

*Table 1 The drivers and barriers of telehealth in general*

**Table**

**Determinants of Telehealth Adoption in general**

| **Technological Factors** | | | |
|---|---|---|---|
| **Enablers (Drivers)** | | **Barriers** | |
| **Items** | **Author** | **Items** | **Author** |
| Investment | Chang et al. (2015); Ellimoottil et al. (2018); Lin et al. (2018) | Compatibility | Handayani et al. (2017) |
| Service Availability | Chang et al. (2015) | Information Security | LeRouge and Garfield (2013); Mohammadzadeh et al. (2013) |
| Usefulness<br>Ease of use | Hu et al. (2002); Hu et al. (1999); Hu et al. (1999); Monthuy-Blanc et al. (2013); Sobrepera et al. | Access to mobile telephony | Carati and Margelis (2013); Dodel (2015); Elder and Clarke (2007) |

| | | | |
|---|---|---|---|
| Attitude<br>Subjective norm<br>Behavioural Control<br>Behavioural Intentions | (2021); Terry and Buntoro (2021); Zailani et al. (2014) | Access to internet | Carati and Margelis (2013); Dodel (2015); Elder and Clarke (2007) |
| | | Unreliable | Scholl et al. (2011) |
| | | Confidentiality | Cherney and Van Vuuren (2012); Mohammadzadeh et al. (2013) |
| | | Coverage | Hafeez-Baig and Gururajan (2010) |
| | | Hacking of health data | Wright et al. (2008) |
| Benefits | Cilliers and Flowerday (2013); Gururajan and Hafeez-Baig (2014); Hafeez-Baig and Gururajan (2010); Hu et al. (2002); Loane et al. (1998); Moffatt and Eley (2010) | System reliability | Dünnebeil et al. (2012); May et al. (2011) |
| Safe Technology | Plaete et al. (2014) | Inconvenience of using equipment | Dünnebeil et al. (2012) |
| Appropriate usage | De Rosis and Seghieri (2015) | | |
| Cost of personal computer | Levine et al. (2014); Mohammadzadeh et al. (2013) | | |
| Improved usage | De Rosis and Seghieri (2015) | | |
| Service Availability | Chang et al. (2015) | | |
| Networking aspects | Loane et al. (2000); Loane and Wootton (2001); Loane et al. (1998) | | |
| Comfort using video link | Loane et al. (2000); Loane and Wootton (2001); Loane et al. (1998) | | |

| | | | |
|---|---|---|---|
| ICT utilisation | Chandwani (2017); Chandwani and Dwivedi (2015) | | |
| Usage | De Rosis and Seghieri (2015); Dodel (2015); Tanriverdi and Iacono (1998) | | |
| Technical knowhow | Faber et al. (2017) | | |
| Personal experience | Loane et al. (1998) | | |

**Organisational Factors**

| Enablers (Drivers) | | Barriers | |
|---|---|---|---|
| **Items** | **Author** | **Items** | **Author** |
| Organisational culture | Bergrath et al. (2011); Gagnon et al. (2005); Mohammadzadeh et al. (2013); Ross et al. (2015) | Policies | De Rosis and Seghieri (2015); Doarn et al. (2014) |
| Organisational Behaviour | Adler-Milstein et al. (2014); Blount and Gloet (2015); Gagnon et al. (2003); Ranganathan and Balaji (2020) | Project team's capacity | Zailani et al. (2014) |
| Actions | Ammenwerth et al. (2006); Andreassen et al. (2006); Araújo et al. (2000); Chung et al. (2008); Finkelstein et al. (2011); Gilmour et al. (1998); Helitzer et al. (2003) | Size of hospital | Kahn et al. (2014) |
| Target | Carati and Margelis (2013) | Adoption by healthcare staff | Adler-Milstein et al. (2014); Alam et al. (2020); Alrahbi et al. (2019); American Medical Association (2020) |
| Purpose | | | |
| Efficiency | | | |
| | | Local Capacity | |

| | | | |
|---|---|---|---|
| Group dynamics | Kahn et al. (2014); Molfenter et al. (2015) | Technical capacity<br>e-readiness | Elder and Clarke (2007); LeRouge and Garfield (2013) |
| Managerial factors | West and Milio (2004); Wu et al. (2011); Yan et al. (2016); Yarbrough and Smith (2007) | Lack of ICT equipment | Elder and Clarke (2007) |
| Collective Attitude | Gururajan and Hafeez-Baig (2014); P. J. Hu et al. (1999); Hunter (2015); Jinka and Venugopal (2015); Johansson et al. (2019) | Lack of ICT infrastructure | Chandwani and Dwivedi (2015); A Dwivedi et al. (2001) |
| Service needs | | Cost of Access | Elder and Clarke (2007) |
| Organizational readiness | Gagnon et al. (2005) | Localisation | Elder and Clarke (2007) |
| Time saving | Liu Sheng et al. (1998); Loane et al. (1998); Wootton (2009) | Short staff | Hafeez-Baig and Gururajan (2010) |
| Process orientation | Dünnebeil et al. (2012) | Poor project management | Azzolini (2011); Khoja et al. (2016); Nessa et al. (2010); Scott and Mars (2015) |
| Top management support | Dünnebeil et al. (2012) | Organisational uncertainty | Adler et al. (2014) |
| Performance | Kijsanayotin et al. (2009) | Complexity of Healthcare systems | Adamson (2016) |
| Effort | Kijsanayotin et al. (2009) | Lack of fit | Cady (2014) |
| Voluntariness | Kijsanayotin et al. (2009) | Lack of evaluation methods | Acharya and Rai (2017); Bashshur (1995); Donovan et al. (2021); Dyk (2014); El-Mahalli et al. (2012) |
| | | Practice | Al-Mahdi et al. (2015); Anwar and Prasad |

| | | |
|---|---|---|
| | | (2018); Anwar et al. (2019); Araújo et al. (2000); Attri et al. (2016); Bai et al. (2007) |
| | Additional workload | Ganapathy (2014); Jameson et al. (2011); Mathur et al. (2017); Radhakrishnan et al. (2015); Sachan (2013) |
| | Need for specialists | Ganapathy (2014); Jameson et al. (2011); Mathur et al. (2017); Radhakrishnan et al. (2015); Sachan (2013) |
| | Lack of organization support | Gagnon et al. (2005); Hu et al. (2002); Kifle et al. (2010); Légaré et al. (2010) |
| | Conveying the doctors message | Acharya and Rai (2017); Andreassen et al. (2006); Anwar et al. (2019); Chandwani (2017) |
| | Lack of information about real costs | Mohr et al. (2013); Ross et al. (2015) |
| | Extra Burden for doctors | Sachan (2013) |
| | Responsibility | Kierkegaard (2015); Kreps and Neuhauser (2010) |

**Environmental Factors**

| Enablers (Drivers) | | Barriers | |
|---|---|---|---|
| **Items** | **Author** | **Items** | **Author** |
| Health culture | Adler-Milstein et al. (2014); Catan et al. (2015); Faber et al. (2017); Kifle et al. (2007); Lluch (2011); Schmeida et al. (2007); Zelmer et al. (2017) | Standardised Policies | Cherney and Van Vuuren (2012); Elder and Clarke (2007); LeRouge and Garfield (2013) |
| Socio-political context | Adler-Milstein et al. (2014); Catan et al. (2015); Faber et al. (2017); Kifle et al. (2007); Lluch (2011); Schmeida et al. (2007); Zelmer et al. (2017) | Access | Doarn et al. (2014); Doarn et al. (2008); Pak et al. (2008) |
| Unhealthy lifestyles | Cherney and Van Vuuren (2012) | Health policy | Cherney and Van Vuuren (2012); Elder and Clarke (2007); LeRouge and Garfield (2013) |
| Social Influence | Bigna et al. (2014) | External Supplier's capacity | |
| Logic of care | Chandwani and De (2015); A Dwivedi et al. (2001) | Regulatory Environment | Cherney and Van Vuuren (2012); Elder and Clarke (2007); LeRouge and Garfield (2013) |
| Logic of Choice | Chandwani and De (2015); A Dwivedi et al. (2001) | Local Environment | Ross et al. (2015) |
| Facilitating conditions | Doarn et al. (2014); Doarn et al. (2008); Pak et al. (2008) | Illiteracy | van Deursen and van Dijk (2011) |
| Societal factors | Doarn et al. (2014); Doarn et al. (2008); Pak et al. (2008) | Disparity | van Deursen and van Dijk (2011) |

| | | | |
|---|---|---|---|
| Ageing population | Doarn et al. (2014); Doarn et al. (2008); Pak et al. (2008) | Economy | van Deursen and van Dijk (2011) |
| Environment / climate change | Doarn et al. (2008); Zailani et al. (2014) | Diversity in religion | Doarn et al. (2008); Zailani et al. (2014) |
| Shortage of healthcare professionals | Anwar et al. (2019); Bai et al. (2007); Doarn et al. (2008); Ganapathy (2014); Mars (2012); Mbarika (2004) | Diversity in language | van Deursen and van Dijk (2011) |
| Consumerism driving demand | Anwar et al. (2019); Bai et al. (2007); Doarn et al. (2008); Ganapathy (2014); Mars (2012); Mbarika (2004) | Ethics | Ross et al. (2015) |
| | | Scientific requirement | Mairinger et al. (1996) |
| | | Legal requirement | Mairinger et al. (1996) |
| | | Health insurance | Kahn et al. (2014) |
| | | Funding | Scholl et al. (2011) |
| | | No priority of health | Scholl et al. (2011) |
| | | Govt. Policy | Scholl et al. (2011) |

**Knowledge Factors**

| Enablers (Drivers) | | Barriers | |
|---|---|---|---|
| **Items** | **Author** | **Items** | **Author** |
| Current competence | Albarrak et al. (2019); Batchelor et al. (2015); Bee et al. (2016); A Dwivedi et al. (2001); Dwivedi et al. (2002) | Technical knowhow | Robben et al. (2012); Ronda et al. (2014); van Deursen and van Dijk (2011) |
| Alert Clinicians | Albarrak et al. (2019); Batchelor et al. (2015); Bee et al. (2016); A | Computing knowledge | Robben et al. (2012); Ronda et al. (2014); van |

| | | | |
|---|---|---|---|
| | Dwivedi et al. (2001); Dwivedi et al. (2002) | | Deursen and van Dijk (2011) |
| Health education | Albarrak et al. (2019); Batchelor et al. (2015); Bee et al. (2016); A Dwivedi et al. (2001); Dwivedi et al. (2002) | Information sharing | Alavi and Leidner (2001); Albarrak et al. (2019) |
| Willingness to share knowledge | Mairinger et al. (1996); Standing et al. (2014) | Knowledge | Tanriverdi and Iacono (1998) |
| Understanding of value | Melissant et al. (2018); Nundy et al. (2014); Zhang et al. (2017) | Documentation | Tanriverdi and Iacono (1998) |
| Self-efficacy | Melissant et al. (2018); Nundy et al. (2014); Zhang et al. (2017) | Lack of Awareness | Alavi and Leidner (2001); Albarrak et al. (2019) |
| End-user training | Albarrak et al. (2019); Batchelor et al. (2015); Bee et al. (2016); A Dwivedi et al. (2001); Dwivedi et al. (2002) | Technical training | Robben et al. (2012); Ronda et al. (2014); van Deursen and van Dijk (2011) |
| | | Lack of knowledge | Albarrak et al. (2019); Batchelor et al. (2015); Bee et al. (2016); A Dwivedi et al. (2001); Dwivedi et al. (2002); Standing et al. (2018) |

**Innovation Factors**

| **Enablers (Drivers)** | | **Barriers** | |
|---|---|---|---|
| **Items** | **Author** | **Items** | **Author** |
| Technological Innovations | Blanchet (2007); McHugh et al. (2018); Rogers (1995); Scott (1990) | Facilities for innovation | Courtney et al. (2008); Katzenstein et al. (2012); Kijsanayotin et al. (2009) |

| | | | |
|---|---|---|---|
| Appropriation | Chib et al. (2015); Mackert and Whitten (2007) | Adoption by patients | Adler-Milstein et al. (2014); Ahmadi et al. (2015); Akhlaq et al. (2016); Alam et al. (2020); Alrahbi et al. (2019); Blount and Gloet (2015) |
| Organisational innovation | Blanchet (2007); Budman et al. (2003); Cho et al. (2009); Cho et al. (2007); Conde et al. (2010); Fleuren et al. (2004) | Adoption by health care professionals | Acharya and Rai (2017); Adler-Milstein et al. (2014); Ahmadi et al. (2015); Ahmed et al. (2010); Akhlaq et al. (2016); Alaboudi et al. (2016); Alam et al. (2020); Alrahbi et al. (2019); Blount and Gloet (2015) |

**Healthcare-Specific Factors**

| Enablers (Drivers) | | Barriers | |
|---|---|---|---|
| **Items** | **Author** | **Items** | **Author** |
| Advantages | Ashburner et al. (2016); Campbell et al. (2001); Chattopadhyay (2010) | Adverse event | Piper et al. (2014); Radhakrishnan et al. (2016); Wallwiener et al. (2009) |
| Remote monitoring | Finkelstein et al. (2011); Looman et al. (2015); Pangarakis et al. (2008); Sharifi et al. (2013) | Unintentional consequences | Piper et al. (2014); Radhakrishnan et al. (2016); Wallwiener et al. (2009 |
| Acceptance for diagnostic purposes | Aiello et al. (2019); Warshaw et al. (2011); Witherspoon et al. (1993); Zayapragassarazan and Kumar (2016) | | |

Further, a list has been prepared with a focus on Indian telehealth, as shown in Table 2. This list of drivers and barriers are expected to provide a direction for the development of the conceptual framework for telehealth adoption in India.

*Table 2 The drivers and barriers of telehealth in India*

**Table**
**Determinants of Telehealth Adoption in Indian Healthcare**

| **Technological Factors** | | | |
|---|---|---|---|
| **Enablers (Drivers)** | | **Barriers** | |
| **Items** | **Author** | **Items** | **Author** |
| Improved ICT Infrastructure | Chandwani (2017); Chandwani and De (2015); Chandwani and Dwivedi (2015) | Broadband speed in rural areas | Pak et al. (2008); Scholl et al. (2011) |
| Usefulness | Ganapathy (2002, 2014); Ganapathy et al. (2019) | Technology safety | Ganapathy (2002, 2014); Ganapathy et al. (2019) |
| Broadband speed | Ganapathy (2002, 2014); Ganapathy et al. (2019) | Service Quality | Ganapathy (2002, 2014); Ganapathy et al. (2019) |

| **Organisational Factors** | | | |
|---|---|---|---|
| **Enablers (Drivers)** | | **Barriers** | |
| **Items** | **Author** | **Items** | **Author** |
| Collective attitude | Acharya and Rai (2017); Ahamed et al. (2017); Anand and Fan (2016) | Organisation Readiness | Dasgupta and Deb (2008) |
| | | Lack of trained health workers | Bhatia (2021); Ganapathy (2015a); Rathi (2017) |
| | | Revenue model | Dasgupta and Deb (2008) |
| | | Lack of organization support | Dasgupta and Deb (2008) |

| **Environmental Factors** | | | |
|---|---|---|---|
| **Enablers (Drivers)** | | **Barriers** | |
| **Items** | **Author** | **Items** | **Author** |
| Accessibility | Elder and Clarke (2007) | Government Policies | Bhatia (2021); Ganapathy (2015a); Rathi (2017) |
| Shortage of healthcare professionals | Bhatia (2021); Ganapathy (2015a); Rathi (2017) | | |
| Vast rural and remote areas | Durrani and Khoja (2009) | | |
| Service needs | Bhatia (2021); Ganapathy (2015a); Rathi (2017) | | |

| | | | |
|---|---|---|---|
| Demographics | Bhatia (2021); Ganapathy (2015a); Rathi (2017) | | |
| Disease Profile | Bhatia (2021); Ganapathy (2015a); Kumar and Ahmad (2015); Rathi (2017) | | |

| **Knowledge Factors** | | | |
|---|---|---|---|
| **Enablers (Drivers)** | | **Barriers** | |
| **Items** | **Author** | **Items** | **Author** |
| Willingness to share knowledge | Ganapathy (2015a) | Non tech savvy healthcare professionals | Rathi (2017) |
| Educating patients | Ganapathy (2015a) | | |

| **Innovation Factors** | | | |
|---|---|---|---|
| **Enablers (Drivers)** | | **Barriers** | |
| **Items** | **Author** | **Items** | **Author** |
| Competitive advantage | Iyer (2014) | Laggards | Iyer (2014) |

| **Healthcare-Specific Factors** | | | |
|---|---|---|---|
| **Enablers (Drivers)** | | **Barriers** | |
| **Items** | **Author** | **Items** | **Author** |
| Advantages | Ghia et al. (2013) | Unintentional consequences | Ghia et al. (2013) |
| Remote Monitoring | Ganapathy (2015a); Ganapathy et al. (2019); Ghia et al. (2013) | | |

### 2.5.1 Gaps in the Literature

The literature review has recognised the drivers and barriers of ICT adoption in the healthcare domain as well as in the telehealth environment around the world. The literature review suggests that there is a considerable gap regarding the absence of a theoretical framework regarding study of ICT adoption in healthcare organisations (R. Chandwani & De, 2015; R. K. Chandwani & Dwivedi, 2015; Dodel, 2015; Ganapathy, 2002; Standing et al., 2011). Elder and Clarke (2007) stressed the need for conducting research in ICT adoption in healthcare according to the local environment. Carati and Margelis (2013) suggested the identification of barriers and enablers of telehealth implementation in different environments. R. K. Chandwani and Dwivedi (2015) suggested further research in ICT adoption in institutional and other perspectives. Further, Dodel (2015) suggested the need to construct cost-effective and quality research instruments and to test the ICT assets of access, usage and appropriation as independent variables in research of ICT adoption of healthcare. Most of the studies were also inadequate in population or response (Gschwendtner, Netzer, Mairinger, & Mairinger, 1997; Mairinger, Gable, Derwan, Mikuz, & Ferrer-Roca, 1996). The framework might be different in developing countries, as different cultures and geographic barriers could alter behaviour, as pointed out by De Rosis and Seghieri (2015). Further, limited research on Indian telehealth technology adoption (R. K. Chandwani & Dwivedi, 2015; Dasgupta & Deb, 2008; Ghia et al., 2013; Iyer, 2014; Kumar & Ahmad, 2015; Marcelo et al., 2015; Mathur et al., 2017; Pal et al., 2002), and a lack of theoretical framework (Acharya & Rai, 2017; R. Chandwani & De, 2015; Ganapathy, 2002) to guide telehealth adoption in India, compels the need to define the determinants of ICT adoption in the Indian Telehealth environment.

As highlighted by the literature review, there is a lack of theoretical framework to guide the research on ICT adoption in telehealth environments (Acharya & Rai, 2017; R. Chandwani & De, 2015; R. K. Chandwani & Dwivedi, 2015; Dodel, 2015; Ganapathy, 2002; Standing et al., 2011). A conceptual framework may provide deeper understanding of the resultant determinants in future research on Indian telehealth adoption. Matching the resultant data to the conceptual framework can yield a new theoretical framework for use in the domain further. In future research, new determinants that are unknown prior to the research can be uncovered. Therefore, apart from identifying the drivers and barriers to telehealth adoption in India, it is necessary to have a working conceptual framework to make future research effective and easily understandable through a theoretical perspective. A theory not only provides potential constructs in relation to ICT adoption but can also provide a pathway to establish relationship between the constructs (Denzin, 1986; Shoemaker, Tankard Jr, & Lasorsa, 2003).

The next section will conceptualise the preliminary framework and develop working hypotheses for further qualitative and quantitative research.

### 2.6 Section D Preliminary Conceptual Framework for Telehealth Adoption

The most prominent and influential theories in the ICT adoption field are Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975, 1976), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Technology Acceptance Model (TAM) (Davis, 1989), Diffusion of Innovations (DOI) (Rogers, 1995), Activity Theory (Kuutti, 1996; Nardi, 1996), Task-Fit-Technology (TFT) Model (Goodhue & Thompson, 1995), Technology-Organisation-Environment Model (TOE) (Depietro et al., 1990), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003; Venkatesh et al., 2016). Other notable theories include Normalisation Process Theory (May & Finch, 2009; May et al., 2009), Systems and Complexity Theories (Benbya & McKelvey, 2006), Selwyn's Digital Divide Theoretical Model (Dodel, 2015) and, Socio-Technical Theories (Geels, 2004; Trist, 1981). Among these, TAM, TPB, TRA, DOI and UTAUT have been used primarily in individual level studies (Chang et al., 2015; Cimperman et al., 2016; Holden & Karsh, 2010; Hu et al., 1999; Lee et al., 2010; Sugarhood et al., 2014). Ammenwerth et al. (2006) noted the lacunae of the TFT model in its inability to include interaction between the user and the task. Davidson and Chismar (2007) noted that the activity theory is concerned with the interaction of individual level and social levels of ICT adoption. The Selwyn's Digital Divide Model is mostly user centric and focusses on the independent variables of access, usage, appropriation and outcome, along with a dependent variable of wellbeing (Dodel, 2015). The Normalisation Process Theory is useful to study the adoption process of technologies which are difficult to embed into everyday use (Pope et al., 2013). Systems Complexity Theory has been used in studies relating to knowledge management systems and organisational learning (McElroy, 2000). Socio-Technical Theories are tested in organisational technology adoption process but are more suited to case studies or an action research design of research (Dillon & Morris, 1996). Technology-Organisation-Environment Model (TOE) (Depietro et al., 1990) has been tested in organisational settings in various domains of ICT adoption including healthcare. TOE is a comprehensive framework (Hu et al., 2002) and yields a consistent conclusion or results, regarding ICT adoption in the healthcare and other domains. This is supported by the researches of Ahmadi et al. (2015); Alaboudi et al. (2016); Brancheau and Wetherbe (1990); Bretschneider (1990); Cooper & Zmud (1990); Fichman (1992); Ghani and Jaber (2015); Kimberly and Evanisko (1981); Lian et al. (2014); Zmud (1982). The different knowledge and technological barriers found through literature review (Adamson, 2016; Faber et al., 2017; Paul et al., 1999; Tanriverdi & Iacono, 1998; Zailani et al., 2014) are well represented through the TOE framework. Since the study aims to identify the different drivers and barriers of telehealth technology adoption in an organisational setting, the TOE framework adapted from Depietro et al. (1990) and Hu et al. (2002) can help to modify and create a new theoretical framework for telehealth technology adoption in the Indian healthcare domain. The different constructs of the TOE framework are ease of use, technology safety, service benefits, service risks, collective attitude of healthcare staff, organisational policies and management and service needs (Hu et al., 2002).

A host of other determinants has been derived from the literature review as listed in Table 1 and Table 2. Considering the determinants, specific themes have been formed to create a conceptual framework to study the adoption of telehealth in the Indian environment. The conceptual framework is represented in Figure 15 below.

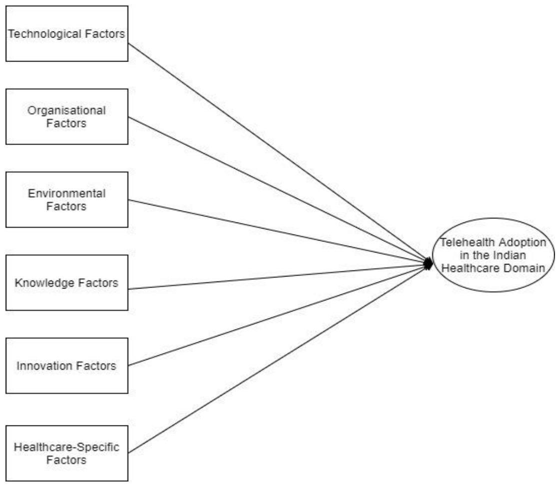



*Figure 15 Conceptual framework for telehealth adoption in Indian healthcare*

The themes formulated for the conceptual framework to study Indian telehealth adoption are Technology, Organisation, Environment, Knowledge, Innovation and Healthcare Specific.

**Technology**

The ease of use construct has been criticised by Chau and Hu (2002), Chismar and Wiley-Patton (2003), and Keil et al. (1995). The researchers were of the view that physicians rely on the usefulness of ICT instead of relying on the ease of using it. The physicians' emphasis is more on the utility, functionality and effective patient outcomes. The results obtained by Lin et al. (2012) show that usefulness has a greater impact than ease of use.

Technology safety can be a hindrance in influencing an organisation's ICT adoption. Physicians are concerned with the safety of the equipment and technology used in their patient's care (Hu et al., 2002). A technology which can affect patients' care outcomes can be considered as risky.

In India, although the urban ICT infrastructure has improved significantly, there is still scope for improvement in broadband speed and increasing rural connectivity which is still low (Confederation of Indian Industry & KPMG, 2017).

**Organisation**

Collective attitude of healthcare staff was found to be the most significant factor influencing ICT adoption in telehealth environment (Hu et al., 2002). The same research concludes that organisation policies and management were non-significant. The collective attitude of the healthcare staff towards telehealth can regulate an organisation's readiness for adopting ICT. The collective attitude may include willingness to share knowledge as well as willingness to learn from training.

A healthcare organisation's main purpose is to provide service to the people who need medical services because of service access or quality. In India there prevails a tremendous health inequality as observed by Balarajan et al. (2011). Exploring alternative arrangements for service delivery is one of the priorities for a healthcare organisation.

**Environment**

The vast rural and remote areas of India are plagued by inaccessibility to healthcare and shortage of healthcare professionals (Rathi, 2017). A standardised government policy and framework regarding telehealth can foster telehealth adoption in India, catering to a larger section of the society (Singh, 2005). Further, the demographics and disease profile in urban and rural areas can be a significant driver for adoption of telehealth (West & Milio, 2004).

**Knowledge**

Easy access to information for healthcare professionals, patients and healthcare workers is needed for adoption of telehealth in India (Dwivedi, Bali, James, & Naguib, 2001). Further, the training needs of the healthcare workers and for non-tech-savvy healthcare professionals are also significant barriers to adoption of telehealth in India

(R. K. Chandwani & Dwivedi, 2015; Dwivedi et al., 2001). Interestingly, the majority of healthcare professionals are willing to share their knowledge and participate in the telehealth adoption process (Ghia et al., 2013).

**Innovation**

The majority of the efforts in the telehealth environment in India are by late adopters (Kumar & Ahmad, 2015). The competitive advantage of telehealth, as to, face-to-face consultations, need to be studied in detail (Cho, Mathiassen, & Gallivan, 2009). The scope of innovation in providing telehealth services in various forms, such as telemedicine for primary care, online consultations by physicians, dietitians etc., and the adoption rates of those services, varies according to the domain (Cho, Mathiassen, & Robey, 2007).

**Healthcare Specific**

In India there have been efforts to provide telemedicine services in the rural areas focussing on primary healthcare (Kumar & Ahmad, 2015). Various healthcare professionals, including physicians, surgeons, dietitians, dentists and physiotherapists, have started to provide online consultations in the urban areas, at least in the initial level of consultation. The online consultations have a broad outreach at a pan-India level (Brindha, 2013; Sivagurunathan et al., 2015). As such, future study of telehealth adoption in specific healthcare domains may extend the viability of such efforts.

### 2.6.1 Discussion

After a preliminary conceptual framework is formed, there is a need for further justification of the constructs under the broad categories of technology, organisation and environment. Constructs of different adoption models can be combined to form a new model for testing in the healthcare domain. The literature review has synthesised and compared constructs of different technology adoption models which have been applied to healthcare and other domains. The main objective was to identify the items within the constructs across the Technology Adoption Models, which can be modified according to the end results of the research (Wisdom 2014). Aarons et al. (2011) observed that that there are a number of models to "summarize factors at multiple levels of the social and organizational context that potentially influence the process of translating research into effective improvements in practice" (p. 5). Further, they assert that the implementation and diffusion literature has focussed most heavily on the implementation phase of the process with less emphasis on the exploration/adoption phases (also known as pre-implementation) or the maintenance/sustainability phase (also known as post-implementation). The implementation of an evidence-based practice is predicated on the organisation's decision to adopt that evidence-based practice (Panzano & Roth, 2006). Adoption, the decision to proceed with a full or partial implementation of an evidence-based practice, is a complex process and understanding this process may provide insights for the development of strategies to increase the uptake of evidence-based practices. (Fixsen et al., 2005). Adoption usually starts with the recognition that a need exists and moves to searching for solutions, then to the initial decision to attempt the adoption of a solution and finally, to the actual decision to attempt to proceed with the implementation of the solution (Damanpour and Schneider 2006; Gallivan 2001; Mendel et al. 2008). Greenhalgh et al. (2004) characterized in the adoption process: pre-adoption (e.g., awareness of innovation), periadoption (e.g., continuous access to innovation information) and established adoption (e.g., adopters' commitment to the adoption decision). Alternatively, Frambach and Schillewaert (2002) discussed two stages associated with adoption: the organisation's decision to pursue adoption and the staff's acceptance and initiation of their individual processes of accepting the innovation. Adoption will either move to initial implementation activities or revert to de-adoption.There is little information about de-adoption (Frambach and Schillewaert, 2002; Gallivan, 2001). Finally, just as the decision to adopt is a process, how the adoption proceeds is better characterised in terms of level, rate or degree of adoption (Mendel et al., 2008). The better the process of adoption can be understood, the more likely adoption challenges can be addressed, thus leading to initial implementation.

On an organisational or system level, the adoption process is complex. It is particularly challenging to promote change in routine practice when decision-makers within organisations do not perceive changes as necessary (Garland et al., 2010). Despite the similarity to individual-level adoption, Aarons et al. (2011) suggest that individuals in organisations may have difficulty knowing, weighing or selecting appropriate innovations to solve particular problems. Alternatively, their decision to adopt is often complicated by organisational factors (e.g., hierarchy, culture, values) that are not necessarily experienced in individual problem-solving. Further, organisations, like individuals, can be classified as low-, medium- or high-adopters, regardless of the innovation of interest (Rogers, 2003). These classifications of adopters, while meaningful for planning and descriptive purposes, need further empirical inquiry into whether there are strategies that can change organisations from medium- or low-adopters to high-adopters (Greenhalgh et al., 2004; Oldenburg and Glanz, 2008).

## 2.7 Chapter Conclusion

The conceptual framework for telehealth adoption in Indian healthcare has been developed after reviewing a wide range of ICT adoption literature from global and Indian healthcare domains. The identified themes of technology, organisation, environment, knowledge, innovation and healthcare specific, may provide a platform for future adoption studies in the Indian telehealth environment, as well as, in ICT adoption studies in other healthcare domains. The conceptual framework can be used in framing policies and procedures in governmental and non-governmental organisations. This literature review, apart from serving as a guide to this research study, also broadens the scope for future empirical research on telehealth adoption in India and in other developing countries.

# CHAPTER 3 RESEARCH METHODOLOGY

## 3.1 Chapter Overview

The previous chapter comprehensively reviewed ICT and telehealth adoption studies and ICT adoption models in the healthcare domain. The literature review helped to develop a preliminary conceptual framework as a basis for this study. Further, various constructs have been identified to be explored in the later stages of this research. For developing a successful model of telehealth adoption research, it is first essential to formulate an appropriate approach, design and strategy suited to answer the research questions. It is then essential to formulate, refine and test the hypotheses developed from the various stages of research. Thus, this chapter begins with the justification for chosen research philosophy assumptions, philosophical stances and approaches. Further, the argument for research design, strategy, techniques and tools employed for this research will be laid out. This chapter is divided into several sections covering research philosophies, research methods and strategy.

## 3.2 Introduction

Methodology is the justification for employing a specific research method. A method is utilizing a research tool, such as a questionnaire, to accomplish a qualitative method like interviews. Understanding the distinction between methods and methodology is critical. The stages of the research are illustrated below (Figure 16).

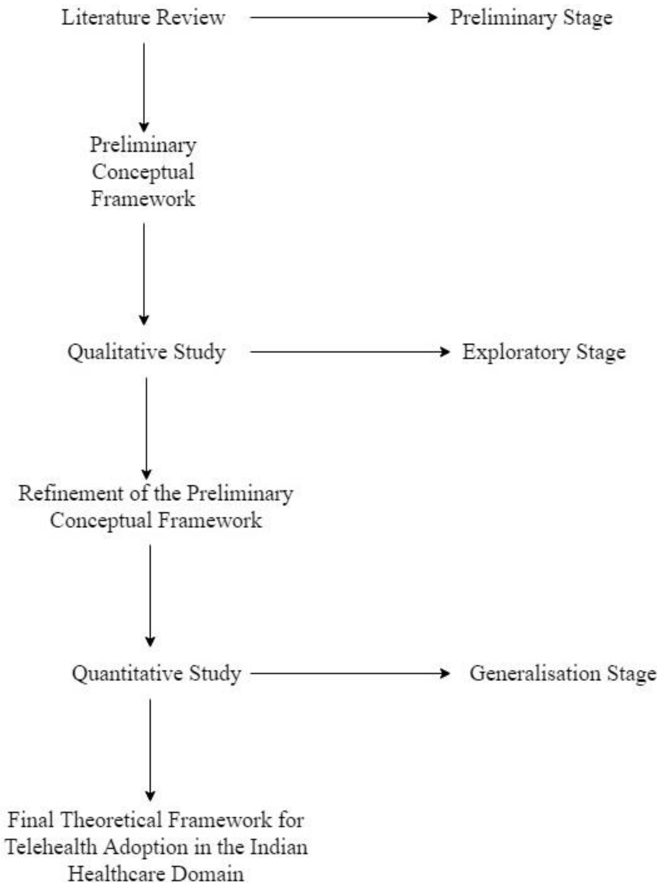



***Figure 16 Step by step approach of the research stages***

### 3.3 Research Philosophy

The philosophy that underlies every research study corresponds to the knowledge which is being developed by the research and also depends on the nature of knowledge explored (Flick, 2015; Holden & Lynch, 2004; Saunders et al., 2016). The ultimate aim of the researcher is to propagate rationally motivated arguments to devise a critical and methodological approach for contribution to the existing knowledge within the subject area (Bryman, 2012; Miles et al., 2014). Hence, selection of an appropriate methodology for the research is contingent upon a proper understanding of the various research philosophies that exist. In the words of Holden and Lynch (2004), "A philosophical review can have a dual effect on the researcher: (1) it may open their mind to other possibilities, therefore, enriching their own research abilities, and (2) it can enhance their confidence in the appropriateness of their methodology to the research problem which, in turn, enhances confidence in their research results."

Saunders et al. (2016), proposed a framework, termed a "research onion", to classify and demonstrate the various approaches, choices and strategies. It is also used to classify the underlying philosophical paradigms guiding the selection of different methods at different stages of the research, up to data collection and data analysis. Based on this model an ontological pragmatic philosophical stance was chosen for this research. The reason behind this is that interpretivism naturally creates hypotheses that can be verified and permits clarifications that are quantified against recognized human knowledge (Bryant 1985). Also, pragmatism can be combined with interpretivism (Goldkuhl 2012). This combination has been termed "Sociological School of Symbolic Interactionism (SI)" which stemmed from American pragmatism, enriched by G. H. Mead, J. Dewey and especially Herbert Blumer (Mead, 1934; Dewey, 1931; Blumer, 1969). Blumer (1969) describes three foundational premises for Symbolic Interactionism (ibid, p. 2): (1) 'Human beings act toward things because of meanings that the things have for them', (2) 'the meaning of such things originates from, or arises out of, the social interaction that one has with one's fellows', and (3) 'these meanings are handled in, and modified through, an interpretive process used by the person in dealing with the things the person encounters.' Again, pragmatism can be used in mixed method research design along with epistemological interpretivism. The pragmatic paradigm infers that a comprehensive approach to research is that of mixing data collection methods and data analysis procedures within the research process (Creswell 2014). Thus, empirical research guided by pragmatic interpretivism creates a framework of knowledge through understanding, as well as aiming for constructive knowledge that is useful in action (Marshall et al. 2005). This approach stresses the importance of computable outcomes that can be statistically analysed. This style of research is guided by interpretivist logic in the initial stages when qualitative data collection methods, encompassing in-depth interviews, are utilised and analysed. After analysing the data and forming the hypotheses the research is then guided by pragmatic logic to statistically test the hypotheses by employing quantitative survey methods. The different philosophical paradigms explored before selection are given in Table 3. Interpretivist logic acts according to the beliefs and justification of the social actors. In the initial stages of research, when in-depth interviews are conducted, the research relies on interpretivist logic to have a deeper understanding of the determinants (Goldkuhl, 2012). Further, as the research progresses and the research model is further refined using quantitative techniques, it is possible for the dataset to yield phenomena, which are independent of the social actors (Marshall et al., 2005). Social actors, for this research, consisted of the population under study, in this case healthcare professionals. Furthermore, one of the advantages of pragmatism is that it can integrate positivist and interpretivist stances within the ambit of the research, according to the complexity of the research questions (Collis & Hussey 2014).

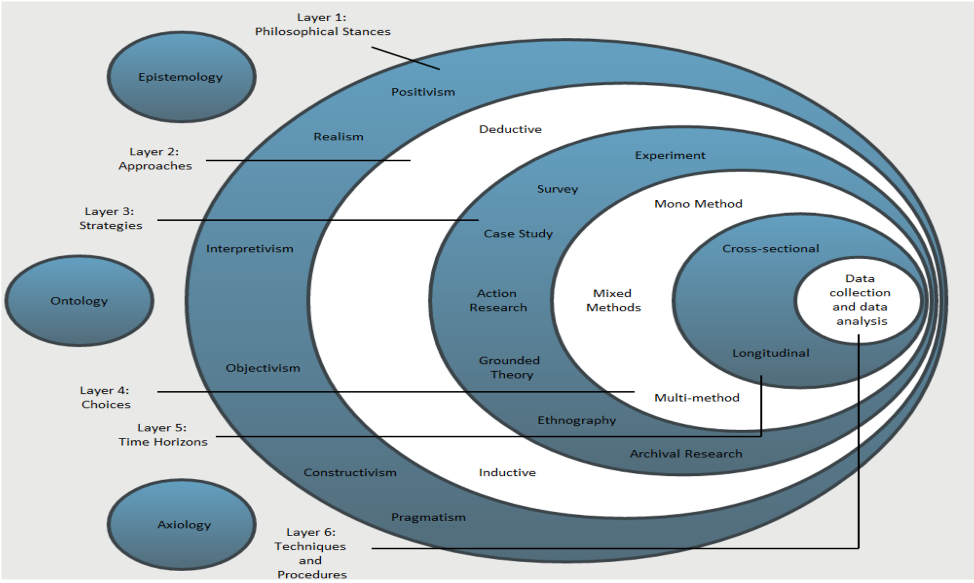



*Figure 17 A comparison of different Philosophical Stances: Research Onion Diagram, Source: Saunders et al. (2016)*

### 3.3.1 Research Paradigm

A paradigm is a framework comprising the commonly accepted understandings about a subject, a structure of the direction of the research and its performance (Deshpande, 1983). A paradigm can also be defined as a set of assumptions or opinions expressed by a group of scientists exploring and studying the world (Denzin & Lincoln, 2008; Deshpande, 1983; Rao & Perry, 2007). Paradigms consist of the three components of ontology, epistemology and methodology (Healy & Perry, 2000; Rao & Perry, 2007). The different philosophical paradigms explored are depicted below in Table 3 (Wilson, 2010; Collis & Hussey, 2014; Saunders et al., 2016).

*Table 3 The different philosophical paradigms explored (Wilson 2010; Collis & Hussey 2014; Saunders et al. 2016)*

| | **Research approach** | **Ontology** | **Axiology** | **Research strategy** |
|---|---|---|---|---|
| *Positivism* | Deductive | Objective | Value-free | Quantitative |
| *Interpretivism* | Inductive | Subjective | Biased | Qualitative |

| | | | | |
|---|---|---|---|---|
| *Pragmatism* | Deductive/Inductive | Objective or subjective | Value-free/biased | Qualitative and/or quantitative |

### 3.3.2 Ontology

Ontology is the study or philosophical concept concerned with the nature of reality and the various types of things that exist universally. It is derived from the Greek words *onto* (being) and *logia* (logic) and refers to written or spoken discourse. It is a subfield of metaphysics concerned with the study of first principles or the essence of things. An ontology is a working model of entities and interactions in a specific domain of knowledge or practice, such as telehealth consultation, or "the activity of planning". According to Tom Gruber, an AI specialist at Stanford University, an ontology is "the specified conceptualizations, used to help programs and humans share knowledge." In this context, an ontology is an assembly of concepts, such as things, events and relations, specific in some way that create a shared vocabulary for exchanging information. An example of this would be specific natural language.

The positivist paradigm proposes that an objective examination of a theory or conceptual model can capture the behaviour or nature of reality. Once developed, this model can be applied to the entire population (Gabriel, 1990; Guba & Lincoln, 1994; Healy & Perry, 2000).

In contrast, constructivists, argue that the characteristics of reality are anticipated in the form of inner multiples that are communally and experientially irrelevant to mental structures (Guba & Lincoln, 1994). All of these are primarily dependent on the structure and content of the individual people and groups who support the constructions (Guba & Lincoln, 1994; Healy & Perry, 2000). The nature of reality may change as their creators become more knowledgeable (Healy & Perry, 2000).

### 3.3.3 Axiology

Axiology originates from the study of values and how they emerge in a society. Axiology is a branch of philosophy that investigates the nature of values and value judgments. It is inextricably linked to two other branches of philosophy: ethics and aesthetics. All three branches are concerned with the concept of value. The study of ethics is concerned with the idea of goodness, attempting to understand what it means to be good. Aesthetics is concerned with the concepts of beauty and harmony, with the ultimate goal of understanding what beauty is and its definition. Axiology is a vital component of both ethics and aesthetics because one must use concepts of worth to define "goodness" or "beauty". Thus one must understand what is valuable and why. Understanding values can help determine the motivations of those within a particular group or society.

### 3.3.4 Epistemology

Epistemology enquires into the meaning of knowledge, how it can be obtained as well as the level to which knowledge is applicable to any given topic (Cousins, 2002; Krauss, 2005). Epistemology explains how a researcher can obtain knowledge about a field of study (Krauss, 2005; Parkhe, 1993; Shah & Corley, 2006). The affiliation between the knower and what can be known is defined as epistemology (Guba & Lincoln, 1994; Perry et al., 1999). Furthermore, the epistemology of each philosophical paradigm varies somewhat.

***Positivism*** describes the connection between the researcher and reality as ‘dualist and objectivist’ (Guba & Lincoln, 1994; Healy & Perry, 2000). Positivism means that the researcher has the ability to conduct the research without being affected by what is being discovered in the area of the research. The outcome of the research is assumed to be a true representation of reality and it can be defined objectively (Healy & Perry, 2000; Hunt, 1991; Parkhe, 1993).

***Interpretivism*** acts according to the beliefs and justification of the social actors. In the initial stages of research when in-depth interviews are conducted, the research relies on interpretivist logic to gain a deeper understanding of the determinants (Goldkuhl 2012). As the research progresses and the conceptual framework is further refined using quantitative techniques, it is possible for the dataset to yield phenomena, which are independent of the social actors (Marshall et al. 2005). Social actors for this research is the population under study, in this case healthcare professionals.

The different philosophical concepts and associated paradigms are presented below in Table 4 adapted from Crotty and Crotty (1998).

*Table 4 The different philosophical concepts and associated paradigms Crotty and Crotty (1998)*

| Paradigm | Ontology<br>*What is reality?* | Epistemology<br>*How can I know reality?* | Theoretical Perspective<br>*Which approach do you use to know something?* | Methodology<br>*How do you go about finding out?* | Method<br>*What techniques do you use to find out?* |
|---|---|---|---|---|---|
| **Positivism** | There is a single reality or truth (more realist). | Reality can be measured and hence the focus is on reliable and valid tools to obtain that. | Positivism<br>Post-positivism | Experimental research<br>Survey research | Usually quantitative, could include:<br>Sampling<br>Measurement and scaling<br>Statistical analysis<br>Questionnaire<br>Focus group<br>Interview |
| **Constructivist / Interpretive** | There is no single reality or truth. Reality is created by individuals in groups (less realist). | Therefore, reality needs to be interpreted. It is used to discover the underlying meaning of events and activities. | Interpretivism (reality needs to be interpreted)<br>• Phenomenology<br>• Symbolic interactionism<br>• Hermeneutics<br>Critical Inquiry<br>Feminism | Ethnography<br>Grounded Theory<br>Phenomenological research<br>Heuristic inquiry<br>Action Research<br>Discourse Analysis<br>Femenist Standpoint research etc | Usually qualitative, could include:<br>Qualitative interview<br>Observation<br>Participant<br>Non participant<br>Case study<br>Life history<br>Narrative<br>Theme identification<br>etc |
| **Pragmatism** | Reality is constantly renegotiated, debated, interpreted in light of its usefulness in new unpredictable situations. | The best method is one that solves problems. Finding out is the means, change is the underlying aim. | Deweyan pragmatism<br>*Research through design* | Mixed methods<br>Design-based research<br>Action research | Combination of any of the above and more, such as data mining expert review, usability testing, physical prototype |
| **Subjectivism** | Reality is what we perceive to be real | All knowledge is purely a matter of perspective. | Postmodernism<br>Structuralism<br>Post-structralism | Discourse theory<br>Archaeology<br>Genealogy<br>Deconstruction etc. | Autoethnography<br>Semiotics<br>Literary analysis<br>Pastiche<br>Intertextuality etc. |
| **Critical** | Realities are socially constructed entities that are under constant internal influence. | Reality and knowledge is both socially constructed and influenced by power relations from within society | Marxism<br>Queer theory<br>feminism | critical discourse analysis, critical ethnography<br>action research<br>ideology critique | Ideological review<br>Civil actions<br>open-ended interviews, focus groups, open-ended questionnaires, open-ended observations, and journals. |

### 3.4 Methods

Research methods are the collection of information and data for decision-making purposes. Methods may include surveys and interviews, as well as other research techniques, such as, observation, focus groups, brainstorming sessions, etc. (Bryman 2012). The collection of information may include both current and previously gathered information (Creswell 2014). Research methods are a systematic way to solve a problem or to fulfil a knowledge gap (Saunders et al. 2016). Additionally, research methods are the science of studying the procedures by which research can be undertaken. Furthermore, logical, efficient and organised procedures can define, expound and anticipate phenomenality (Zikmund 2003).

#### 3.4.1 Research Design

It was decided that this research study would employ both qualitative and quantitative research methods. The mixed method was chosen for conducting the research in order to reduce the shortcomings of each of the individual methods alone. By combining them, this method becomes grounded in the research problem which creates a single dataset, whereby gaining new knowledge becomes possible (Flick, 2015). As such, the breadth of the research and in-depth understanding is expanded. As was evident from a review of the literature, the uptake of telehealth is in a nascent stage in Indian healthcare organisations. Additionally, with limited research conducted in the Indian context to date, it was decided that the aim of the research should be descriptive and exploratory in nature. Also, this approach helped in selecting the best research design and primary data collection methods for the study (Zikmund, 2003). For these reasons, the need for a case study approach was eliminated. An exploratory study would help in gaining new insights, and forming hypotheses. Also, a completely new theory or a theoretical framework could be developed by analysing the data obtained (Urquhart, 2012). Further, the results might fit into an existing theory (Bryman, 2012). Though a priori reference to a theoretical framework and hypothesis developed, after a thorough review of relevant literature, is possible in exploratory research, it is rather uncommon. This is because hypotheses are formed after the results are obtained. As such, a preliminary conceptual framework and hypothesis formed before the research was undertaken could be termed a "working hypothesis" (Shields & Rangarajan, 2013). The purpose of the research was to test, refine, reject or add the constructs derived through literature review and the preliminary conceptual framework. Further, the purpose was to build a theoretical framework, on the determinants of ICT adoption in Indian telehealth organisations, through a deductive logic.

Mixed methods research (MMR) is a new and evolving research methodology that calls for both qualitative and quantitative approaches to be used in the same study. The methodology is more than just two separate investigations; it is intended to integrate the qualitative and quantitative components to answer one's research question. As such, MMR is a research approach in the social, behavioural and health sciences in which the investigator collects quantitative and qualitative data sequentially. This is then integrated and interpreted based on the combined strengths of both sets of data to understand the research problems. MMR is important in telehealth research because the questions that benefit the most from a mixed methods design are typically broad, complex and multifaceted (John W Creswell, 2014; Creswell et al., 2011). MMR has grown in prominence in health services research, and telehealth research, arguably, fits within this paradigm because telehealth entails a complex intervention that is part of a healthcare ecosystem (O'Cathain et al., 2007). As a result, determining whether it ‘‘works" or not entails assessing a wide range of factors. The axiom that quantitative methods explore ‘‘what" has happened and qualitative methods explore ‘‘why", has been combined in MMR to explain ‘‘what has happened and why it has happened", increasing confidence in research findings (Caffery et al., 2017).

### 3.4.2 Research Methods

This research was conducted sequentially in three stages. The first stage of the research consisted of a review of relevant literature in the global and Indian healthcare domain, as discussed in the previous chapter. A conceptual framework using the constructs of ICT Adoption in healthcare domain were visualised at the first stage. The second stage of the research involved in-depth interviews of healthcare professionals who were actively involved in providing telehealth services. These included doctors, nurses, medical and ICT technicians, management personnel and other allied healthcare staff. The in-depth interview questionnaire was framed with the help of the conceptual framework prepared in the first stage of the research. Semi-structured interview questions were formed, in easy-to-understand language, to obtain the opinions of interviewees regarding the determinants of ICT Adoption in Indian telehealth environment. In-depth interviews permit thorough study of an individual participant’s opinion without influence, as each individual participant was interviewed separately.

In focus groups, the chances of being influenced by other participants are greater, so this was avoided. Other reasons for choosing in-depth interviews, over focus group discussions, were cost and outreach. In a diversely populated country such as India, it was deemed too difficult to gather together several healthcare professionals in one go, due to geographical considerations, time and professional constraints. It was also decided that the cost could be reduced substantially if telephone interviews or video conferencing calls replaced the conventional face-to-face in-depth interview technique. A semi-structured questionnaire, built upon the conceptual framework, was designed to focus on the objectives of the research as well as be open to receive and induct new opinion, constructs and ideas.

In qualitative research, data can be collected using a variety of methods. These may include observations, textual or visual analysis, from sources such as books or videos. They may also include interviews of individuals or groups. In healthcare research, however, interviews and focus groups are the most commonly used methods.

### 3.4.3 The purpose of research interviews

The goal of a research interview is to elicit individuals' perspectives, experiences, beliefs, and/or motivations on specific topics (e.g. factors that influence their attendance at the dentist). Qualitative methods, such as interviews, are thought to provide a "deeper" understanding of social phenomena than purely quantitative methods, such as questionnaires. Interviews are thus most appropriate when little is known about the study phenomenon or when detailed insights from individual participants are required. They are also ideal for delving into sensitive topics where participants may be reluctant to discuss them in a group setting (Dearnley, 2005).

Structured, semi-structured and unstructured are the three main types of research interviews. Structured interviews are verbally administered questionnaires, in which a list of predetermined questions is asked with little or no variation. There is also no opportunity for follow-up questions to be asked, to responses that require further elaboration. As a result, they are relatively quick and simple to administer and may be especially useful if clarification of specific questions is required or if the respondents are likely to have literacy or numeracy issues. However, by definition, they only allow for a limited number of participant responses and are thus ineffective when 'depth' is required (Creswell, 2014; Creswell et al., 2011; Deterding & Waters, 2021).

Unstructured interviews, on the other hand, do not reflect any preconceived theories or ideas and are conducted with little or no organization. Such an interview may simply begin with an opening question, such as 'Can you tell me about your experience using Telehealth as a medium of medical practice?', and will then proceed primarily based on the initial response. Unstructured interviews are typically time-consuming, often lasting several hours. They can be difficult to manage, and participate in, because the lack of predetermined interview questions provides little guidance on what to discuss. This can be confusing and unhelpful for participants. As a result, their use is generally considered only when significant 'depth' is required, when virtually nothing is known about the subject area, or a different perspective of a known subject area is required.

A semi-structured interview is a qualitative method of investigation that combines a pre-determined set of open questions, questions that prompt discussion, with the opportunity for the interviewer to delve deeper into specific themes or responses. Respondents in a semi-structured interview are not limited to a set of pre-determined responses, unlike a structured questionnaire. Semi-structured interviews are used to learn more about how interventions work and how they can be improved.. Semi-structured interviews include a series of key questions that help to define the areas to be explored, while also allowing the interviewer or interviewee to deviate in order to pursue an idea or response in greater depth. This interview format is most commonly used in healthcare because it gives participants some direction on what to talk about, which many people find useful. The flexibility of this approach, especially when compared to structured interviews, allows for the discovery or elaboration of information that is important to participants but may not have been considered relevant by the research team previously (J W Creswell, 2014; Creswell et al., 2011; Deterding & Waters, 2021).

### 3.4.4 Focus Groups

Focus groups were first used as a research method in market research in the 1940s, as part of the work of Columbia University's Bureau of Applied Social Research. The success of focus groups as a marketing tool in the private sector eventually led to their use in public sector marketing, such as assessing the impact of health education campaigns. However, the techniques used in focus groups in the public and private sectors have diverged over time. As a result, in this thesis, focus groups are described in the context of academic and health research.

### 3.4.5 When are focus groups used?

Focus groups are used to gather information about collective beliefs and the meanings that underpin those beliefs. They are also useful in developing a comprehensive understanding of participants' experiences and beliefs. The following are some suggested criteria for using focus groups:

• As a stand-alone method for studying group norms, meanings and processes.

• In a multi-method design, to investigate a topic or collect group language or narratives for later use.

• To clarify, extend, qualify or challenge data gathered by other means.

• Informing research participants about the findings.

Morgan (1998) recommends avoiding focus groups based on the following criteria:

• If listening to participants' perspectives creates unrealistic expectations for the outcome of the research.

• If participants are uncomfortable with one another and will not discuss their feelings and opinions openly.

• If the researcher's topic of interest is not one that the participants can or want to discuss

• If statistical information is required. Focus groups provide depth and insight but do not yield useful numerical results.

## 3.5 Qualitative Data Analysis Techniques

The in-depth interviews were audio or video recorded and the process depended on the participants' consent and suitability. The location of the interview was decided prior to the interview, based on mutual consent, and included the healthcare professionals' workplace. Later, the raw data was transcribed to usable data through a professional transcriptionist. Further, NVivo Qualitative Analysis Software was used to analyse the data, to empirically test the constructs qualitatively and derive new opinions or constructs. NVivo thematic analysis to match the construct to themes was used for this purpose. Furthermore, a deductive content analysis provided deeper understanding as to the reality (why? and how?) behind such constructs.

### 3.6 Online Survey and Statistical Analysis Plan

The third stage involved an online survey using a closed-ended structured questionnaire. The motive of the online survey was to test and confirm the constructs derived from the theoretical framework, outlined through qualitative analysis, thereby establishing the determinants of ICT Adoption in the Indian Telehealth environment. The choice of the closed-ended questionnaire lay with the notion that it would be easy for participants to respond and a vast population could be tested.

Descriptive Statistics were used to arrange the dataset, thus obtained. Further, correlation, SEM (Structural Equation Modelling, Partial Least Squares Regression (PLS) modelling were used to obtain statistical validity or significance to confirm the constructs derived through qualitative analysis, as well as add determinants to the final theoretical framework of ICT Adoption in Indian Telehealth Environment (Hair et al., 2006).

### 3.7 Population, Sampling and Sample size

A Cross-sectional study was conducted at a single point of time to examine the relationship between the determinants of ICT Adoption in Indian Telehealth environment. Random convenience sampling was used for conducting the semi-structured interview as the selection of participants was based on ease, accessibility, speed and low cost.

The proposed sample size for semi-structured interviews is thirty persons to forty persons. Glaser and Strauss (1967) suggested the perception of saturation for accomplishing a fitting sample size in qualitative research. Qualitative sample sizes ought to be large enough to attain responses for furthermost or all insights. Deriving maximum or all the perceptions will lead to the attainment of saturation. Saturation happens when adding more participants to the research study does not result in additional perspectives or information.

The proposed sample size for an online survey is between three hundred to five hundred participants. The reason for a large sample size is to establish the determinants with a minimal margin of error. Further, it also increases the confidence level, or in other words, reduces the uncertainty accompanying the estimate (Creswell 2014).
The number of participants proposed for the semi-structured interview is based on the best evidence from the literature review (Glaser & Strauss, 1967; Creswell 2014; Wilson, 2010; Saunders et al., 2016). In reality, the number of semi-structured interviews will continue till it reaches a saturation level where similar answers are derived from subsequent interviews (Glaser and Strauss 1967).
The number of participants for the quantitative analysis rely upon the responses from the participants. A number of existing studies (Mairinger et al., 1996; Gschwendtner et al., 1997; Durrani, 2009; Ghia, 2013; Iyer, 2014), were found to be low in population and response. As such, considering the limitations, a large sample size of three hundred to five hundred participants was proposed to be fit for this study. Furthermore, a pilot study, conducted before each stage, testified and confirmed the reliability and validity of the respective dataset / instruments (Creswell, 2014; Saunders et al., 2016).

### 3.8 Sampling and Recruitment Strategy

The selected healthcare professionals for both the interview and survey required some exposure in telehealth projects. They needed to be healthcare professionals with varied roles in the Indian healthcare system. A participant information sheet for the study, which included the research objective, was sent to the potential participants routed through the supervisors or heads-of-unit beforehand. The initial contact was established through the supervisors or heads-of-unit by an email or personal visit. Before the interview and survey, the participants were provided with the consent form detailing the project objectives, nature of the interview and survey, and their rights. The participants were informed about their right to withdraw at any time, both from the research study and data collection, without any consequences.

### 3.9 Transcribing and Analysis

The in-depth interviews were audio or video recorded and the process depended on a participant's consent and suitability. The location of the interview was decided prior to the interview, based on mutual consent, and could include the healthcare professional's workplace. Later, the raw data was transcribed to usable data through a professional transcriptionist. Further, NVivo Qualitative Analysis Software was used to analyse the data, to empirically test the constructs qualitatively and derive new opinions or constructs. NVivo thematic analysis to match the construct to themes was used for the purpose. Furthermore, a deductive content analysis provided deeper understanding as to the reality (Why? and How?) behind such constructs.

### 3.10 Validity and reliability of the qualitative stage

Qualitative methods such as in-depth interviews should be evaluated for dependability (reliability) and validity (Silverman, 2000). Rao & Perry (2003) pointed out that by cross checking, aspects of reliability and validity can be achieved. These different methods of quality control for qualitative research were taken into consideration by using four different research design tests. The research design tests were construct validity, internal validity, external validity and reliability (Yin, 2009). Each of these tests will be described next.

#### 3.10.1 Construct validity

Construct validity describes the progress of suitable operational measures for the concepts being researched (Emory & Cooper, 1991). Construct validity exists under the semi-structured interviews as the researcher is constructing an agreement related to the construct meaning by carrying out several interviews (Carson et al., 2001). This method is flexible for various interviews and permits the refined approach of the construct. Construct validity can be obtained by triangulating the interview questions and constructs through the use of two carefully worded questions that determine the same issue from different perspectives (Rao & Perry, 2003). Triangulation of interview questions was designed in this research for the important constructs, in order to prevent iteration or non-concerned perception to the participant (Carson et al., 2001). Each interview included questions through the use of two carefully worded questions that determine the same issue from different perspective such as: "*What is the impact of the technological factors (such as cost, technological readiness and security) on the intention to adopt telehealth? Please explain. Do technological factors (such as cost, technological readiness and security) have positive or negative impact on the intention to adopt telehealth? If so, how? Please explain)".*

### 3.10.2 Internal validity

Internal validity refers to the validity and relationships of the variables' effects in a system on the other variables (Zikmund, 2000). Exploratory research methods such as in-depth interviews uncover causal tendencies or generative mechanisms which suggest an informal link under certain situations and these links are not assured easily (Perry et al., 1999). Probing questions, in-depth listening methods and existing knowledge are required to develop the cause and effect links which are raised during semi-structured interviews and are considered important (Carson et al., 2001). Each interview had some probing questions to elicit additional details about factors/issues such as: "*How does the cost have a positive impact on the intention to adopt telehealth?", and "Why does Internet speed need to be considered as an important factor when focusing on the adoption of telehealth?"*

### 3.10.3 External validity

External validity describes the capability of the research results to be generalised beyond the project scope (Sekaran, 2000). For this purpose, the participants selected for the semi-structured interviewing process were chosen because of their knowledge, expertise, and leadership in this field of study, and because their position in the industry influenced many people (Carson et al., 2001). As was evident from their deliberate selection, it was necessary to ensure that there was enough external validity present for the exploratory purposes of semi-structured interviews.

### 3.10.4 Reliability

Reliability is directly related to the method's consistency to evaluate the data and to examine the reproduction and repetition of research, by other researchers, to draw similar conclusions (Sekaran, 2000). Reliability can be authenticated by introducing a co-interviewer to validate cross checking and benchmarking. In this research, a second interviewer was not introduced because of the time and financial implications and because of the confidentiality of the participants' interviews (Carson et al., 2001). Instead, the research supervisor can associate an expert by forming a committee in order to monitor the process of the research (Guba & Lincoln, 1994).

### 3.11 Ethical dimensions

The literature review has identified several governmental and non-governmental organisations providing telehealth services. Before the research started ethical approval was undertaken from the respective authorities in the government/private health organisations/departments, as well as from the health organisations' management body. As the research is conducted from an Australian University an ethics application was submitted to the University of Southern Queensland's Human Ethics Committee. After the ethics approval [H18REA086 (v3)] from USQ, Australia, the participants were contacted from the identified telehealth providing organisations.

### 3.12 Political dimensions, and red tape clearing

An important consideration for this research was the potential time consuming nature of dealing with red tape associated with the political environment in India. To minimise this, early contact was made with the Indian Government Health Department/Private healthcare organisation's top management for ethics approval. It was decided that the study would focus on private organisations or non-governmental organisations to enable faster ethics approval. The literature review revealed several non-governmental organisations which provide telehealth in India. In this way, politicised decision-making process and excessive red tape in the Indian healthcare environment was avoided. Effectively, this was achieved by bringing all the stakeholders, from top to bottom, on board and keeping them informed as the research progressed. Furthermore, as a lot of focus has recently been on the improvement of healthcare in India by government and political leaders (Kumar & Ahmad, 2015; Mathur, et al., 2017; Rathi, 2017), this research can contribute significantly to that discussion. This research supports the development of telehealth in India and, as such, is non-threatening to any political party. Furthermore, there is a consensus among all political parties in India and their leaders, that it is necessary to provide healthcare to the general public of India with a universal outreach to even in the remotest regions. Hence, it was expected that considerable support from the government, political parties and political leaders, would be gained for this research.

### 3.13 Communications with the healthcare organisations

An important aspect of this study was to communicate with the government health departments, hospitals and telehealth providers both at governmental and non-governmental levels. As noted above, the literature review has identified several governmental and non-governmental providers of telehealth in India. At this point the research was relying on published information. The identified organisations could only be contacted after ethics approval was given, both from the University Ethics Committee, the Indian Health Department at the central and state levels/Private healthcare organisation's top management. The research was aimed towards the development of healthcare and particularly telehealth in India, benefiting many in India. As such, it was deemed as non-threating to the general public, government, political parties, leaders, and healthcare organisations. Consequently, delays due to red tape, often associated with unfavourable criticism of India, was not expected for this research.

### 3.14 Conclusion

This research was limited to few states of India wherein a cross-sectional study was conducted in selected organisations providing telehealth services. This was undertaken following ethical approval. Nonetheless, as India is a geographically diverse and a large populous country it is a hard task to cover all the geographical regions. Also, it is evident from the literature review that telehealth service is in a nascent stage in India (Durrani & Khoja, 2009; Mahapatra et al., 2009). As such, the selection would depend on the availability of telehealth services in a geographical region of India. The presence of a certain level of health and ICT infrastructure could also play a determining role in selecting the organisations.

# CHAPTER 4 QUALITATIVE DATA COLLECTION

## 4.1 Chapter Overview

The previous chapter discussed the research methodology adopted for this research. The chapter justified the methodologies and techniques adopted to answer the research questions. Further, the chapter justified the research design adopted for this research. This chapter will deal with the second stage of the research, which is qualitative data collection. The first stage of the research was the literature review which was discussed in Chapter 2. The current chapter will discuss extensively the semi-structured interview methodology adopted for this research. It will justify (process to identify and engage) the needs to employ this method to derive (collect relevant) information from healthcare professionals operating in the telehealth environment in India. Further, this chapter will justify how the data will be collected by setting up a protocol for data collection. Furthermore, this chapter will describe the process of identifying the participants and the ways to contact them.

An outline of the chapter is depicted below.

**Chapter Overview – Introduction – Defining Semi-Structured Interviews – Justifying Semi-Structured Interviews – Conducting the Semi-Structured Interviews – Recording Semi-Structured Interviews – Participant Selection – Protocol – Semi-Structured Interview Guide – Semi-Structured Interview Questions – Conclusion**

## 4.2 Introduction

There are limited studies on identifying the determinants of telehealth adoption in the Indian healthcare domain (Chandwani & Dwivedi, 2015; Dasgupta & Deb, 2008; Dattakumar, 2012; Durrani & Khoja, 2009; Ganapathy, 2002, 2014; Ganapathy, 2015b; Ghia et al., 2013; Iyer, 2014; Kumar & Ahmad, 2015; Mahapatra et al., 2009a; Marcelo et al., 2015; Pak et al., 2008; Pal et al., 2002). Moreover, as discussed below, few studies followed a comprehensive methodology to conduct their research. Most of the research proposed a critical review model for telehealth adoption. Some empirical research was lacking in population and response. Further, as there is a lack of theoretical frameworks available on Indian Telehealth adoption (Chandwani & De, 2015; Chandwani & Dwivedi, 2015; Dodel, 2015; Ganapathy, 2002, 2014; Standing et al., 2011), the research has been designed to be exploratory. The researcher, in exploratory research, begins with a broad idea (often derived from a literature review) and uses the research to identify issues in the domain that could be the subject of future studies. The researcher's willingness to change course if new information or insight is discovered is critical in exploratory research. Furthermore, exploratory research is usually carried out when the research problem is in its early stages (Jaeger & Halliday, 1998; Stebbins, 2001). The exploratory factor coupled with the comparative originality of the research compelled the decision to adopt the semi-structured interview methodology (Bernard, 2017; Cabassut & Ferrando, 2015). Nonetheless, the geographical factors (Chandwani & Dwivedi, 2015; Kruse et al., 2018; Mohammadzadeh et al., 2013) were also considered in adopting semi-structured interviews. This was because it was deemed too difficult in a vast country, with varied geographic and demographic characteristics, to get another chance to interview a HCP. The demand of HCPs in India exceeds their supply (Baishya; Purohit & Bandyopadhyay, 2014; Sharma, 2021; Zodpey et al., 2018). As such, it was not feasible for the HCPs to attend to structured interview questions, due to the time commitment this would require. Further, as the cultural scenario varies from state to state, the structured interview questions could lead to obtaining inconsistent data relating to the research questions (Panda & Gupta, 2004; Sinha et al., 2004). In semi-structured questions the HCPs are free to provide their opinions, however, there is also the chance that they may veer off-topic. The semi-structured interview allows the interviewer to lead them back to the research questions, whenever the HCPs deviate (Bernard, 2017; Cabassut & Ferrando, 2015). A large country, in terms of land area as well as population, such as India, brought with it certain challenges for research. With complex healthcare settings and varying ICT infrastructure in different states (Noir & Walsham, 2007; Syed-Abdul et al., 2011), it was decided to approach the healthcare organisations located in various states of India independently. As such, semi-structured interviews suited the purpose and nature of the research. Further, the semi-structured interviews opened up the possibility of exploring new themes from varied responses of the participants (Bryman, 2012).

### 4.3 Semi-structured interviews:

The most common form of interviews undertaken in healthcare research are semi-structured interviews (Low, 2013; Whiting, 2008). A semi-structured interview can be defined as a qualitative approach to elicit information from the respondents through open-ended questions. Such questions lead to conversation around a particular topic, opening up the possibility for the interviewer to delve into opinions further (Dearnley, 2005; Harrell & Bradley, 2009; Luo & Wildemuth, 2009). Unlike a structured questionnaire, a semi-structured interview might change course and does not limit respondents to a set of pre-determined answers (Harrell & Bradley, 2009; Harvey-Jordan & Long, 2001; Longhurst, 2003). Semi-structured interviews are used for insights on how interventions work and how they could be improved. They also allow respondents to discuss and raise issues that may not have been considered. The characteristics of semi-structured interviews are as follows (Longhurst, 2003; Low, 2013; Luo & Wildemuth, 2009):

a) The interviewer reviews relevant literature and develops an 'interview guide'. The interview guide is a set of unstructured questions and topics that are essential to elicit maximum information on the research questions during the conversation, usually in a particular order.

b) The interviewer and respondents engage in a formal interview

c) The interviewer follows the guide but is able to follow topical trajectories in the conversation that may stray from the guide, when they feel this is appropriate.

Semi-structured interviewing, according to Bernard (2013), is best used when the interviewer only gets one chance to interview someone or when there are several interviewers. This research is set in the Indian healthcare environment which comprises a vast geographical area. As such, the telehealth services are scattered throughout the country (Chandwani & Dwivedi, 2015; A. Dwivedi et al., 2001; Ganapathy, 2015a). It is evident, from the literature reviewed, that telehealth is in a nascent stage in India and dominated by the private sector (Mahapatra et al., 2009b; Marcelo et al., 2015; Sood et al., 2007). With these considerations in mind, semi-structured interview methodology has been adopted over focus groups. Focus groups, as a research method, were unworkable due to logistical difficulties associated with organising healthcare professionals spread over a vast geographical area at the same time and place (Dearnley, 2005; DeJonckheere & Vaughn, 2019; Harrell & Bradley, 2009). It was also not cost effective (Harvey-Jordan & Long, 2001; Luo & Wildemuth, 2009; McIntosh & Morse, 2015). The semi-structured interview guide provides clear instructions to interviewers and can result in reliable, comparable qualitative data. Semi-structured interviews are frequently preceded by observation, informal, and unstructured interviewing to allow researchers to develop relevant and meaningful semi-structured questions. However, by including open-ended questions and training interviewers to follow relevant topics that may deviate from the interview guide, new perspectives and understandings of the topic can be identified.

Researchers prefer semi-structured interviews because questions can be prepared ahead of time. This allows the interviewer to appear knowledgeable and prepared during the Interview In semi-structured interviews, informants can also express themselves in their own words. Semi-structured interviews can provide both reliable and comparable qualitative data (J W Creswell, 2014; Creswell et al., 2011; Deterding & Waters, 2021).

When creating an interview schedule, it is critical to ask questions that will elicit as much information about the study phenomenon as possible while also addressing the goals and objectives of the research. Open-ended (assuming more than a yes/no response), neutral, sensitive and understandable questions for a qualitative interview are ideal. The best practice to start the interview is by asking simple questions and work up to more difficult or sensitive subjects. This can help respondents relax, gain confidence and establish rapport, as well as generate rich data that can be used to extend the interview further (Dearnley, 2005; Harvey-Jordan & Long, 2001).

It is good practice to assess the interview schedule by performing a few test interviews before conducting the actual data collection. This allows the research team to assess whether the schedule is clear, understandable and capable of answering the research questions, as well as whether any changes to the interview schedule are required as a result.

The length of an interview varies according to the topic, researcher and participant. Healthcare interviews usually last between 20 and 60 minutes. If change over time is of interest to the researcher, such as investigating the psychosocial impact of telehealth on participants and their subsequent treatment experiences, interviews can be conducted once or repeatedly (Dearnley, 2005; Harvey-Jordan & Long, 2001).

**4.4 Conducting the semi-structured interview**

Before conducting an interview, respondents should be informed about the details of the study and assured of ethical principles, such as anonymity and confidentiality. This provides respondents with an idea of what to expect from the interview, increases the likelihood of honesty and is an important part of the informed consent process (Dearnley, 2005; Harvey-Jordan & Long, 2001).

When possible, interviews should be conducted in areas free of distractions and at times and locations that are convenient for participants. Many people do this in their own homes in the evenings. While researchers may have less influence over the respondent's home environment, familiarity can help them relax and conduct a more productive Interview It is also important to establish rapport with participants prior to the interview, as this can have a positive impact on the subsequent development of the Interview (Dearnley, 2005; Harvey-Jordan & Long, 2001).

Before conducting the actual interview, the interviewer should become acquainted with the interview schedule so that the process appears more natural and less rehearsed. However, in order for the interview to be as fruitful as possible, researchers must be equipped with a set of skills and techniques that allow them to collect comprehensive and representative data during the Interview One of the most important abilities is the ability to listen to what is being said so that participants can recount their experiences as completely as possible without being interrupted (Dearnley, 2005; Harvey-Jordan & Long, 2001).

Using open and emotionally neutral body language during the interview, such as nodding, smiling, looking interested and making encouraging noises (e.g., 'Mmmm'), are also important skills. Strategic use of silence, when used correctly, can also be very effective at getting respondents to think about their responses, talk more, elaborate, or clarify specific issues. Reflecting on participant comments and making probing remarks are two other techniques for developing the Interview It is also important to ask for clarification from respondents if the interviewer is not sure what the participant means. As 'leading' or 'loaded' questions may have an undue influence on responses, it is vital that these are avoided (Dearnley, 2005; Harvey-Jordan & Long, 2001).

At the end of the interview, it is critical to thank participants for their time and ask if there is anything else they would like to say. This allows respondents to raise issues that they have considered or believe are important, that the interviewer has not addressed. This frequently leads to the discovery of new and surprising information. Following the completion of the interview, respondents should be briefed on the study. To avoid bias and provide a permanent record of what was said, all interviews should be voice recorded and transcribed verbatim afterwards. Making 'field notes' about observations, thoughts and ideas, during and immediately after each interview, can also aid in the data analysis process (Dearnley, 2005; Harvey-Jordan & Long, 2001).

### 4.5 Open ended vs. Closed Ended

In open-ended questions, respondents can include additional information such as their feelings, attitudes and understanding of the subject. This enables researchers to gain a better understanding of the respondents' true feelings regarding a topic. Closed-ended questions may not provide respondents with options that accurately reflect their true feelings due to their simplicity and limited nature. Closed-ended questions also prevent respondents from explaining that they do not understand the question or do not have an opinion on the subject. Furthermore, respondents are less likely to forget the answers from which they have to choose, if they are given the freedom to respond freely. Open-ended questions prevent respondents from skipping over the questions and simply "filling in" the survey with the same answers; such as filling in the "no" box on every question (John W Creswell, 2014; Creswell & Clark, 2017; Creswell et al., 2011).

Surveys with open-ended questions are easier for other researchers to use, for secondary analysis, than surveys that do not provide contextual information about the survey population. This is because they allow for the collection of additional information from the respondent, such as demographic information, including current employment, age, gender, etc. (Dearnley, 2005; Harvey-Jordan & Long, 2001).

A closed-ended question elicits a limited set of responses which can be easily coded in a database, by using a number or symbol to represent a response. Multiple-choice, ordinal, interval and ratio questions generate closed-ended responses. Closed-ended questions, simply because they require a yes or no response, should not be regarded as simple questions to which anyone can quickly respond. Closed-ended questions can be challenging to answer. However, they are easier to analyse than open-ended questions (Dearnley, 2005; Harvey-Jordan & Long, 2001).

### 4.6 Telephonic vs. Face-to-Face

Methodological textbooks have previously claimed that the telephone mode is unsuitable for qualitative interviewing (Gillham, 2005; Rubin & Rubin, 2005; Legard, Keegan, & Ward, 2003). It is argued that a lack of face-to-face contact, in particular, limits the development of rapport and a "natural" encounter (Gillham, 2005; Shuy, 2003). The absence of visual cues is thought to limit the depth of meaning that can be conveyed (Fielding & Thomas, 2008; Gillham, 2005). Telephone interviews, it has been suggested, will be shorter because they are more tiring and difficult to focus on (Gillham, 2005; Shuy, 2003). According to the researchers, telephone interviews should also be based on more specific questions and more structured interview guides (Berg, 2007; Gillham, 2005; Gray, Williamson, Karp, & Dalphin, 2007; Ruane, 2005). These factors may be disadvantageous when in-depth data is required. Obviously, the mode will be inconvenient for participants who do not have access to a telephone or who have hearing impairments (Wenger, 2002; Worth & Tierney, 1993). Simultaneously, there are a number of well-established arguments for why telephone interviews may be a viable option in some situations. The most common benefit is resource savings. As telephone interviews do not require travel, they take less time and money (Robson, 2002; Shuy, 2003; Ruane, 2005; Fielding & Thomas, 2008). Telephone interviews, for similar reasons, enable researchers to reach out to people over a larger geographical area and gain access to people in places where travel is difficult or dangerous. For ethical reasons, telephone interviews may be preferable. A phone conversation, for example, provides greater anonymity and less intensity which participants may prefer when discussing sensitive topics (Chapple, 1999; Kavanaugh & Ayres, 1998; Tausig & Freeman, 1988). Despite the fact that qualitative interviews conducted by telephone have a number of practical and ethical advantages, there is still a perception in the instructional literature that they are a methodological compromise. This view centres around concerns about the quality of the interaction and the data that can be generated. However, several researchers have recently published first-hand accounts of conducting various types of qualitative interviews by telephone (Burke & Miller, 2001; Carr & Worth, 2001; Chapple, 1999; Dicker & Gilbert, 1998; Garbett & McCormack, 2001; Grant, 2011; Holt, 2010; Miller, 1995; Opdenakker, 2006; Rose, 1998; Stephens, 2007; Sturges and Hanrahan, 2004; Sweet, 2002; Tausig & Freeman, 1988). Overall, these researchers contend that phone interviews are "just as good" as face-to-face interviews for achieving successful social interactions and obtaining useful data. For example, Chapple (1999) reports that telephone interview data were “unexpectedly rich” (p.91); Sweet (2002) concludes that “the quality and quantity of data was not noticeably different between face-to-face and telephone interviews” (p.63); and Stephens (2007) describes his telephone interviews as achieving equally “friendly rapport” as face-to-face interviews and producing “unexplainable results” in all cases (p.211). As a result, these accounts call into question the widely held belief that telephone interviews are inappropriate for qualitative research. It appears that previous studies drew their conclusions primarily through broad and arbitrary comparisons. Furthermore, rather than providing an empirical comparison of modes, some only provide general reflections on telephone interviews. Few researcher accounts include detailed descriptions of the analytic methods they used to arrive at their conclusions. Similarly, authors of methods texts almost always provide cautionary advice on phone interviews without citing empirical evidence. To summarise, direct, detailed and empirically supported comparisons of telephone and face-to-face interview modes do not appear to exist in the qualitative methodological literature to date. Qualitative interviews come in a variety of shapes and sizes and are used for a variety of purposes, to collect data in a variety of academic disciplines and applied research fields. As a result, there may be no definitive answer to whether phone interviews are appropriate for some broad definition of "qualitative research." Among other things, the overall research objectives of a study, the specific questions to be addressed, the type of participants involved and the analytic approach to be used, will all have an impact (Holt, 2010; Novick, 2008; Sweet, 2002). Furthermore, for a variety of practical reasons, telephone interviews are undeniably used in contemporary social research. Rather than debating whether telephone interviews are "appropriate" or "as good as" face-to-face interviews, it appears that the more pressing concern is to gain a better understanding of what difference it makes to our research processes and outcomes. If we choose to conduct research interviews over the phone, for whatever reason, what are the implications for our research? Telephone interviews, as a research tool, are not going away; in fact, as research budgets tighten, they may become a more viable and practical option. Currently, the evidence based on mode effects in qualitative interviews is underdeveloped (Sweet, 2002; Sturges & Hanrahan, 2004; Novick, 2008). According to Sweet (2002), “the telephone has found its way into qualitative research processes as a medium for data collection,” but “its use has not generated the critical discussion that is warranted” (p. 58).

Many factors, including physical capacities, safety concerns, the importance of the physical/visual context, available budgets and time constraints, will influence whether telephone interviews are used in qualitative research. For a variety of practical and ethical reasons, the telephone is sometimes a preferable or entirely justified methodological choice for a given project or specific Interview As a result, it is critical to expand the evidence, regarding the difference it makes to the interview interaction and data, when we conduct interviews over the phone rather than face-to-face. Based on such evidence, researchers will be better able to assess the implications for any given project and, if necessary, modify their interviewing approach to address any perceived risks to the quality or usefulness of the data.

### 4.7 Recording semi-structured interviews

Typically, the interviewer will follow a paper-based interview guide when asking questions. As semi-structured interviews frequently include open-ended questions and discussions that deviate from the interview guide, it is usually best to record and then transcribe the interviews for analysis. While it is possible to take notes to capture responses, it is difficult to focus on both conducting an interview and taking notes. This method will result in poor notes and will impede the development of rapport between the interviewer and interviewee. Developing rapport and dialogue is critical in unstructured interviews. If an interview cannot be recorded, having a note-taker present during the interview can be beneficial.

### 4.8 Participant Selection:

Purposive sampling is commonly used in qualitative research to identify and select information-rich cases related to the phenomenon of interest. Despite the fact that there are numerous purposeful sampling strategies, criterion sampling appears to be the most commonly used in implementation research. Combining sampling strategies, on the other hand, may be better suited to implementation research goals and more in line with recent advances in quantitative methods (Proctor et al., 2009).

A cross-sectional study was conducted at a single point of time to examine the relationship between the determinants of ICT Adoption in Indian Telehealth environment. Random convenience sampling was used for conducting the semi-structured interview as the selection of participants was based on ease, accessibility, speed and low cost.

The proposed sample size for semi-structured interviews was thirty to forty participants. Glaser and Strauss (1967) suggested the perception of saturation for accomplishing a fitting sample size in qualitative research. Qualitative sample sizes ought to be large enough to attain responses for furthermost or all potential insights. Deriving maximum or all potential perceptions will lead to the attainment of saturation. Saturation happens when adding more participants to the research study does not result in additional perspectives or information.The number of participants proposed for the semi-structured interviews was based on the best evidence from the literature review (Glaser and Strauss 1967; Creswell 2014; Wilson 2010; Saunders et al. 2016). In reality the number of semi-structured interviews will continue till it reaches a saturation level where similar answers are derived from subsequent interviews (Glaser and Strauss 1967). Furthermore, a pilot study was conducted before each stage to testify and confirm the reliability and validity of the respective dataset / instruments (Creswell 2014; Saunders et al. 2016).

## 4.9 Protocol:

Qualitative interviewing is a versatile and powerful tool for capturing the voices of participants and interpretations of their experiences. When designing and conducting semi-structured interviews, the following six steps should be undertaken: a) determining the type of interview; b) developing ethical guidelines; c) developing the interview protocol; d) conducting and recording the interview; and e) reporting the results (Rabionet, 2011).

This is the most time-consuming part of the process. The interview protocol contains two key elements: (a) how the interviewer introduces the person being interviewed; and (b) the questions that will be asked. The first component is critical for establishing rapport, creating a suitable environment, and eliciting honest reflection and comments from the interviewee. To establish a line of communication that will elicit the necessary information, the researcher must carefully craft the opening statement. When the protocol was first introduced, statements about confidentiality, consent, withdrawal options and the use and scope of the results were included. The second and most important component of this stage was the development of questions and follow-up probes. In order to do this effectively, it was necessary to have a thorough understanding of the subject. For this, existing literature and previous work were the best resources. Additionally, experts in the field were consulted to improve the quality of the interview protocol, and expert qualitative researchers, who have used interviews, provided feedback and guidance. Piloting the interview also helped improve the instrumentation. Aside from paying close attention to the relationship between the questions asked and the content produced during the interviews, it was also important to consider whether the questions were perceived by the interviewees as respectful and culturally sensitive.

Planning, introductions and establishing rapport and neutrality were all part of the interview protocol (Gaskell, 2000; Kvale, 1996). Each of these steps will be covered in detail in the sections that follow.

During interview protocol planning, the required information for the research problem was defined (Dick, 1998). The framework for conducting in-depth interviews in this study was created and adapted from a variety of sources (Carson et al., 2001; Gaskell, 2000). The information required was defined using existing theory (Carson et al., 2001; Perry, 1998).

Firstly, the introduction was written to inform the chosen respondent about the Interview All respondents who were chosen were contacted by phone. During the phone conversation, the interviewer introduced himself and provided a brief description of the research topic. The interviewer then explained the main purpose of the interview in detail. The additional information included the reason they were chosen as a participant, the type of information required and what their participation would entail (Carson et al., 2001). Ethical guidelines were followed by the researcher when conducting the qualitative interviews (Carson et al. 2001). Ethical approval was obtained through the University of Queensland’s (USQ) Human Research Ethics Committee (Approval No. H18REA086 v3). After the initial introductions, the researcher made certain that the interviewee read the participant information sheet (refer to Appendix 4). The participant information sheet and consent form provided information about the research topic, the researcher's contact information, the rights of the interviewees and the reason for audio recording the interviews. In particular, the significance of interview confidentiality was emphasised (Rao & Perry, 2007). The chosen respondents were informed that they could withdraw their permission to be interviewed at any time during the process (Johnson, 2001). They were assured that the relationship of the participant with USQ, as well as their place of work, would be unaffected by their decision to participate or not participate, or to participate and then withdraw.

In order to establish impartiality and rapport, the researcher introduced himself and gave a brief explanation of the main purpose and scope of the research (Carson et al., 2001).

Preparing for an Interview (Valenzuela & Srivastava, 2002; Dempsey et al., 2016; Doody & Noonan, 2013; Zorn, 2008):

1. Prepare thoroughly for the interview, even if it will only be semi-structured. Make a list of the topics and questions you would like to ask, and consider how you would like to arrange them.

2. If this is your first interview with the interviewee, provide an overview of your purpose, your intended uses for the interview data, and the measures you have taken to protect confidentiality and anonymity. Also, discuss it and obtain permission to tape record or take notes.

3. If this is your first interview, begin by asking a few background questions, such as the interviewee's job title and responsibilities, time with the company and so on. These questions are frequently used to provide necessary information as well as to "warm up" the interviewee; that is, they are simple to answer and help the interviewee get into the interviewing mindset.

4. Focus on establishing rapport and creating a relaxed, comfortable environment. Nonverbal communication includes smiles, seating position, open/closed body

posture, and eye contact. Be yourself (authentic), positive about the interview and self-assured in general.

5. Questions about the topic of interest should be broad and open-ended, allowing the interviewee to construct their own answer. Open-ended questions are useful for qualitative researchers who want to understand the interviewee's language and meanings. When the interview is about a particular event, episode, factors, or technology such as telehealth, the interviewer may ask, "Tell me the story of telehealth, beginning when you first heard about it." A question like this, followed by probes, can result in a response time of 30-40 minutes.

6. Write down questions about specific facts or topics of interest and save them for later in the Interview

7. If the interview is based on observation, the interviewer may want to enquire about specific messages or exchanges. Again, avoid being too direct in the interrogation. Rather than asking, "What did you mean when you said...", ask, "What did you mean when you said....?"

8. Use probes with caution to elicit more detailed responses or to follow up on points of interest. Because many interviewees speak in broad strokes, probe them with questions such as "Can you give me an example of that?" or "What did he say?" If the emphasis is on communication, try to elicit the language and specific meanings involved.

9. Silence is sometimes the best probe. When interviewees pause, keeping quiet can encourage them to continue. Also, rather than interrupting a good story, make a mental note to return to a specific point later in the Interview

10. Think about how you want to wrap up the interview. It is a good idea to ask near the end, "Is there anything else you would like to tell me?" This works especially well after the tape recorder has been turned off. If you have any follow-up questions, it is also a good idea to ask the interviewee if you can contact them later.

11. Check your recorder to see if you have recorded the entire interview, fill in the blanks in your notes and write down your impressions immediately following the Interview

**4.10 Development of Semi-Structured Interview Guide**

The conceptual framework developed through the literature review, along with feedback from the healthcare professionals and experts in research methodology, were utilised to develop appropriate semi-structured interview questions relating to the research. The protocol developed beforehand also played a role in developing the interview guide and, subsequently, conducting the interviews. Initially, a researcher's copy of the interview questions was developed, along with references, to gain feedback from the supervisory team, health care professionals and methodology experts. The final approved copy of the in-depth, open-ended, semi-structured interview questions are as follows:

Good Day Doctor!

Many thanks for consenting to the Interview

1) What are your experiences in providing telehealth services?

(How are the telehealth services provided?)

2) In your opinion what are the motivators/drivers to provide telehealth/telemedicine services?

3) What are the technologies you use to provide telemedicine/telehealth services? What is your opinion on using the technologies to provide telemedicine/telehealth services?

(Need of technical upgrades, comfort factor, internet speed etc.)

(Suitability/comfort factor regarding online platforms, digital stethoscope, examining camera, etc.)

4) What organisational support do you get and how do you get it to provide telemedicine/telehealth services?

5) What is your opinion about sharing your knowledge with other doctors/patients using telehealth services?

6) What is your opinion on training healthcare professionals to provide telemedicine/telehealth services?

7) What is your opinion with regard to serving any particular demographic area through telemedicine/telehealth services? (Rural primary care, urban areas etc.)

8) What is your opinion on the need for organisation policy/government policy for implementing telemedicine/telehealth services?

9) What changes are required to make telemedicine/telehealth successful?

10) Any other challenges you would like to talk about regarding telehealth?

Thank you very much in helping me!

If you can sign and send me the consent form that would be great!

The above questions were open-ended questions and the actual interview process often differed in terms of the order of the questions and the participant's responses. Whenever there was a tendency for the participant to drift away from the research questions, the interviewer led the participant back to the original questions in a tactful manner. The open-ended, semi-structured nature of the questions allowed the interviewer to find alternative wording whenever confusion arose with a participant. Further, as it was an in-depth interview, the interview process lasted till all, or the majority of the information was retrieved. Since, the participants were associated with the health profession and therefore had many demands on their time, their availability was assessed beforehand. An adequate protocol about their time requirements was communicated to the participant HCPs prior to the Interview The set protocol was that the HCPs might abruptly stop the interview process if there is requirement of some urgent medical attention or in case of other emergency situations. Further, the heads of the units were informed before conducting such interviews and the emergency contact numbers were kept handy with the interviewer and the research team. Additionally, the supervisory team of the interviewer was always informed before an interview took place.

### 4.11 Conclusion

The semi-structured interviews were conducted, via telephone, with health care professionals in India. The next stage of the research will deal with the collection and analysis of the data revealed. The qualitative data collection was quite challenging in the sense that an appropriate protocol had to be prepared before conducting the interviews. The protocol was prepared by extensively studying published literature and by receiving feedback from the research supervisors and experts in healthcare research methodology. The next chapter will explore in detail how the data was collected and dealt with by choosing suitable qualitative methods for analysis.

# CHAPTER 5 QUALITATIVE DATA ANALYSIS

## 5.1 Chapter Overview

The previous chapter provided information on how the actual qualitative data will be collected from Indian health care professionals (HCP) in challenging conditions. Afterwards, a rich data set was procured for analysis and interpretation for this research. This chapter will provide information on how the data was collected and analysed with a rigorous process so as to achieve data triangulation for maximum validity. This chapter is organised into 3 sub-chapters: Chapter 5A Qualitative Data Analysis – Manual Coding; Chapter 5B Qualitative Data Analysis – Leximancer Coding; and Chapter 5C – NVivo Coding. The manual coding enabled the researcher to gain sufficient understanding of the HCP's perceptions through iterative readings of the manuscript. The Leximancer coding was an automated, quantified coding process to find any relevant concepts that might have been overlooked in the manual coding process. The themes were finalised in the NVivo coding process which is a semi-automated, computer assisted qualitative coding software.

## 5.2 Interviews conducted in India:

Semi-structured interviews were conducted with participants engaged in telehealth, from private and public healthcare domains. The in-depth interviews were audio recorded and the process depended on each participant's consent and suitability. The location of the interview was decided prior to the interview based on mutual consent, and included each healthcare professional's workplace. 12 interviews were conducted from 15 February 2019 to 30 May 2019 from various regions in India. All interviewees were healthcare professionals involved in providing telehealth services. Table 5 presents the participants demographics.

*Table 5 Demographics of Interview participants*

**Table 5**

**Demographics of Interview Participants**

| **Characteristics** | | **Number of participants** |
|---|---|---|
| **Gender** | | |
| Male | 7 | |
| Female | 5 | |
| **Occupation** | | |
| Doctors | 6 | |
| Dietitians | 5 | |
| Healthcare Administrator | 1 | |
| **Role in telehealth** | | |
| Primary care telemedicine | 4 | |
| Nutritional online consulting | 5 | |
| Pre-surgery online consulting | 1 | |
| Initial Contact online consulting | 2 | 12 |
| **Region** | | |
| Tamil Nadu | 5 | |
| Uttar Pradesh | 3 | |
| Maharashtra | 2 | |
| Karnataka | 1 | |
| West Bengal | 1 | |
| **Employment** | | |
| Public | 2 | |
| Private | 10 | |
| **Qualifications** | | |
| UG | 0 | |
| PG | 12 | |

The aim of this stage of the research was to gain an understanding of the perceived determinants of telehealth by health care professionals in India, within the telehealth environment. This exploratory qualitative research was conducted using in-depth, semi-structured interviews. Doctors and other allied healthcare staff were interviewed with their responses being recorded. The qualitative research study followed an interpretivist approach wherein the semi-structured interviews yielded rich data. Afterwards qualitative content analysis delved deeper into the healthcare professional's perceptions to find the latent meanings hidden inside the rich dataset. This is based on the interpretivist paradigm's premise that understanding the meanings individuals select and interpret depends on the situation in which one is placed and where the individual is headed (Blumer, 1969). Initially, a manual thematic analysis (Braun & Clarke, 2006) was conducted to analyse the healthcare professionals' narratives. This was to identify, evaluate and report themes regarding the determinants of adoption within the telehealth environment. Ethics approval (Approval No. H18REA086 v. 3) to conduct this research was obtained from the relevant authorities prior to conducting the interviews.

## 5.3 Design

The design of the research was exploratory in nature, reflecting the paucity of information on this topic (Stebbins, 2001). Semi-structured interviews were selected as they enabled the researcher to prepare questions prior to the Interview. It also enabled the participants the freedom to express their individual opinions and provided reliable, comparable qualitative data (Cohen & Crabtree, 2006). Additional considerations for selecting semi-structured interviews, instead of focus groups, included outreach and costs. In making this decision, constraints associated with focus groups, including finding a convenient interview time, participants not willing to contribute their opinions, participants being under pressure to concur with the dominant views and the results being difficult to analyse, were avoided (Barbour & Morgan, 2017). Additionally, the cost of gathering participants together for a focus group were reduced as interviews were conducted with each participant either face-to-face or via a telephone.

## 5.4 Protocol

Cross-sectional data collection was used in this research (Kijsanayotin, Pannarunothai, & Speedie, 2009; Schmeida, McNeal, & Mossberger, 2007; Shin, Lee, & Hwang, 2017), with 12 semi-structured interviews being conducted between February 2019 and June 2019 with health professionals located in India. The Head of each healthcare department was contacted prior to this research occurring. They authorized this research being undertaken in their workplace and assisted in organizing the written consent of each participant. The site of each interview was decided prior to the interview taking place and was mutually agreed upon. Sites included the healthcare professional's workplace or where appropriate and convenient, via a telephone conversation. Each semi-structured interview was audio recorded to enable translation of the conversations into text for analysis and were conducted in English. The participant healthcare professionals were situated in the Indian states of Uttar Pradesh (three participants), West Bengal (one participant), Maharashtra (two participants), Tamil Nadu (five participants) and Karnataka (one participant) and all were involved in providing a range of telehealth services. Random convenience sampling was used for selecting the participants based on ease, accessibility and low cost (Acharya et al., 2013; Creswell, 2014). Seven participants were male and five were female. Among the healthcare professionals eight were doctors, two were dietitians, and one was a healthcare administrator. Four of the participants were involved in primary care telemedicine and seven were involved in medical advising through an online medium.

### 5.5 Pre-testing and Pilot Study

The interview questions were finalized after pre-testing with health care professionals and experts in healthcare research methodologies. The final copy of the questions was put to use initially for a pilot study for validating the instrument. The pilot study was conducted by considering the initial four interviews to test and confirm the reliability and validity of the questions and respective dataset (Creswell, 2014; Saunders, Lewis, & Thornhill, 2016). The interview questions were refined, accordingly, after the pilot study. Only the question on policy was eliminated from the open-ended questions as the topic was coming up automatically among the participants. The interviewer observed these phenomena throughout the rest of the remaining eight interviews.

### 5.6 Saturation

The interviews reached a saturation point at the end of the ninth interview whereby similar answers were coming through from the participants. Another 3 interviews were conducted, with a total of 12 interviews completed. The interviews were then stopped for retrieving, transcribing and analysing the rich dataset produced.

### 5.7 Transcription

The interviews were retrieved from the voice recorder to the office computer. The audio files were then played and the primary investigator did the transcription. The transcription script was finalised after consulting the research supervisors. The interviews revealed a rich data set for further analysis by suitable qualitative methods.

After describing the qualitative data collection process in the healthcare domain in India, in the previous section of this chapter, the next section (Chapter 5A) will begin with describing the manual coding process adopted initially to report the themes generated from iterative readings of the transcribed qualitative data.

## Chapter 5A Qualitative Data Analysis – Manual Coding

### 5A.1 Data transcription

The audio recorded data, which was the outcome of the in-depth open-ended semi-structured interviews held with Indian HCPs, were first retrieved from the recorder and uploaded to the university computer. The data was transcribed by the primary investigator and was later verified by the research supervisors for accuracy. After the approval of the supervisors the final copy of the transcript was used to start the first stage of the qualitative data analysis.

### 5A.2 Manual Analysis

Manual analysis of the data was performed in order to determine the broad themes around telehealth adoption, as well as to delve deeper into the data to gain insight into the latent themes hidden therein. The main investigation of the research was to identify the determinants of telehealth adoption in India and to understand the drivers and barriers of telehealth adoption in India. The participants were doctors and dietitians, providing either telehealth services or online consultations. The significant broader themes and items identified by the participant doctors around India based on their knowledge, practice and experience are presented in the following table no. 1.

*Table 6 Frequency of items identified by the Indian healthcare professionals*

**Table 6**

**Frequency of items identified by the Indian healthcare professionals**

| **Themes** | **Interviews** No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 | No. 9 | No. 10 | No. 11 | No. 12 | **Frequency** | **%** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Clinical Practices** | | | | | | | | | | | | | | |
| Diagnosis | . | . | . | . | . | . | . | . | . | . | . | . | 12/12 | 100% |
| Treatment | . | . | | | . | . | . | . | | . | | . | 8/12 | 67% |
| Follow-up | . | . | . | . | . | . | . | . | . | . | . | . | 12/12 | 100% |
| Referral | . | . | | | . | | | | | . | | | 7/12 | 58% |
| Prevention | . | . | | | . | . | . | | . | . | . | | 8/12 | 67% |
| Counselling | | . | . | . | . | . | . | | . | . | | | 8/12 | 67% |
| Rehabilitation | | . | | . | . | . | . | . | | | . | | 7/12 | 58% |
| Expert Opinion | . | . | . | . | . | . | . | . | . | . | . | . | 10/10 | 100% |
| **Technology** | | | | | | | | | | | | | | |
| Usefulness | . | . | . | . | . | . | . | . | . | . | . | . | 12/12 | 100% |
| Usability | . | . | | | . | | . | . | . | | | | 6/12 | 50% |
| Connectivity | . | . | . | . | . | . | . | . | . | . | . | . | 12/12 | 100% |
| Bandwidth | . | . | | . | . | | . | . | | | | | 6/12 | 50% |
| Upgraded technology and future directions / new models | . | . | . | . | . | . | . | . | . | | | | 9/12 | 75% |
| Security | . | | | . | . | . | . | . | . | . | | | 8/12 | 67% |
| Safety | . | . | . | . | | . | | . | . | . | | | 8/12 | 67% |
| **Training** | | | | | | | | | | | | | | |
| Healthcare professionals ICT training | . | . | . | . | . | . | . | . | | | | | 8/12 | 67% |
| Healthcare Professionals technology awareness | . | . | | | . | . | . | . | . | . | | | 8/12 | 67% |
| Health workers technological awareness | . | . | . | . | . | | . | | . | . | | | 8/12 | 67% |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Policies and Procedures** | | | | | | | | | | | | | | |
| Heath policy | . | . | . | . | . | . | . | . | . | | | | 9/12 | 75% |
| Organisation policy | . | . | | . | | . | . | . | | | | | 6/12 | 50% |
| **Usefulness** | | | | | | | | | | | | | | |
| Benefits | . | . | . | . | . | . | | . | . | . | | | 8/12 | 67% |
| Time saving | . | . | . | . | . | . | . | . | . | . | . | . | 12/12 | 100% |
| Distance | . | . | | . | . | . | . | | . | . | . | | 9/12 | 75% |
| Remote areas | . | . | | . | | | | | . | . | . | . | 8/12 | 67% |
| Rural Areas | . | . | | . | . | . | . | | | . | | . | 8/12 | 67% |
| **Patient Awareness** | | | | | | | | | | | | | | |
| Patient Health Education | . | . | . | . | . | . | . | . | . | . | . | | 11/12 | 100% |
| Patient Wellness | . | . | | . | . | | | . | . | . | . | | 8/12 | 67% |
| **Access to Healthcare** | | | | | | | | | | | | | | |
| Rural Areas | . | . | . | . | . | | | | | . | . | . | 8/12 | 67% |
| Remote Areas | . | . | . | . | . | | | | | . | . | . | 8/12 | 67% |
| Healthcare Facilities | . | . | . | . | . | | | . | . | . | | | 8/12 | 67% |
| **Organisation** | | | | | | | | | | | | | | |
| Reluctance | . | . | | . | . | . | . | . | . | | | | 8/12 | 67% |
| Actual Adoption | . | . | . | . | . | . | . | | | . | . | . | 10/12 | 83% |
| Shortage of doctors | . | . | . | . | . | . | . | . | . | . | . | . | 12/12 | 100% |
| Shortage of health workers | . | . | . | . | | | | | . | . | . | . | 8/12 | 67% |

Qualitative data analysis involved transcription of the raw interview data to a usable written format. This process enabled the researcher to get acquainted with the data in the first instance. Qualitative methods were then used to analyse the data, to empirically justify the opinions of the healthcare professionals. Furthermore, an inductive content analysis provided deeper understanding as to the reality behind such opinions (Elo & Kyngäs, 2008; Vaismoradi et al., 2013). Latent analysis helped the researcher extract the deeper meaning hidden within the interview data (Bengtsson, 2016; Berg, 2001). Computer-aided qualitative data analysis software is faster but has its limitations. These include an inability to understand the underlying or hidden meaning of texts. As such, manual method of analysis has been chosen over automated analysis. Moreover, manual coding is likely to be more efficient and a cheaper option for a small data set (Hsieh & Shannon, 2005; Kondracki et al., 2002).

The process of manual content analysis resulted in the emergence of several themes pertaining to telehealth adoption in the Indian healthcare. The perceptions of the healthcare professionals were classified into themes, on the basis of the opinion and frequency of responses of the participants. The themes identified as having a positive effect on telehealth adoption or the perceived drivers of adoption in Indian healthcare were, clinical practice, patient awareness, access to healthcare, usefulness and training. Further, the themes of technology, organisation and, policies and procedures were identified as the perceived barriers or having a negative impact on telehealth adoption in Indian healthcare. The resultant themes and the drivers and barriers of telehealth adoption in India are presented in Table 7 below.

***Table 7 Resultant themes and the perceived drivers and barriers of telehealth adoption in Indian healthcare***

**Table 7**

**Resultant Themes**

| **Perceived driver themes** | **Perceived barrier themes** |
|---|---|
| **1. Clinical Practices** | **1. Technology** |
| Diagnosis | Connectivity |
| Prevention | Bandwidth |
| Treatment | Upgraded technological requirements |
| Referral | Security |
| Monitoring | |
| Expert opinion | |
| Counselling | |

| | |
|---|---|
| Rehabilitation | |
| | **2. Organisation** |
| | Shortage of health workers |
| **2. Patient awareness** | Reluctance |
| Patient health education | Late adopters |
| Patient wellness | Shortage of doctors |
| | Revenue model |
| | Doctors' salary |
| **3. Usefulness** | |
| Ease of use | **3. Policies and procedures** |
| Economical | Impractical Govt. policy |
| Time-saving | Lack of standardisation |
| Distance saving | |
| Global reach | |
| **4. Access to healthcare** | |
| Remote areas | |
| Rural areas | |
| **5. Training** | |
| Medical education | |
| Collaboration on knowledge sharing | |

The above Table 7 shows the identified themes and the drivers and barriers of telehealth adoption in Indian healthcare. The identification process and their relevance is discussed in the next section.

## 5A.3 Findings

The eight themes which emerged from the interpretation of the data were derived from the subjective analysis of each participant's opinion on various factors responsible for telehealth adoption in Indian healthcare. Further, the themes were analysed as having positive or negative effects on telehealth adoption in Indian healthcare and have been classified and further grouped into drivers and barriers.

### 1 Clinical Practices

Clinical practices were identified as a significant theme of telehealth adoption from the Indian doctors' perspective. The theme includes many factors such as diagnosis, treatment, follow-up, referral, prevention, counselling, rehabilitation and expert opinion. Though diagnosis emerged as a significant factor of motivation for the doctors to uptake telehealth services, the approach to the diagnosis differs in the opinion of the participant doctors. For some, it is a valid method of first contact, seeing reports and initial diagnosis. However, they are much more comfortable with face-to-face interactions and, according to the participants, see this as essential in cases of severe diseases and surgeries. Through initial contact and transfer of reports via electronic means, an initial assessment can be made of the patient's condition and the patient can receive initial information. This can be evident from the following interview excerpts:

> *'Lot of my practice depends on messaging through whatsapp, seeing reports, advising them, seeing pictures of patients. Quite an essential part of my practice ... It is not everything. Not every information can be provided. Judging by pictures only. Picture quality matters. Physical/face-to-face consultations are more important. Online consultations are only in 2D format."* (Interview 4)

> *"The doctors can see the image for diagnosis ... we then talk over the phone with the doctors for management and treatment ... Face-to-face doctor-patient interaction is better."* (Interview 12)

Several participants identified treatment as a factor of motivation for the doctors to uptake telehealth. Normally, the doctor sees the patient through examining cameras and, after establishing the condition, prescribes certain investigations to be performed. Once those are completed and the diagnosis verified, a follow-up telehealth session will be scheduled where medicine or treatment is prescribed. Typical answers were:

> *"All patients are examined by the doctors. Entry of records is done by the health workers there. Software captures all the data – diseases, required examinations. Then the doctors prescribes medicine."* (Interview1)

> *"So the purpose is to screen patients, treat patients, diagnosis of cancer, or refer for cancer, to identify diseases."* (Interview 2)

Follow-up of the patients utilising telehealth services or using online medium has emerged as a leading factor in the adoption of telehealth services by the doctors. After the initial diagnosis and medicines are prescribed, or post-surgery, the follow-up of patients can be done conveniently using telehealth. Thus, it becomes convenient for all involved as scheduling appointments becomes easy, regular follow-up continues and travel is nullified, saving time for both doctor and patient.. As such, it can be observed that the convenience for follow-up provided by telehealth has a positive significance in adopting telehealth by the doctors.

The above phenomena is evident with the following interview excerpts:

> *"Also they keep on monitoring the patients 2-3 times."* (Interview 2)

> *"Second time follow up is after that and if necessary reference to urban hospitals is done."* (Interview 5)

Referral of the patients to other healthcare providers has emerged as a factor for consideration of adopting telehealth by the doctors. Many are of the opinion that where the condition of the patient is such that it could not be properly treated over electronic medium, then the best option is to refer the person to the nearest hospital. This might occur where there is an emergency, or the condition needs urgent attention and it is not possible to treat the patient without face-to-face interactions. This is particularly significant in the rural and remote areas of India, where there is insufficient healthcare facilities and s shortage of doctors. This is evident from the following interview excerpts:

> *"Cancer patients are referred to Vrindaban. So the purpose is to screen patients, treat patients, diagnosis of cancer, or refer for cancer, to identify diseases."* (Interview 2)

> *"Our focus is on rural areas, non-communicable and chronic diseases. The first meeting comprises of complaints, advising and investigations. Second time follow up is after that and if necessary reference to urban hospitals is done."* (Interview 5)

Prevention of diseases is also a factor in adopting telehealth services by doctors in India. Many of the doctors interviewed are of the opinion that adopting telehealth could help prevent certain health conditions. Furthermore, awareness and prevention of certain diseases, such as diabetes and high blood pressure, can be developed. Telehealth services can be used to educate patients about wellness measures they may undertake to prevent such diseases. This is evident from the following interview excerpts:

> *"Telehealth can be used for preventing diseases ... should be more robust and mobile."* (Interview 1)

Diagnosis has been a major driver in providing telehealth services globally. Various studies have pointed out the significance of telehealth in early diagnosis of medical conditions (Taylor et al., 2015; Thielst, 2010; Weinstein et al., 2014). The findings of this study corroborates with the fact that, at least as a reason for first contact, diagnosis can be a driver to uptake telehealth. Moreover, the drivers of treatment, monitoring, referral, rehabilitation, expert opinion and counselling via telehealth have found favourable responses in earlier research (Ahmed et al., 2010; Anwar et al., 2019; Ashburner et al., 2016; Bee et al., 2016; Bowman et al., 2013; Finkelstein et al., 2011; Ganapathy et al., 2019).

Thus, from the above analysis of the interviews of the sample population of doctors, it can be concluded that the above factors are the major perceived drivers of telehealth adoption in India. The combined medical processes of diagnosis, treatment, follow-up, referral, prevention, counselling, rehabilitation, monitoring and expert opinion are classified under the theme of clinical practices.

**2 Patient Awareness**

Developing patient awareness was another theme which emerged from the analysis of the data. Many of the participants providing primary care in rural areas through telehealth services, are of the opinion that there is a distinct advantage in using telehealth as a medium of patient education. Particularly, to promote prevention of diseases and aspects of wellness such as healthy lifestyles, healthy diets and self-management of diseases. The perceptions are in favour of increasing health outcomes through the use of telehealth. The participants providing online consultations in the urban areas also stressed the importance of this factor. Furthermore, the participants stressed on the promotion of wellness among the patients through the use of telehealth. These are evident from the following interview excerpts:

> *"Awareness required throughout India – North, East, South, and West. Health is not priority in India. Health spending required. Education in health required. Consciousness in remote areas required. In urban areas people are lazy to go to hospital/doctors/appointments. Follow up of diabetes can be done in*

*urban areas. Awareness should be created in rural areas about privileges of telemedicine, follow up, benefits about your health"* (Interview 5)

*"More awareness of the population regarding the privileges of using online platforms are required"* (Interview 6)

*"There are apps coming up to input their weight and health data and all ... so now educating patients are important ... rather than preparing diet charts ... there is awareness among the consumers how the dietitian works ... when the clients come for wellness as well as therapeutics I try to educate them ... this is where the online platforms come to play ... "* (Interview 8)

The factors of patient health education and wellness have been a major driver of telehealth globally (Ackerman et al., 2010; Suter et al., 2011). Further to this, the combination of adult learning and promotion of self-efficacy to manage diseases can be promoted using telehealth as a medium. Thus, development of patient awareness can be a significant perceived driver of telehealth adoption in Indian healthcare.

**3 Technology**

The data analysis revealed details of technological barriers in adoption of telehealth in Indian healthcare. Most of the participants are of the opinion that although India has progressed much in infrastructure development, it is not uniform among different regions in a vast country such as India. There are geographic differences in the development of ICT infrastructure and it varies significantly between the urban and rural regions. The quality of infrastructure also varies significantly. This is evident from the following interview excerpt:

*"Not satisfied with the connectivity ... not getting desired sound quality for digital stethoscopes."* (Interview 5)

*"It is still a huge challenge. The use of internet is very high in India and we still do not have that bandwidth to cope up with the huge demand. The signals become poor, the lines get cut, these technological problems we still face today."* (Interview 11)

In India, although the urban ICT infrastructure has improved significantly, there is still scope for improvement in broadband speed and increasing rural connectivity which is still low (Confederation of Indian Industry & KPMG, 2017). The introduction of 5G services in the near future can be a major boost in pan-India level, uniform ICT infrastructure development and increase in broadband bandwidth capacity ((Kumar et al., 2014)). The connectivity is poor in some regional and remote areas with high call-drop rates. This is a phenomenon even in the urban areas (Mukherjee, 2019). The bandwidth is poor in the rural and remote areas of India. This is a major barrier in the uptake of telehealth in the Indian healthcare system because uniform and robust ICT infrastructure is essential in providing efficient and reliable telehealth services.

Technological upgrade requirements and the need for improved online platforms for providing telehealth services (Doarn et al., 2019) are also an important barrier in adoption of telehealth by healthcare professionals. Several participants felt the necessity of improvement in software, improvement in image quality and the development of online platforms where the patients can interact with the healthcare professionals without the need for logging in or creating user identity and password. This is evident from the following interview excerpts:

> *"The challenge is … human resources are required to run this technology efficiently/effectively with focus and institutional interest. Software/EMRs are good though differs from western countries … saves times for patients … need for improvement in software."* (Interview 1)
>
> *"The technologies are good but I think the quality based technological development is not happening … Going ahead … technology has to keep up with the lifestyle and disease pattern, see someone send you an x-ray … how to send it … that kind of technology … .the technology of the doctors looking at the systems, good quality screens, if somebody looks at a terrible image quality the diagnosis cannot be done. It should be the combination of both."* (Interview 7)

> *"the patient do not have to log in. This is an advantage for the non tech-savvy patients … creating online platforms which are easy to login without creating IDs for the patients."* (Interview 6)

Security of patient data and validation of healthcare professionals' credentials is an area which has to be addressed to remove the barriers of telehealth adoption by healthcare professionals in India. The perceptions of the participants towards ownership of the patient data as well as regarding the validation of the healthcare professionals' credentials are evident in the following interview excerpts:

> "*How the patient assess that you are not a false person. Ill advises from false doctors. It is both a challenge for doctor and patient. Also, doctors have to be open to patients that whatever is said online is hundred per cent true.*" (Interview 4)

> *"As far as I can understand to have a non-breaching electronic medium is impossible….but it should be secured ... the main challenge is who owns the data ... government ... corporates ... individual doctor ... that is the big issue. Validation of doctors is useful for patients ... during the first consultation ... credential checking system could be useful."* (Interview 5)

The barriers of technological upgrade requirements in telehealth, patient data security and healthcare professionals' credential validation have been areas of vulnerability in global circumstances (Aswathy et al., 2019; Shukla et al., 2019; Zhou et al., 2019) and the findings need to be generalised in Indian healthcare context.

**4 Organisation**

The shortage of doctors and health workers in the rural and remotes areas of India is a common problem throughout India (Bhandari & Dutta, 2007; Goel et al., 2019; Sachan, 2013). While this could be a motivation for healthcare professionals to uptake telehealth, it has, in fact, become a barrier. This is due to a lack of proper organisational infrastructure, reluctance on the part of the healthcare professionals for virtual adoption, lack of a revenue model and salary for providing extra services. This is the reason for late adoption of telehealth by the healthcare professionals in India. This is evident from the following interview excerpts:

> *"Doctors are more comfortable with traditional work. They are reluctant because the doctors complain about doing clerical work, type the medicine ... extra burden for doctors ... loopholes are ... need for extra money … there is a need for more revenues for doctors."* (Interview 5)

> *"Doctors are reluctant to enter data. Not tech savvy. Not very enthusiastic. Motivation is for diagnosis."* (Interview 2)

Furthermore, the shortage of health workers in India needs to be mitigated by organised training of the health workers, who play an important role in the follow-up of patients. Their role in telehealth includes configuring technical equipment and conveying healthcare professionals' messages to the patients. They are an important link between the healthcare professionals and the patients and also fulfil the missing human touch in telehealth services. The lack of human touch is a psychological barrier for the patient and properly trained health workers are able to remove this barrier. The following interview excerpts corroborates the organisational barriers:

> *"The intermediary are the health workers who are responsible for the follow-up after the consultation because the doctors are far away. There is another barrier of human touch which is missing. It is a psychological barrier. This barrier can be removed through the health workers. Doctors can't tell everything from far away as such, health workers can shoulder responsibility of gaining the patient's confidence in touch. Training sessions for both the health and doctors are necessary."* (Interview 5)

> *"hardworking health workers are critical. On the field the health workers should treat the patients well, they should know how to do various things, and doctors should become more regular. Medicine supplies are there. Improvement of health workers are required through training."* (Interview 1)

### 5 Usefulness

The usefulness and inherent benefits of telehealth in Indian healthcare are evident from the literature (Dasgupta & Deb, 2008; Ganapathy, 2014; Ganapathy, 2015b). The majority of the participants agreed on the usefulness of telehealth to society as well as to the healthcare professionals. Further to this, the participants stressed that the benefits of telehealth to the population as well as to the healthcare professionals should be promoted. This is evident from the following interview excerpts:

> *"Awareness should be created in rural areas about privileges of telemedicine, follow up, benefits about your health, how to save money by telling to use telemedicine instead of travelling."* (Interview 5)

Further the participants agreed that adoption of telehealth saves time, saves money, reduces distance of travel and has a global reach (Janda et al., 2019).

> *"It should be made as part of the regular consultations to save time, reach out to a larger number of people worldwide."* (Interview 3)

> *"so the motivators are comfort and convenience of commuting and saving the hackles of parking and all that ... that is one area ... we have larger reach to the people and we can work as per their convenience also."* (Interview 8)

It is evident that the physicians' emphasis is on the utility, functionality and effective patient outcomes brought about by telehealth adoption. The results obtained by Lin et al. (2012)) show that usefulness has a great impact on the adoption of telehealth by the healthcare professionals. As such, usefulness has the potential to be a perceived driver of adoption of telehealth in Indian healthcare.

### 6 Access to Healthcare

The vast rural and remote areas of India are plagued by accessibility to healthcare and a shortage of healthcare professionals (Bodavala, 2002; Rathi, 2017). Furthermore, the demographics and disease profile in urban and rural areas can be a significant driver for adoption of telehealth (West & Milio, 2004).

> *"The distances in rural areas are huge and hardly doctors are available in rural areas. The disease burden is increasing day-by-day ... telemedicine is useful for access to cover 3 villages at a time."* (Interview 1)

Current researchers investigating the cost effectiveness of telehealth programmes are of the opinion that telehealth can lessen the cost of healthcare services, thereby affecting affordable and accessible healthcare services (Torre-Díez et al., 2015). Thus, access to healthcare in rural and remote areas can be facilitated by adopting telehealth by the healthcare organisations. The prevailing health inequality in the Indian healthcare system can be removed by the efficient use of telehealth. The data analysis of the current research revealed access to healthcare as a significant perceived driver to adopt telehealth.

**7 Training**

Medical education regarding further professional development of healthcare professionals has been one of the key factors identified by the participants that could be enhanced through telehealth. The participants also stressed that collaboration among doctors is another benefit of the use of telehealth, as is evident with the ECHO project:

> *"Connections can be made across centres in India through telehealth. It can be used in discussing cases, researching with the whole team, presenting and different things can be used in many other ways. Doctor to doctor connection is possible. Doctor to patient connection is not required for all."* (Interview 3)

> *"We have to have open dialogue with doctors ... and debate ... intellectual debates open up the platform for the doctors, and those platforms can be accredited by the medical council and doctors get points for it because it is part of their practice ... continuing medical education for doctors. All doctors should get involved in it. The platform can be used to educate the doctors as well as the patients. It is absolutely important."* (Interview 7)

> *"we follow ECHO ... which started in the USA ... it is not teleconsultation but it is doctor to doctor, the specialist talks to the primary care physician and empowers him to manage the cases ... basically specialist talks to medical officers and empower them and they also make a case presentation and they get solutions. The patient is not involved directly, that's the idea."* (Interview 10)

Telehealth has been used as a tool for continuing medical education and collaboration between healthcare professionals globally (Conde et al., 2010). Thus, the theme of training emerged as a significant driver of telehealth adoption in Indian healthcare. Continuing medical education and collaboration between the doctors can increase and can be effected in real time, without having physical presence at a location.

**8 Policies and Procedures**

Standardisation of telehealth services have been a priority in developed countries globally. In India, by comparison, impractical governmental and organisation policies creates a barrier to successful adoption of telehealth by healthcare professionals. Telehealth is anticipated to overhaul healthcare through reforming and restructuring policies and procedures in the prevailing healthcare organisations and systems. These are evident from the following interview excerpts:

> *"Yes there should be standards formed for uniformity and non-disruption of the facility. Yes licensing regulations are important. Private in private sector, government in public sector."* (Interview 3)

> *"That will be good ... but they should not unnecessarily impose ... sometimes they are impractical ... especially in India ... impossible norms (may impose mandatory pharmacist, blood technicians). Basic problem in health system in India is lack of trained manpower to stay and work in villages. They are welcome ... but previously they have failed. Practical policies are required."* (Interview 1)

The research identified lack of standardisation and impractical government policies impacts the adoption of telehealth in Indian healthcare in a negative way. Thus, removal of this barrier is necessary for successful adoption of telehealth in Indian healthcare.

### 5A.4 Section Conclusion

The significant themes for telehealth adoption in Indian healthcare has been developed after reviewing a wide range of ICT adoption literature from global and Indian healthcare domains and conducting a qualitative interview study. The identified themes of clinical practice, patient awareness, access to healthcare, usefulness and training may provide an initial framework for further understanding and development of the Indian telehealth environment. The initial framework can also be utilised for ICT adoption studies in other healthcare domains. Moreover, the initial framework could be used in framing policies and procedures in governmental and non-governmental organisations. While this qualitative interview study and subsequent analysis is limited to five Indian states, it nevertheless broadens the scope for future research to build upon the findings on telehealth adoption in Indian healthcare and in other developing countries.

## Chapter 5B: Qualitative Analysis – Leximancer coding

The interviews of the healthcare professionals generated a rich dataset. After the manual coding process through iterative readings of the interview transcription, Leximancer software was employed to analyse the data further. The adoption of this two-step process established rigour in the analysis, as well as using a different automated approach. This helped uncover new themes and concepts in the research data, and lead to the reduction of bias in subjective analysis. Unlike the other computer-assisted qualitative data analysis software (CAQDAS), Leximancer uses quantitative algorithms which can exploit the more profound meanings from the interview transcripts by decoding the primary concepts and themes. Leximancer has been used in empirical qualitative healthcare research, as well as in other domains such as psychology, to define the thematic concepts present within text passages of an interview transcript.

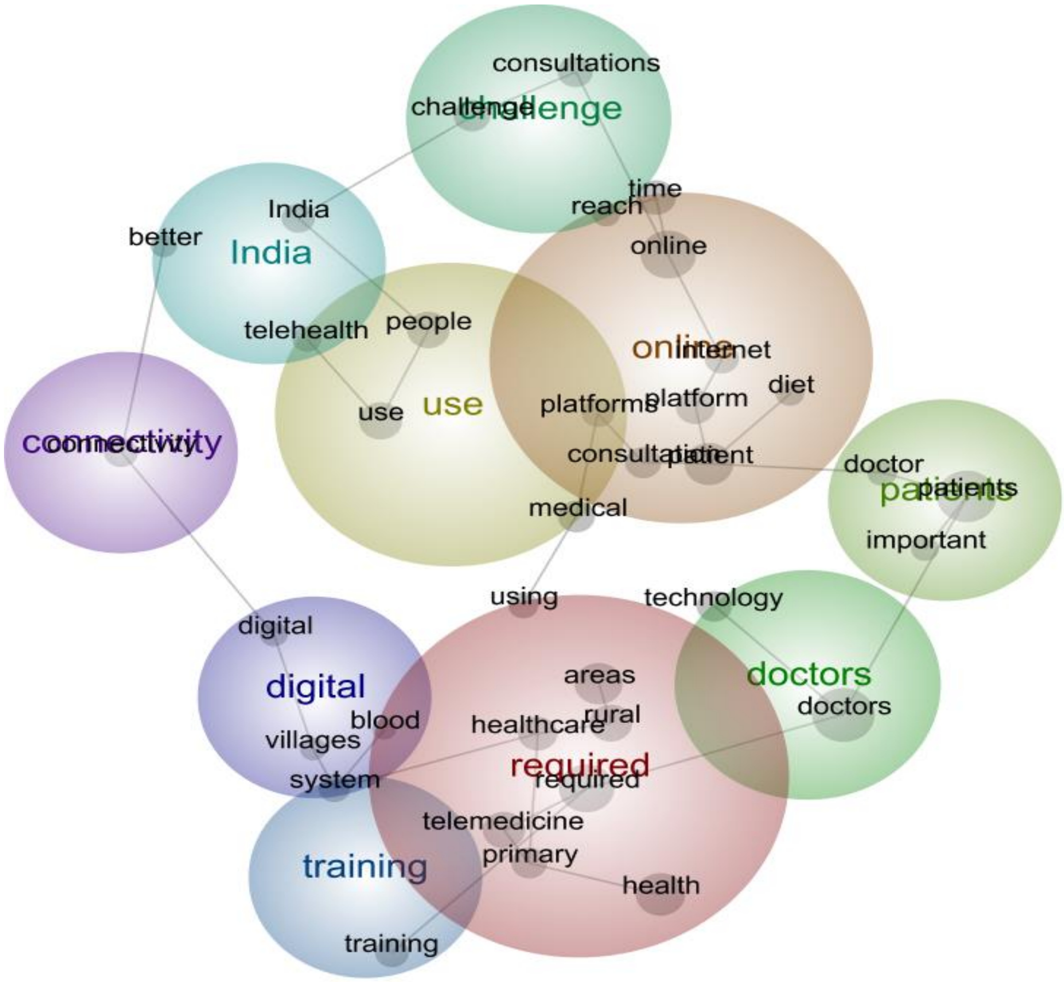



*Figure 18 Theme map of interviews of Indian HCPs*

A theme map, including the concepts, was generated and was the primary basis of analysis of the interview transcripts. Altogether, nine themes were generated along with their connectivity rates (in parentheses) in order of their proportionate significance which are, required (100%), online (86%), use (34%), patients (32%), doctors (31%), challenge (23%), India (17%), training (15%), digital (12%), and connectivity (8%). These are the primary themes regarding the perceptions of Indian HCPs regarding telehealth adoption. The percentage of connectivity rates depicted by Leximancer represents the calculation of connectedness of the concepts within the themes as well as their proportionate significance.

Figure 1 shows the theme map including the nine primary themes and also the concepts associated with it. Figure 19 depicts the connectivity rates of themes associated with the concepts.

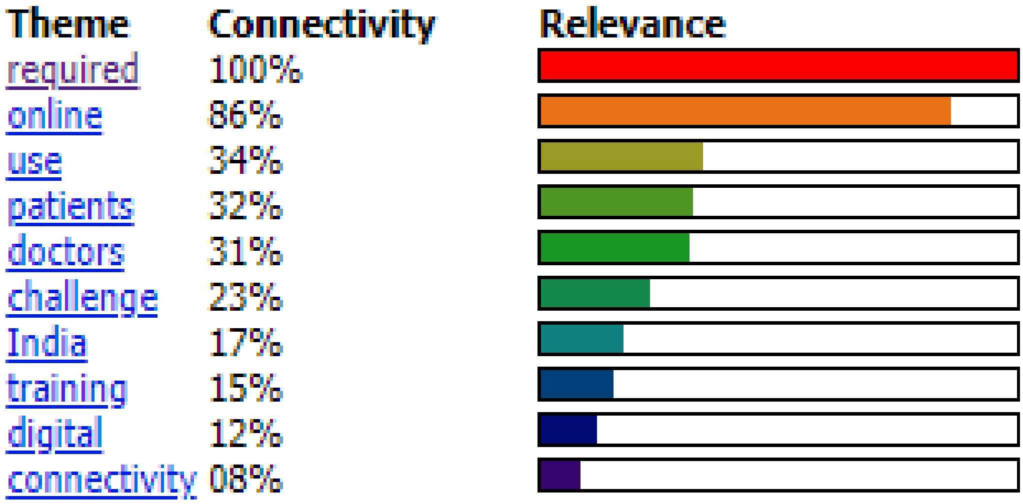



*Figure 19 Connectivity rates of themes*

The smaller grey nodes of the Leximancer output depicts the concepts and rainbow-coloured groups within which the theme names are formed. The most important theme being “required” in this research has been assigned the colour red. The subsequent themes were arranged in descending order of significance and assigned the colours brown, olive, various shades of green, various shades of blue, and purple, respectively. Altogether, Leximancer identified thirty-seven concepts (Figure 20).

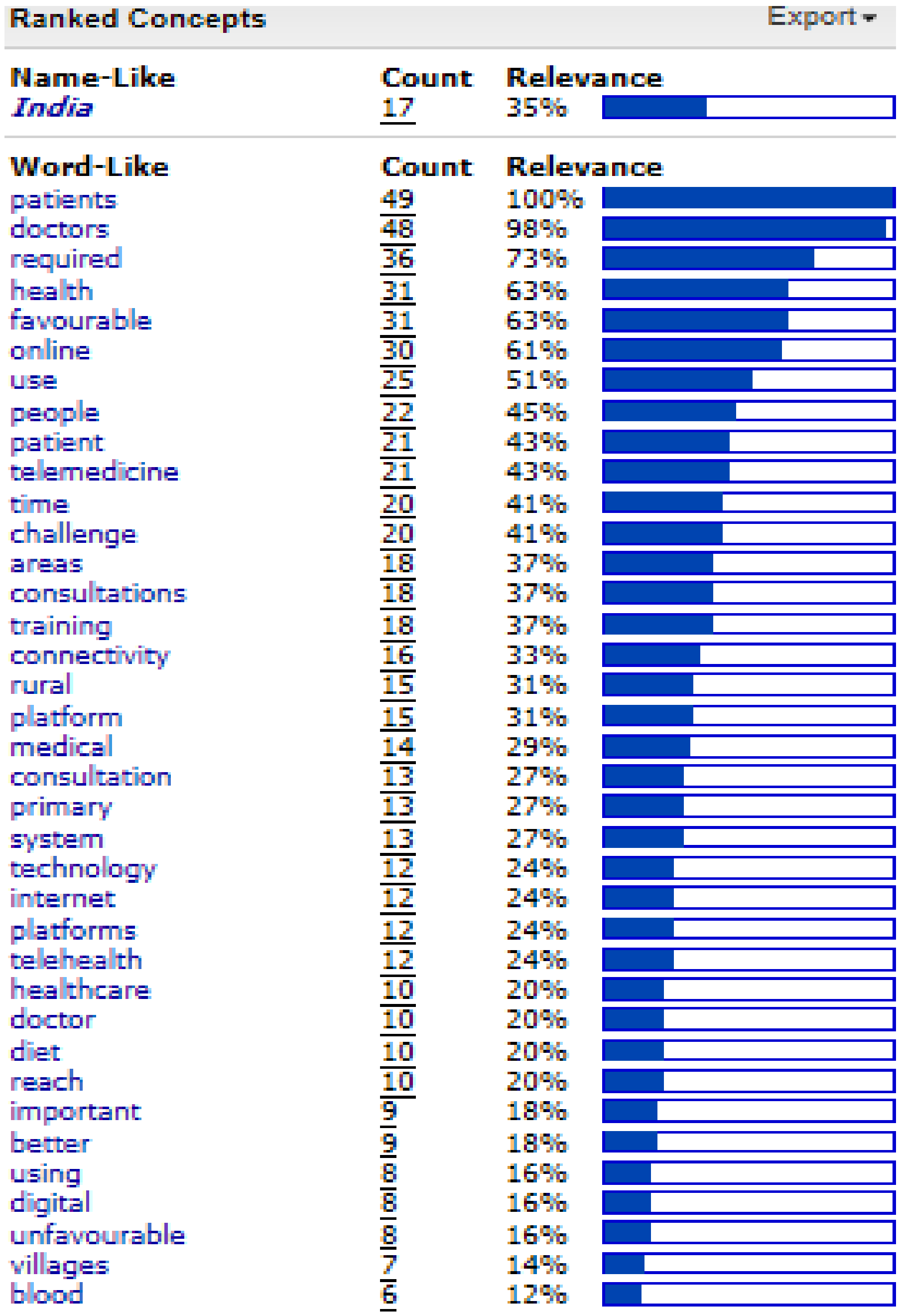
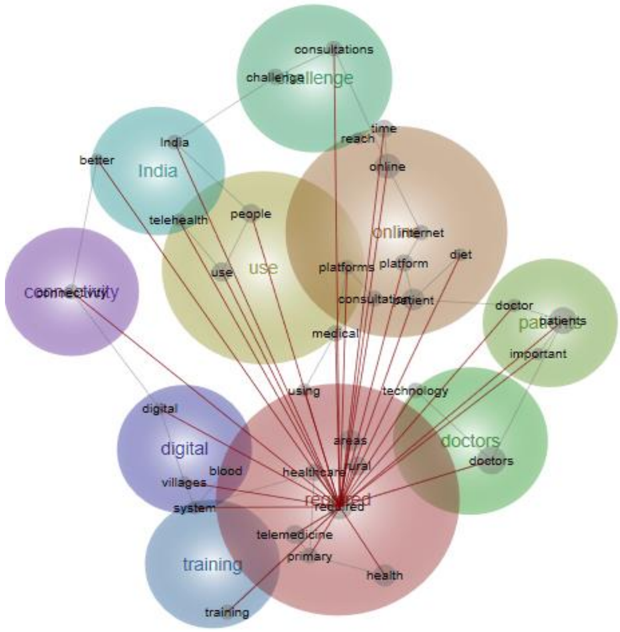



*Figure 20 Ranked concepts generated from the qualitative data*

The theme represents deeper meaning when more concepts are placed within that theme. Here, the conceptual structure of the text which overlaps themes are important to induct deeper meaning of the themes. An initial interpretation of Figure 18 propounds that healthcare requirements, shortage of HCPs, rural and remote areas, online platforms and training requirements are some of the areas which are the essential building blocks of telehealth adoption in India. The themes which have strong connections to various concepts were required, and online though the themes such as use, patients, doctors, challenge, India, training, digital, and connectivity have overlapping conceptual structure with the other themes. As such, the significance of such themes cannot be ignored and the related overlapping concepts will be discussed along with the findings of the two most significant themes of "online" and "required". The next section will discuss the significant themes and their related concepts in detail.

### 1. Required

Required was the most significant theme depicted by Leximancer intertwined with several concepts within the theme as well as overlapping with concepts within other themes. The concepts within the "required" theme connect with shortage of doctors, governmental and organisational policies, training requirements, health awareness and health promotion, rural areas, telemedicine and primary healthcare.




| Related Word-Like | Count | Likelihood |
|---|---|---|
| training | 8 | 44% |
| technology | 5 | 42% |
| connectivity | 4 | 25% |
| telemedicine | 5 | 24% |
| platform | 3 | 20% |
| health | 6 | 19% |
| doctors | 9 | 19% |
| consultation | 2 | 15% |
| system | 2 | 15% |
| patient | 3 | 14% |
| villages | 1 | 14% |
| using | 1 | 12% |
| digital | 1 | 12% |
| areas | 2 | 11% |
| important | 1 | 11% |
| better | 1 | 11% |
| healthcare | 1 | 10% |
| doctor | 1 | 10% |
| diet | 1 | 10% |
| platforms | 1 | 08% |
| telehealth | 1 | 08% |
| patients | 4 | 08% |
| use | 2 | 08% |
| primary | 1 | 08% |
| medical | 1 | 07% |
| online | 2 | 07% |
| rural | 1 | 07% |
| consultations | 1 | 06% |
| time | 1 | 05% |
| people | 1 | 05% |

*Figure 21 Conceptual structure of the concept "required "*

The concepts within the theme of "required" are required, health, areas, rural, telemedicine, healthcare, primary and using. The concept of "required" implies requirements of practical policies, safeguarding of data, tech-savvy doctors, shortage of doctors, requirement of training sessions, robust system requirements, upgradation of HCPs, promotion of health awareness and doctor's touch. Figure 21 represents the conceptual structure of the concept "required" as quantified by Leximancer.

The concept of “required” is evident from the interview excerpt:

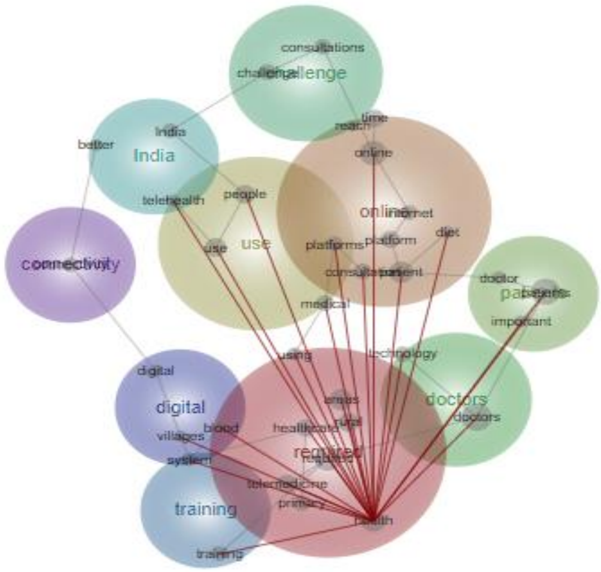
> *“Basic problem in health system in India is lack of trained manpower to stay and work in villages. They are welcome ... but previously they have failed. Practical policies are required.”* (Interview 1)

This sample interview excerpt focusses on the policy requirement regarding the shortage of trained HCPs in rural and remote areas of India. This in fact paves the way as a perceived motivator for telehealth adoption in India because of its outreach. Another underlying idea for the concept of “required’ includes the training requirements for HCPs as well as the health workers to adopt telehealth. It is evident that though HCPs have special knowledge in clinical practices, the lack of knowledge or willingness to learn the applications of ICT, in order to integrate them within their practices, can be a hindrance in adopting telehealth. As such, the requirement is for tech-savvy doctors, who can exploit the outreach of new technologies, to offer healthcare services at rural and remote areas. Though the lack of physical touch would present a psychological barrier for some patients, this can be overcome through health awareness promotions and programs. For telehealth to achieve its farthest outreach, requires it be supported by robust, uniform ICT infrastructure and connectivity. This can be achieved by strengthening organisational capabilities. The idea of safeguarding patient data also remains a concern for HCPs in adopting telehealth. To address this concern, a standardised security practice regarding telehealth is a primary requirement for telehealth to prosper.

The concept of “health” within the theme “required” is intertwined with ideas such as health workers training requirement, organisational policies regarding telehealth, health education and health awareness development. One of the significant issues in telehealth adoption appears to be health education for patients. The sample interview excerpt represents the idea:

> *“for that training of the health workers are required. Beyond providing telehealth patients education about telehealth is necessary.”* (Interview 5)

Furthermore, organisational policies can influence the adoption of telehealth when these policies directly relate to patient health education and health awareness development. The concept of health workers' training is directly related to this.




| Related Word-Like | Count | Likelihood |
|---|---|---|
| primary | 6 | 46% |
| training | 6 | 33% |
| healthcare | 3 | 30% |
| using | 2 | 25% |
| telemedicine | 5 | 24% |
| important | 2 | 22% |
| medical | 3 | 21% |
| required | 6 | 17% |
| blood | 1 | 17% |
| system | 2 | 15% |
| doctors | 7 | 15% |
| patients | 7 | 14% |
| villages | 1 | 14% |
| areas | 2 | 11% |
| diet | 1 | 10% |
| people | 2 | 09% |
| technology | 1 | 08% |
| platforms | 1 | 08% |
| telehealth | 1 | 08% |
| use | 2 | 08% |
| consultation | 1 | 08% |
| rural | 1 | 07% |
| patient | 1 | 05% |
| online | 1 | 03% |

*Figure 22 Conceptual structure of the concept "health"*

Since the HCPs are operating from a distance, there are policy requirements whereby the health workers present, in remote locations, can be entrusted with imparting health education and health awareness to the patients.

The concept of "areas" within the theme "required" primarily related to the healthcare needs in rural areas, including challenges faced in the way of ICT infrastructure and connectivity. The idea of developing model telemedicine hubs in rural areas is also prominent. Further, it highlights the means of mobile connectivity to reach people in rural and remote areas for their primary healthcare needs. The following sample interview excerpt is one of the several opinions of HCPs which reflected the ideas within the concept.

> *"Our focus is on rural areas, non-communicable and chronic diseases. The first meeting comprises of complaints, advising and investigations."* (Interview 5)

There were several ideas relating to urban areas whereby follow-up of patients, on issues such as diabetes, can be done using telehealth. The busy urban schedule of both the HCPs and the patients can be managed efficiently by reducing both travel time and distance. Figure 23 depicts the conceptual structure of “areas” within the themes.

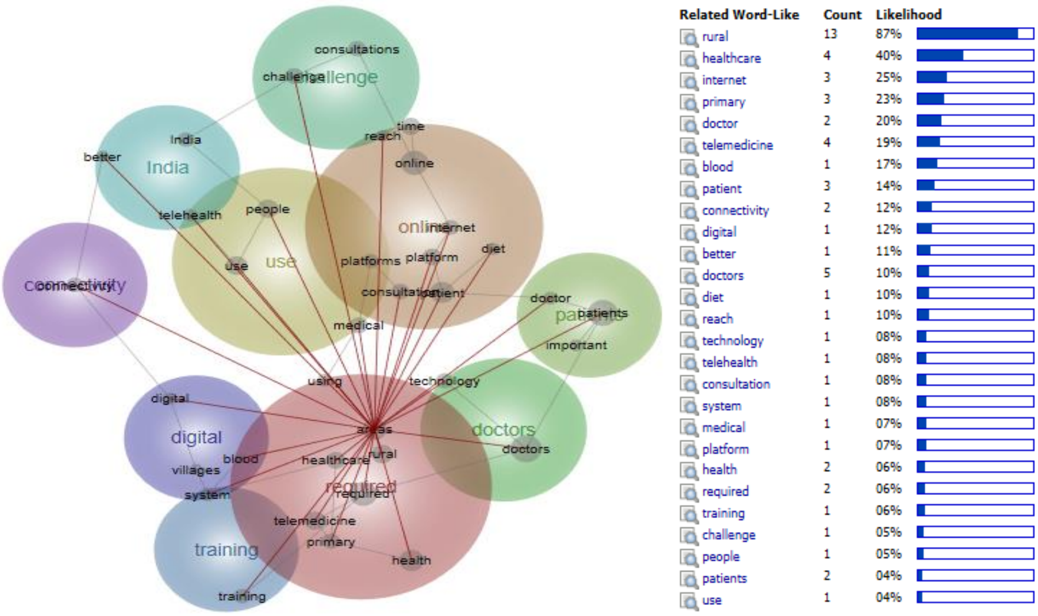
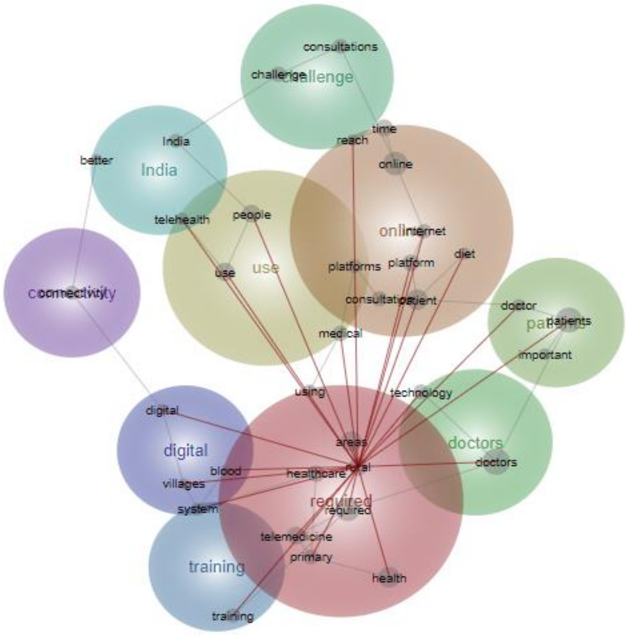



*Figure 23 Conceptual Structure of the concept "areas"*

Further to this, the concept of “areas” comprises management of non-communicable and chronic diseases through the usage of mobile phones linking it to a robust telehealth platform. The idea also relates to the requirement of good ICT infrastructure and connectivity in rural and remote areas. The idea is to connect rural and remote area patients to healthcare professionals by connecting their mobile phones to the telehealth platform. This would allow patients to have an initial consultation with their healthcare providers regarding advising, investigations and follow-up. In case of emergencies, there can be urgent arrangements for referrals to district hospitals. Further, the concept of “rural” within the theme “required” strongly relates to the ideas present within the concept “areas.” The needs of those in rural areas, in particular, are expressed in the following interview sample:

> *“rural area person can get in touch with a mobile phone. It depends on the remote area telecommunications … very good platform.”* (Interview 4)

The concept of “rural” strongly associates with the same concepts of “areas.” Thus, while the concept of “areas” encompasses the perceived adoption factors of telehealth in both the urban and rural areas, the concept of "rural" further stressed the perceived factors of telehealth adoption in the rural areas of India. The shortage of HCPs in rural areas and the need for trained health workers are also related concepts connected with the concept of "rural."

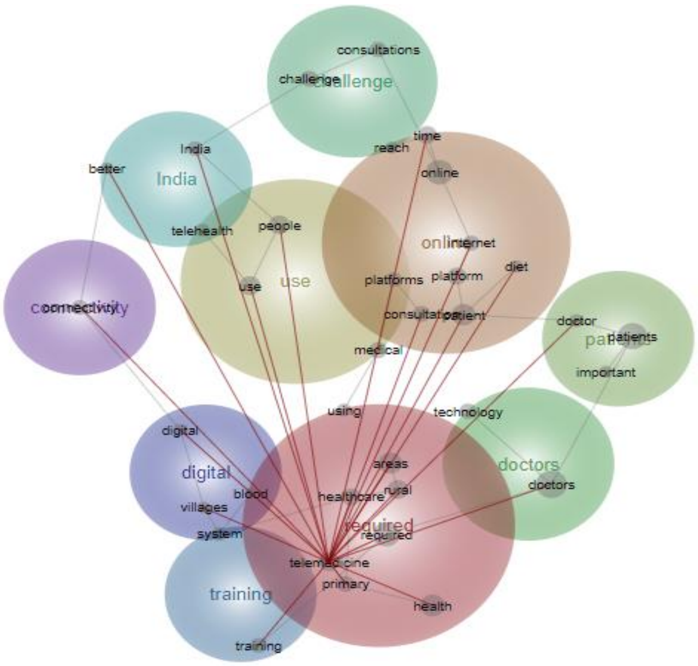



| Related Word-Like | Count | Likelihood |
|---|---|---|
| areas | 13 | 72% |
| healthcare | 4 | 40% |
| primary | 4 | 31% |
| internet | 3 | 25% |
| telemedicine | 4 | 19% |
| blood | 1 | 17% |
| villages | 1 | 14% |
| digital | 1 | 12% |
| doctor | 1 | 10% |
| diet | 1 | 10% |
| reach | 1 | 10% |
| patient | 2 | 10% |
| technology | 1 | 08% |
| telehealth | 1 | 08% |
| system | 1 | 08% |
| medical | 1 | 07% |
| platform | 1 | 07% |
| doctors | 3 | 06% |
| training | 1 | 06% |
| people | 1 | 05% |
| patients | 2 | 04% |
| use | 1 | 04% |
| health | 1 | 03% |
| required | 1 | 03% |

*Figure 24 Conceptual structure of the concept "rural"*

The healthcare needs of the population in rural areas of India, which have minimum access to healthcare facilities, present very real challenges to the healthcare system. This is viewed as a perceived motivational factor to adopt telehealth by the HCPs.

The concept of "telemedicine" within the theme "required" connects with concepts of various other themes and primarily generates the ideas of setting up of telemedicine hubs and staff training in telemedicine units. The concept also strongly associates itself with the organisational revenue model of providing telehealth services and also the salary model for the HCPs. The revenue model of telehealth services and the expectations of the HCPs for further stabilising their income, are among the perceived barriers for telehealth adoption as found in this subjective analysis.




| Related Word-Like | Count | Likelihood |
|---|---|---|
| healthcare | 3 | 30% |
| villages | 2 | 29% |
| rural | 4 | 27% |
| primary | 3 | 23% |
| areas | 4 | 22% |
| health | 5 | 16% |
| required | 5 | 14% |
| digital | 1 | 12% |
| better | 1 | 11% |
| training | 2 | 11% |
| doctors | 5 | 10% |
| doctor | 1 | 10% |
| diet | 1 | 10% |
| patient | 2 | 10% |
| people | 2 | 09% |
| internet | 1 | 08% |
| use | 2 | 08% |
| consultation | 1 | 08% |
| connectivity | 1 | 06% |
| time | 1 | 05% |

***Figure 25 Conceptual structure of the concept of "telemedicine"***

The concept of "healthcare" within the theme "required" conceptualises the willingness of the HCPs to share knowledge using telehealth, the ease-of-use and usefulness of telehealth, as well as viewing telehealth adoption as an alternative solution to assist current healthcare. The view of telehealth as an alternative solution to assist healthcare in India is evident from the interview sample:

> *"If the health system is well then the technological tool will help. Telehealth cannot replace the normal healthcare system but if good health system is in place then it can assist in the outcome"* (Interview 10)

The concept has placed emphasis on where telehealth can assist the normal healthcare system in terms of providing consultative or advisory healthcare services to rural and remote areas and during natural disasters and emergencies. The concept of "healthcare" also connects to the idea of ease-of-use of telehealth. The tech-savvy HCPs are willing to adopt telehealth for knowledge sharing as well as consultation, advisory purposes, follow-up and monitoring, provided there is adequate additional earning potential, standardised policies and reliable ICT infrastructure. The concept implies the usefulness of telehealth adoption for saving time and distance both for the

HCPs and the patients. Additionally, busy schedules of the HCPs and the patients can be managed efficiently. This can also lead to reducing patient loads in clinics and hospital OPDs for initial appointments, follow-up and monitoring.

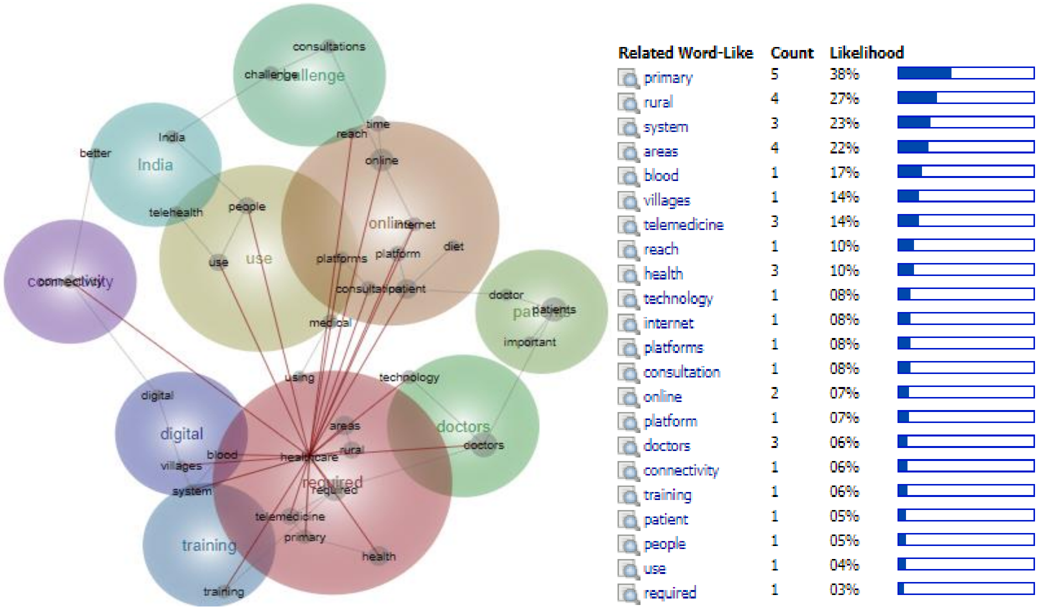
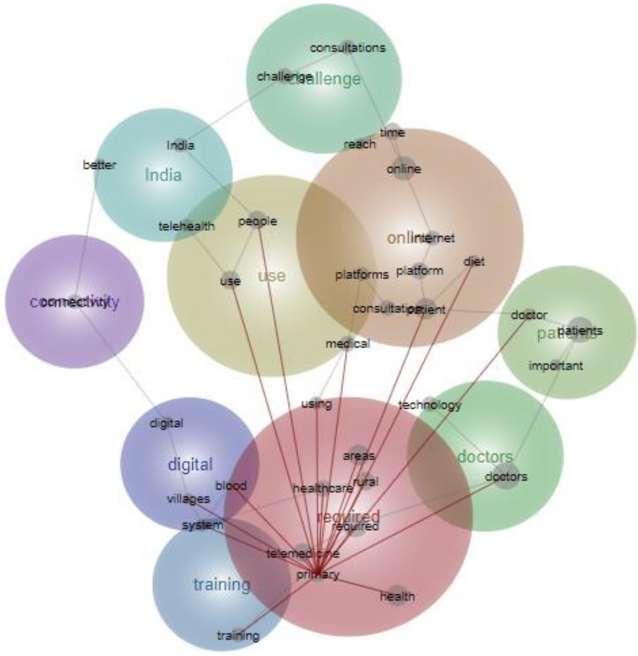



*Figure 26 Conceptual structure of the concept "healthcare"*

The concept of "primary" within the theme "required" connects with specific requirements in the primary health sector in India. The requirement of computers in primary healthcare centres, and the training of the associated staff, is the focus of this concept. The requirement of computers becomes evident with the following interview sample:

> *"More computers should be made available at primary health centres. Audio messages can be sent to those without smart phones, video messages can be sent to those with smart phones."*
>
> (Interview 3)

The concept next associates itself with the training of primary healthcare workers in using telehealth technology, as well as raising the awareness of patients about health, wellness and the facilities available through telehealth. Raising the awareness of patients relates to health education. This is not just limited to awareness about diseases and their prevention, but also focusses on matters of hygiene and diet for a healthy lifestyle.



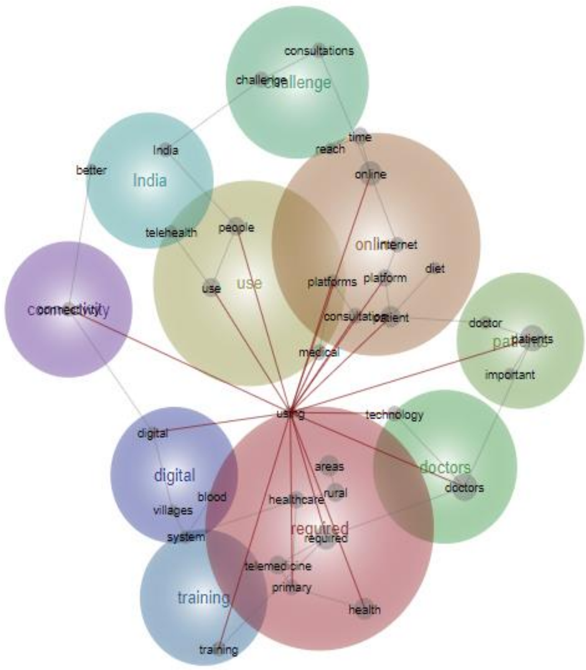

| Related Word-Like | Count | Likelihood |
|---|---|---|
| healthcare | 5 | 50% |
| rural | 4 | 27% |
| using | 2 | 25% |
| health | 6 | 19% |
| blood | 1 | 17% |
| areas | 3 | 17% |
| system | 2 | 15% |
| villages | 1 | 14% |
| telemedicine | 3 | 14% |
| doctor | 1 | 10% |
| diet | 1 | 10% |
| people | 2 | 09% |
| medical | 1 | 07% |
| training | 1 | 06% |
| patient | 1 | 05% |
| use | 1 | 04% |
| required | 1 | 03% |
| doctors | 1 | 02% |

*Figure 27 Conceptual structure of the concept "primary"*

The concept of "using" within the theme "required" relates to connectivity issues, creating easy-to-use online telehealth platforms and using the electronic medium for providing emergency services. The concept of "using" is evident from a sample of the interviews as follows:

> *"The government is taking up for emergency services where they can send paramedics who can contact the doctors using some electronic medium.*" (Interview 12)

The usage of electronic medium is directly connected with the quality of connection regarding video and voice services. The urban ICT infrastructure, in terms of connectivity, is more well placed than in the rural and remote areas of India, which creates a perceived barrier in adopting telehealth by the HCPs.




| Related Word-Like | Count | Likelihood |
|---|---|---|
| platforms | 2 | 17% |
| primary | 2 | 15% |
| medical | 2 | 14% |
| digital | 1 | 12% |
| patient | 2 | 10% |
| technology | 1 | 08% |
| use | 2 | 08% |
| consultation | 1 | 08% |
| platform | 1 | 07% |
| health | 2 | 06% |
| connectivity | 1 | 06% |
| training | 1 | 06% |
| people | 1 | 05% |
| online | 1 | 03% |
| required | 1 | 03% |
| doctors | 1 | 02% |
| patients | 1 | 02% |

*Figure 28 Conceptual structure of the concept "using"*

The theme "required" summates the concepts within it by focussing on the requirement of practical organisational policies, safeguarding of data, tech-savvy doctors, shortage of doctors, requirement for health workers' training sessions, robust system requirements, upgradation of HCPs and promotion of health awareness. Nonetheless, the underlying perceived barriers to adopt telehealth include insufficient rural area ICT infrastructure and connectivity, shortage of tech-savvy doctors, lack of an organisational revenue model, lack of a revenue model for HCPs to adopt telehealth and lack of standardised practices to safeguard patient data. Furthermore, the shortage of doctors, health workers training sessions through telehealth, initial consultation, patient follow-up and monitoring, promotion of health education and awareness are highlighted as the perceived drivers for telehealth adoption in India. In addition, the willingness to share knowledge using telehealth, usefulness and ease-of-use, telehealth as an alternative assisting solution and use of telehealth for providing healthcare support during emergencies (such as natural disasters) are also conceptualised as the perceived drivers of telehealth.

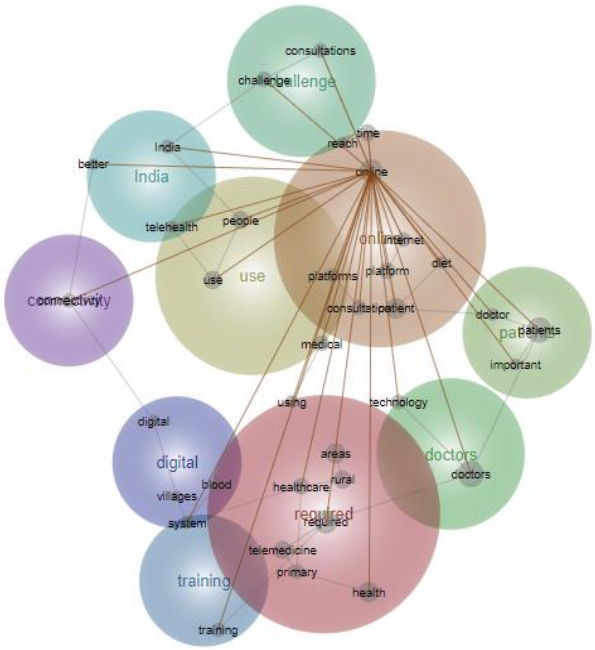
**2. Online**

The theme "online" is significant, connecting the concepts of online, patient, time, platform, medical, consultation, internet, platforms, and diet. The concepts relate to the adoption of online consultations for the benefit of both the HCPs and patients. The concept also encompasses the challenges of online interactions between the HCPs and patients.

The concept of "online" within the theme "online" implies the adoption of online consultations by the HCPs for several reasons. Urban HCPs have adopted online consultations, especially for the review and follow-up of patients. The robust ICT infrastructure in urban areas, including good connectivity, is also another reason for adoption. Further, and where possible, the rural area patients can avail themselves of an initial consultation or referral by the use of online medium to contact HCPs. Additionally, the concept is also related to the development of patient awareness which is evident from the following interview excerpt:

> *"there is awareness among the consumers how the dietitian works … when the clients come for wellness as well as therapeutics I try to educate them … is where the online platforms come to play … "* (Interview 8)

Thus, the perception of the Indian HCPs using the online medium to develop awareness about health is another area where the concept of "online" connects with patients, consultations and awareness, along with the connectivity requirements to adopt such a practice.



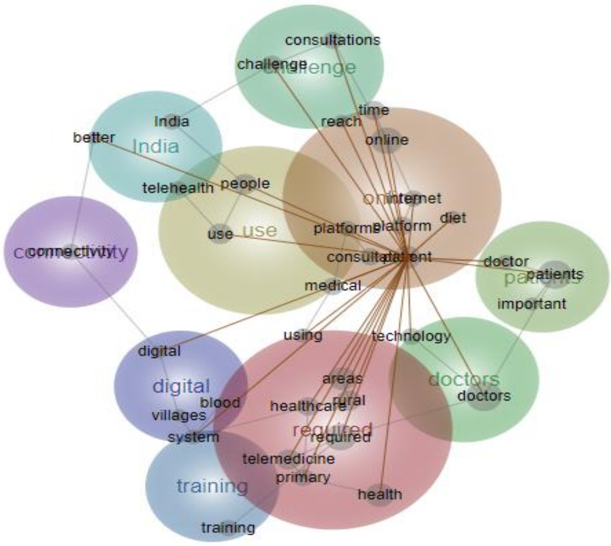

| Related Word-Like | Count | Likelihood |
|---|---|---|
| consultations | 10 | 56% |
| platforms | 5 | 42% |
| consultation | 5 | 38% |
| platform | 5 | 33% |
| internet | 3 | 25% |
| patient | 5 | 24% |
| healthcare | 2 | 20% |
| challenge | 4 | 20% |
| diet | 2 | 20% |
| telehealth | 2 | 17% |
| time | 3 | 15% |
| patients | 7 | 14% |
| medical | 2 | 14% |
| people | 3 | 14% |
| using | 1 | 12% |
| important | 1 | 11% |
| better | 1 | 11% |
| doctor | 1 | 10% |
| technology | 1 | 08% |
| system | 1 | 08% |
| doctors | 3 | 06% |
| connectivity | 1 | 06% |
| required | 2 | 06% |
| training | 1 | 06% |
| use | 1 | 04% |
| health | 1 | 03% |

***Figure 29 Conceptual structure of the concept "online"***

The concept of "patient" within the theme online implies challenges in patient-HCP online interaction, the condition of the patient and the method and time allotted for such interaction.

> *"discussed and put in place ... everybody should understand ... both parties have to tackle the challenges in an online system ... should be made for patient as well as practitioner requirement"*
>
> (Interview 7)

This concept delves deeper into the patient-HCP relationship whereby the co-operation of both patients and HCPs are necessary for the successful adoption of telehealth by the Indian HCPs.

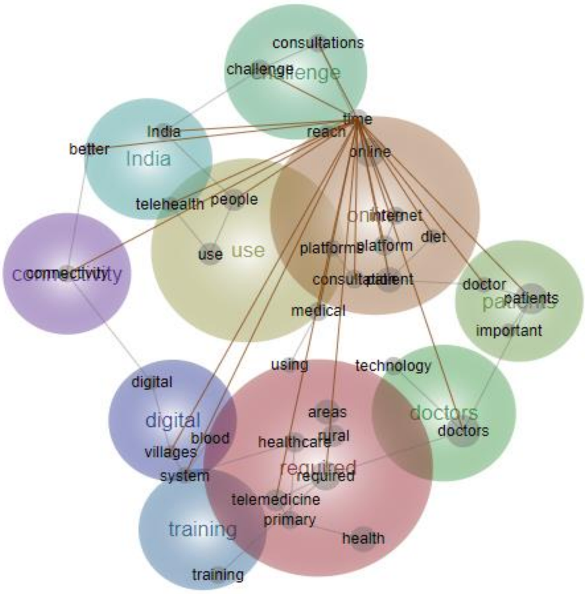



| Related Word-Like | Count | Likelihood |
|---|---|---|
| doctor | 5 | 50% |
| consultation | 4 | 31% |
| time | 5 | 25% |
| using | 2 | 25% |
| online | 5 | 17% |
| areas | 3 | 17% |
| technology | 2 | 17% |
| challenge | 3 | 15% |
| medical | 2 | 14% |
| rural | 2 | 13% |
| platform | 2 | 13% |
| digital | 1 | 12% |
| better | 1 | 11% |
| healthcare | 1 | 10% |
| diet | 1 | 10% |
| reach | 1 | 10% |
| telemedicine | 2 | 10% |
| doctors | 4 | 08% |
| required | 3 | 08% |
| internet | 1 | 08% |
| patients | 4 | 08% |
| use | 2 | 08% |
| primary | 1 | 08% |
| system | 1 | 08% |

*Figure 30 Conceptual structure of the concept "patient"*

The concept of "time" within the theme "online" relates to overcoming the barriers of time and distance through adoption of telehealth. The perception of saving time for both the patient and HCP, as well as, reducing the travel distance required for both the HCP and patients, is significant. The concept also connects strongly with concepts within other themes such as patients, reach, consultations and villages. This denotes that saving time and distance extends benefits to the patients in rural areas with the possibility of an initial consultation without long distance travel. The following interview excerpt is a sample which underlies the concept of "time" within the theme "online":

> *"It saves the time of patients and appointments, although there are loopholes. It has improved but not up to the mark yet."* (Interview 5)

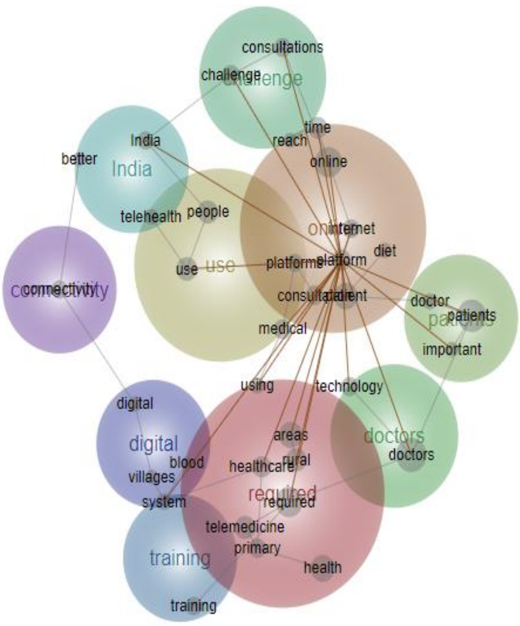



| Related Word-Like | Count | Likelihood |
|---|---|---|
| patient | 5 | 24% |
| reach | 2 | 20% |
| consultations | 3 | 17% |
| consultation | 2 | 15% |
| villages | 1 | 14% |
| people | 3 | 14% |
| platform | 2 | 13% |
| better | 1 | 11% |
| online | 3 | 10% |
| challenge | 2 | 10% |
| doctor | 1 | 10% |
| diet | 1 | 10% |
| internet | 1 | 08% |
| telehealth | 1 | 08% |
| patients | 4 | 08% |
| system | 1 | 08% |
| medical | 1 | 07% |
| doctors | 3 | 06% |
| connectivity | 1 | 06% |
| telemedicine | 1 | 05% |
| required | 1 | 03% |

*Figure 31 Conceptual structure of the concept "time"*

The concept of "platform" and "platforms" within the theme "online" relates to the online platforms and applications which are currently being used in telehealth by the Indian HCPs. It also relates to the requirement of upgraded technology to enable better consultation capabilities. The concept of an efficient system is visible within the concept. The concept also strongly connects with the concepts of online, consultation, internet, system and medical, which implies the availability of specialised platforms can be perceived as a motivator for the HCPs to adopt telehealth.

> *"A specialised platform is required where the pictures zoom larger than life and somewhere the connect feel in the virtual mode should be easier."* (Interview 8 )



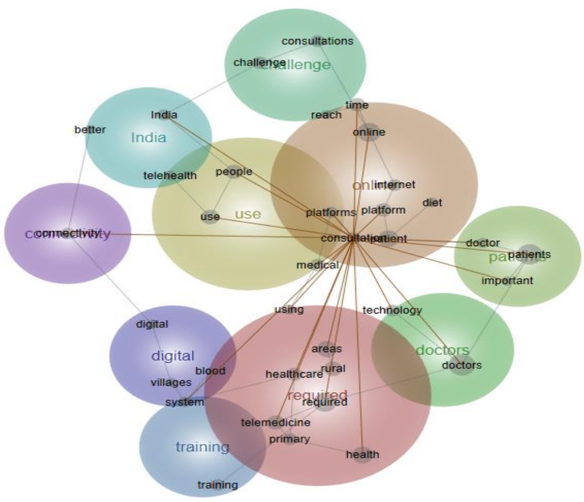

| Related Name-Like | Count | Likelihood |
|---|---|---|
| *India* | 1 | 06% |

| Related Word-Like | Count | Likelihood |
|---|---|---|
| online | 5 | 17% |
| internet | 2 | 17% |
| consultation | 2 | 15% |
| system | 2 | 15% |
| medical | 2 | 14% |
| using | 1 | 12% |
| use | 3 | 12% |
| consultations | 2 | 11% |
| important | 1 | 11% |
| time | 2 | 10% |
| healthcare | 1 | 10% |
| patient | 2 | 10% |
| required | 3 | 08% |
| technology | 1 | 08% |
| platforms | 1 | 08% |
| patients | 4 | 08% |
| rural | 1 | 07% |
| doctors | 3 | 06% |
| areas | 1 | 06% |
| challenge | 1 | 05% |

*Figure 32 Conceptual structure of the concept "platform"*

The concept of "consultation" embodies the perceptions of Indian HCPs who expressed opinions on the available opportunities of providing overseas consultations.

> *"The opportunities are unlimited. Consultation can be done across the world ... sitting in India consultation can be done people whichever country they reside."* (Interview 11)

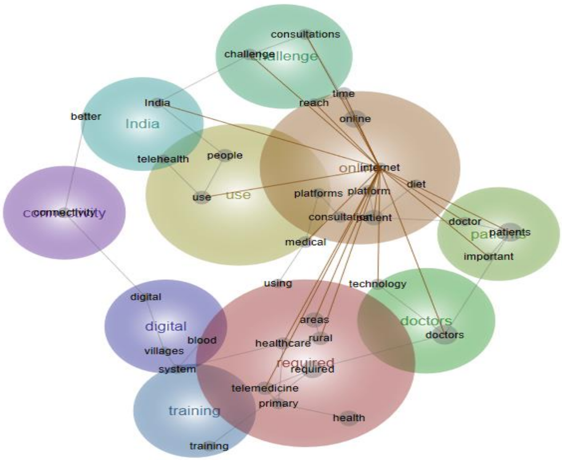



| Related Word-Like | Count | Likelihood |
|---|---|---|
| patient | 4 | 19% |
| online | 5 | 17% |
| technology | 2 | 17% |
| platform | 2 | 13% |
| using | 1 | 12% |
| important | 1 | 11% |
| time | 2 | 10% |
| healthcare | 1 | 10% |
| doctor | 1 | 10% |
| people | 2 | 09% |
| platforms | 1 | 08% |
| system | 1 | 08% |
| medical | 1 | 07% |
| connectivity | 1 | 06% |
| required | 2 | 06% |
| areas | 1 | 06% |
| telemedicine | 1 | 05% |
| doctors | 2 | 04% |
| use | 1 | 04% |
| health | 1 | 03% |
| patients | 1 | 02% |

*Figure 33 Conceptual structure of the concept "consultation"*

This concept also links with India, connectivity, time, online, health, telemedicine, system and rural within other themes. This further suggests that to realise the benefit of time-saving, telehealth consultation depends on the availability and quality of connectivity and requires a robust online platform. Thus, consultation through online medium is not limited to domestic consultation in rural areas but can extend to overseas consultation as well, providing the required healthcare system and infrastructure is present.

The next concept within the theme "online" is "internet" which depicts the inherent lack of high-speed and reliable broadband services, especially in the rural and remote areas, as a barrier to providing online consultations.




| Related Name-Like | Count | Likelihood |
|---|---|---|
| India | 1 | 06% |

| Related Word-Like | Count | Likelihood |
|---|---|---|
| rural | 3 | 20% |
| areas | 3 | 17% |
| technology | 2 | 17% |
| platform | 2 | 13% |
| consultations | 2 | 11% |
| important | 1 | 11% |
| online | 3 | 10% |
| reach | 1 | 10% |
| healthcare | 1 | 10% |
| challenge | 2 | 10% |
| doctor | 1 | 10% |
| use | 2 | 08% |
| medical | 1 | 07% |
| patients | 3 | 06% |
| time | 1 | 05% |
| patient | 1 | 05% |
| telemedicine | 1 | 05% |
| doctors | 1 | 02% |

*Figure 34 Conceptual structure of the concept "internet"*

The "internet" concept also strongly connects with other concepts such as consultations, doctors, patients, challenges, rural and telemedicine and demonstrates the interconnectedness and interdependent nature of the concepts.

> *"It is still a huge challenge. The use of internet is very high in India and we still do not have that bandwidth to cope up with the huge demand."* (Interview 11)

The concept mainly highlights the healthcare user demand of internet in India and the challenges faced in the doctor-patient interaction. This reflects the limitations to full exploitation of the technology, due to infrastructural deficiencies, especially in the rural and remote areas of India.

The next concept within the theme “online” is “diet” which focusses on online nutritional counselling and its inherent challenges.

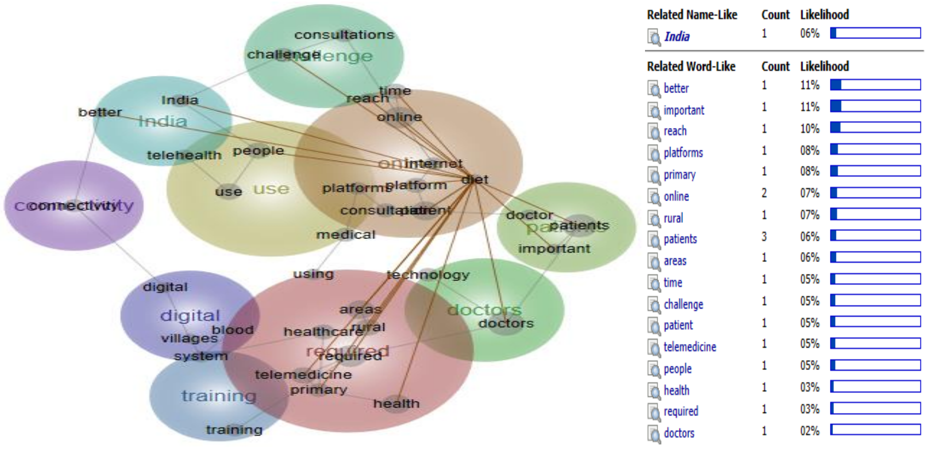



***Figure 35 Conceptual structure of the concept “diet”***

The concept “diet” connects with other concepts such as “challenge”, “online”, “health”, “doctors”, and “patients” within several themes. The challenges presented by varied diets consumed in India, coupled with language barriers, are reflected in the following interview excerpt

> *“Diets are diverse in India … there is no standardisation … clients come from Maharashtra, South India, North India … it is difficult to make clients understand the portions of diet, intakes, and all that … so counselling technique is a challenge”* (Interview 8)

The focus on counselling techniques, while using online counselling, is evident. Though there are challenges in counselling techniques, as well as technological barriers, the advantage of online counselling is evident, especially in the areas of creating patient awareness and education relating to nutrition. Furthermore, once diagnosed with health-related problems, patients are not required to visit the clinic for nutritional guidance if it can be provided online.

The theme of “online” primarily summarizes the challenges faced by the healthcare professionals in online interaction with the patients. The adoption of online consultations have added an advantage both to the HCPs and patients in terms of saving time and distance. However, inherent challenges, relating to insufficient online platforms and varied requirements within diet counselling, need to be tackled for adoption of online consultations and telehealth.

By manually analysing the generated concepts of the two most significant themes of “online” and “required”, the primary perceived determinants of telehealth adoption were determined, as discussed in the earlier section. These two themes focussed on the relevance of healthcare practices, shortage of healthcare facilities, policies, training and health awareness as significant perceived determinants. The themes also highlighted the lack of sufficient ICT infrastructure, especially in the rural and remote areas, connectivity challenges and lack of standardised practices as perceived barriers in the adoption process of telehealth in India.

The other themes generated by Leximancer, are “use”, “patients”, “doctors”, “challenge”, “India”, “training”, “digital” and “connectivity”. These concepts overlap with the significant themes of “online” and “required” discussed earlier. Further to this, the analysis explored the indirect relationship between the concepts, with a knowledge pathway which extended from “required” to “consultations”. This showed the most likely path between the two, intertwining the concepts of “doctors”, “patients”, and “online” in between. Finally, exploration into the interview excerpts reveals that the pathway depicts the perceived challenges or perceived barriers of adoption of telehealth from the initial requirements to the end-point of consultation.

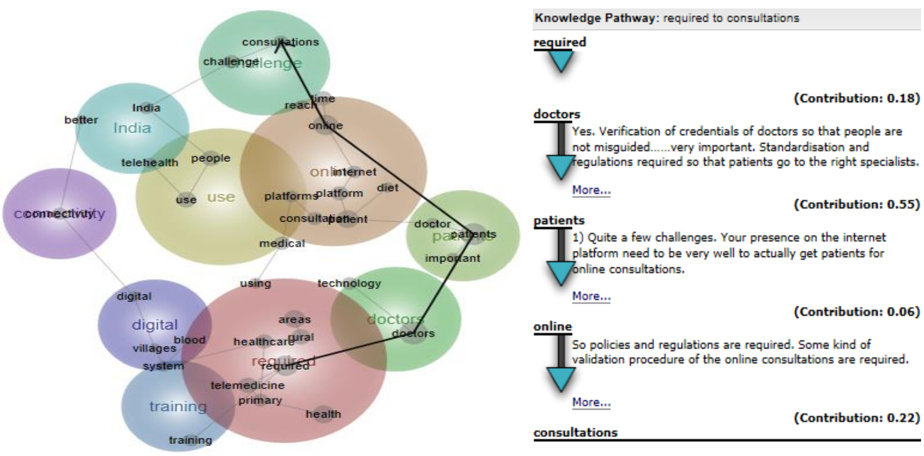



*Figure 36 Knowledge pathway from the concept of “required” to “consultations”*

Thus, while Leximancer generated concepts mostly focussed on the perceived determinants of telehealth adoption, the knowledge pathway focussed on the roadmap of adoption challenges of telehealth from technological issues to regulatory issues.

The themes generated from the manual analysis and the Leximancer-automated analysis revolved around the same concepts and, as such, a priori codes could be generated combining the two methods of analysis. The a priori codes could be used later on for an extensive analysis with NVivo software which combines the codes to categorize and summarize the coded results in an easy manner (Sotiriadou et al., 2014). The next section Chapter 5C will discuss the NVivo analysis of qualitative data.

## Chapter 5C: NVivo Coding

### 5C.1 Introduction

The researcher conducted an analysis using a priori codes from the preliminary conceptual framework developed earlier by an extant literature review. Further, the earlier qualitative methods (manual coding and Leximancer coding) generated codes were also taken into consideration. The a priori codes served as a guide and a posteriori coding was also involved to accommodate new factors and themes. Thus, deductive and inductive logic were both followed to hypothesise the perceived drivers and barriers of telehealth adoption in Indian healthcare. Additionally, the themes were analysed at the micro (individual), meso (technical and organisational) and the macro levels (national culture and policies) adapted from the socioecological framework (Bronfenbrenner, 1992; Sallis et al., 2015). Furthermore, the meso and macro levels are the contextual perceived factors influencing the telehealth adoption process (Ly et al., 2017). The themes and the concepts are presented in Table 8.

***Table 8 The final NVivo12Pro coding tree depicting the emergent themes along with the factors***

**Table 8**

**Coding Tree NVivo**

| **Perceived driver themes with concepts** | **Perceived barrier themes with concepts** |
|---|---|
| **1. Healthcare Practices (Meso level)** | **1. Technology Inhibitors (Meso level)** |
| Initial Diagnosis | Connectivity |
| Treatment | Bandwidth |
| Follow-up (Monitoring, Counselling, Rehabilitation) | Upgraded technological requirements |
| Referral | Ethics |

| | |
|---|---|
| **2. Patient Awareness (Meso level)** | **2. Organisational Issues (Meso level)** |
| Patient health education | Shortage of health workers |
| Prevention of diseases | Reluctance |
| Promotion of healthy diets | Late adopters |
| Self-management of diseases | Shortage of doctors/HCPs |
| Improved health outcomes | Revenue model |
| | Doctors’ salary |
| **3. Usefulness (Micro level)** | **3. State Leadership (Macro level)** |
| Ease of use | Impractical Govt. policy |
| Behavioural Intention | Lack of standardisation |
| Behavioural Attitude | Cost of implementing |
| | Standard revenue model |
| **4. Healthcare Facilities (Meso level)** | |
| Access | **4. Communication Issues (Micro level)** |
| Remote areas | Preference of face-to-face interaction |
| Rural areas | Reluctance to provide online advice |
| | HCP risk of misleading information |
| **5. HCP Awareness (Meso level)** | |
| Medical education and training | |
| Collaboration on knowledge sharing | |
| Expert opinion | |
| **6. Technology Motivators (Meso level)** | |
| Good connectivity in urban areas | |
| Robust telecommunications | |
| Alternative solution | |
| **7. Competitiveness (Meso level)** | |
| Economical | |
| Time-saving | |
| Distance saving | |
| Global reach | |
| Allied health services | |

The researcher conceived a word cloud (Figure 37) from the NVivo12Pro, using the interview transcripts, which automatically categorised the most common concepts and ideas within the transcripts. Further to this, text-search queries of the clustered concepts and ideas, generated through the software, helped in forming the emergent codes and the final themes.


*Figure 37 Word Cloud generated from the interview transcripts with NVivo12Pro*

Finally, seven themes emerged as the perceived drivers and four themes emerged as the perceived barriers of telehealth adoption by the participant Indian HCPs. The final themes generated through *NVivo12Pro* are discussed below.

### 5C.2 Critical emergent themes from NVivo12Pro CAQDAS thematic analysis

#### 1 Healthcare Practices

The study identified four healthcare practice factors that have the perceived potential to influence the adoption of telehealth in the Indian healthcare domain (Table 8).

Most of the healthcare professionals (99%) mentioned the concept of initial diagnosis as a perceived influence to adopt telehealth in their regular practice schedule. The attitude regarding diagnosis using telehealth, though, varies among the HCPs. The *NVivo12Pro* coding process identified the various approaches to diagnosis by different HCPs. This factor can significantly motivate the HCPs to use telehealth. Some HCPs consider the factor as a means of initial approach by a patient to the HCP. The patients may send their reports and mention their problems to the HCPs. The HCPs can see the reports, make an initial diagnosis of the problem and, once this is done, the first appointment can be scheduled. The phenomena can be observed from the following interview excerpts:

> *'Lot of my practice depends on messaging through whatsapp, seeing reports, advising them, seeing pictures of patients. Quite an essential part of my practice."* (Interview 4)

Again, the HCPs preference for face-to-face interaction was also noted in contrast with the motivation.

> *"The doctors can see the image for diagnosis ... we then talk over the phone with the doctors for management and treatment ... Face-to-face doctor-patient interaction is better."* (Interview 12)

Further, initial diagnosis can be a measure of prevention of diseases, making patients aware of their health conditions and to take preventive measures. Reports of blood glucose levels, blood pressure, etc., can be sent over online media to the HCPs to have an initial assessment. Additionally, wellness measures can be advised and patient awareness can be developed, regarding prevention of certain diseases. This is supported by Interview 10:

> "We also use telehealth for blood sugar monitoring, cervical, mother's contraction. If there any problem one supervisor can monitor it."

This was also earlier mentioned by Interview 1 amongst others:

> *"Communication is about primary prevention ... diet, nutrition, exercise, healthy lifestyle. Regarding secondary prevention ... lifestyle changer ... not only medicine ... pictorials, multimedia, films ... on TV/Computer. Films can be send over internet."*

As such, prevention is found as a latent theme within the data and a perceived driver for adoption of online consulting and telehealth services by the participant HCPs.

Several HCPs (approx. 83%) agreed upon treatment as a perceived driving factor for them to use telehealth. Usually, in the telehealth environment, the HCP observes the patient with the help of examining cameras, assesses the problems, prescribes the required diagnostic reports, and there-after, during follow-up, prescribes medicines. A typical interview excerpt was:

> *"All patients are examined by the doctors. Entry of records is done by the health workers there. Software captures all the data – diseases, required examinations. Then the doctors prescribes medicine."* (Interview 1)

Interview 2 supported the statement:

> *"So the purpose is to screen patients, treat patients, diagnosis of cancer, or refer for cancer, to identify diseases."* (Interview 2)

The following Figures 38 and 39 show the text search query results for diagnosis and treatment, respectively, in *NVivo12Pro:*

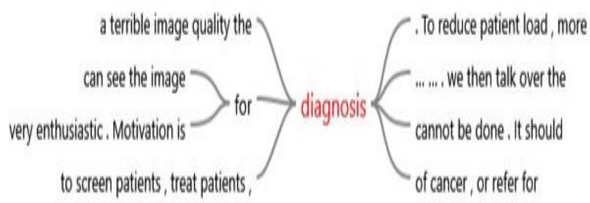



***Figure 38 NVivo12Pro text search query for diagnosis***

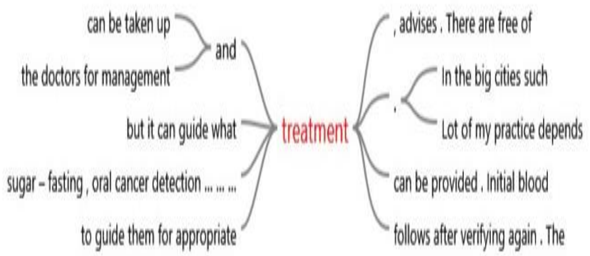



***Figure 39 NVivo12Pro text search query for treatment***

Follow-up of patients (approx. 95%) utilising telehealth services or online medium emerged as another significant perceived driver for the adoption of telehealth or online consulting for the participant HCPs in India. From post initial assessment to final diagnosis and treatment or post-surgery, when medicines are prescribed, and regular follow-up is essential, the use of online media or telehealth services present a convenient solution for both the HCPs and the patient. This perceived factor saves time for both the HCPs and patients on one hand and on the other hand removes the need to travel long distances to report to the HCPs. As such, there is a direct relationship of electronic follow-up to reducing time and distance. This phenomenon is evident with the following sample of interview excerpts:

> *"Patients are advised what to do and what not to do. Follow-up takes place. This is the basic service we provide."* (Interview 1)

Supported by:

> *"Consultation online is given only for review patients. Either through e mail or Whatsapp. Sometime patients queries are answered through phone."* (Interview 9)

Further, the latent themes of monitoring, counselling, and rehabilitation are found to be related to the theme of follow-up. Monitoring of patients after the mandatory follow-up period can be done without difficulty both for the HCPs and the patient. Counselling for diet and lifestyle change can be provided, as well as rehabilitation services for improved outcomes for patients. This is supported by several participant HCPs and the following interview excerpt is a sample of a typical statement on the topic.

> *"Easier reach out to parents, details login for the clients, support from somebody for the parents … neurological children parents are diligent, progress in the change in diet, close monitoring. Diligence from both ends improve outcomes in diet, psychology … these are the motivations."* (Interview 8)

The text search query in *NVivo12Pro* returned the following results which helped the researcher to code the emergent perceived factors of monitoring, counselling and rehabilitation into the broad theme of follow-up.

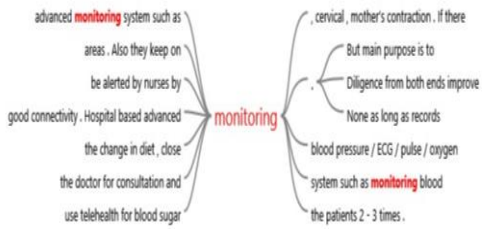



***Figure 40 NVivo12Pro text search query for monitoring***

Patient referral services emerged as a latent theme of telehealth adoption by participant Indian HCPs. Referral services depend upon the patient's condition, where it is not possible to be monitored through an online medium or in case of an emergency. In particular, patients from rural areas can be benefitted by way of quick referrals to district hospitals, irrespective of the disease being communicable or non-communicable. The rural areas in India experience a lack of healthcare facilities and a shortage of HCPs according to the participant HCPs. Adoption of telehealth by Indian HCPs may facilitate the referral services of rural patients in India. The following interview excerpts are samples of evidence:

> *"Cancer patients are referred to Vrindaban. So the purpose is to screen patients, treat patients, diagnosis of cancer, or refer for cancer, to identify diseases."* (Interview 2)

Also, agreed upon by Interview 5

> *"Our focus is on rural areas, non-communicable and chronic diseases. The first meeting comprises of complaints, advising and investigations. Second time follow up is after that and if necessary reference to urban hospitals is done."*

The researcher performed a text search query to get an overall estimation of the concepts related to the theme of healthcare practices and to match the coded themes and its related contents. The researcher inserted the word "consultations" as a frequently found word as per the word cloud tree map in *NVivo12Pro*. The results preview further established the reliability of the coding process and justification for the coded theme of healthcare practices. Some of the ideas generated through the text-search query overlapped with several themes, as well as perceived challenges which will be discussed subsequently.


*Figure 41  NVivo12Pro text search query for consultations*

The exploration of the interviews of the participant HCPs brought to the forefront several perceived factors analysed above. The perceived factors such as initial diagnosis and prevention, treatment, follow-up, monitoring, counselling and rehabilitation and referral services emerged from the *NVivo12Pro* coding process. These factors were perceived to have a potential influence on the adoption of telehealth or online media by the participant Indian HCPs. These perceived ideas and concepts are coded as the theme of healthcare practices and are grouped as a potential perceived driver for adoption of telehealth by Indian HCPs.

**2 Patient Awareness**

Patient health education and patient wellness are the two perceived factors which emerged from the thematic analysis. Several participant HCPs opined about developing awareness programs on patient health education and wellness. The factors were mentioned irrespective of the HCP operating in rural primary care centres or providing part of their services online while operating from an urban area. The problem of poverty and lack of awareness of health, amongst the broader Indian population, is well documented in published literature. The research study explored the participant HCPs' opinions on these factors and found this to be a perceived motivating factor for the adoption of telehealth or providing services through other online media. The promotion of lifestyle changes to develop mass wellness through online media was also stressed upon by most of the participant HCPs. These perceived factors can be evident from the following sample of interview excerpts.

*"Awareness required throughout India – North, East, South, and West. Health is not priority in India. Health spending required. Education in health required. Consciousness in remote areas required. In urban areas people are lazy to go to hospital/doctors/appointments. Follow up of diabetes can be done in urban areas. Awareness should be created in rural areas about privileges of telemedicine, follow up, benefits about your health"* (Interview 5)

Supported by Interview 6:

*"More awareness of the population regarding the privileges of using online platforms are required"* (Interview 6)

Also, agreed upon by Interview 8:

*"There are apps coming up to input their weight and health data and all … so now educating patients are important … rather than preparing diet charts … there is awareness among the consumers how the dietitian works … when the clients come for wellness as well as therapeutics I try to educate them … this is where the online platforms come to play"* (Interview 8)

A text search query was performed using the term "awareness" to find out the related concepts and ideas to establish the reliability and validity of the coded theme and its contents.

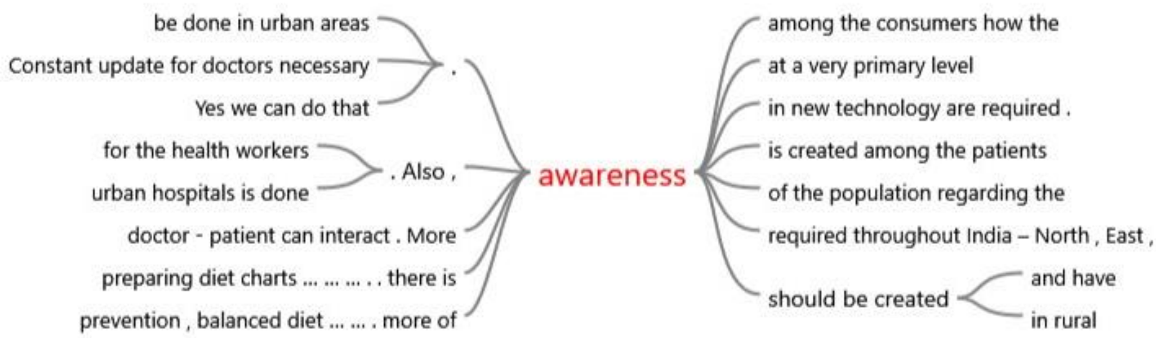



***Figure 42 NVivo12Pro text search query for awareness***

The above-mentioned perceived factors, which have the potential to influence the adoption of telehealth by the participant HCPs, are coded into a common theme of patient awareness. The perceptions of HCPs lead to combining the adult learning procedures with the capability building of adults, to manage their own health conditions using the telehealth and other online platforms, such as WhatsApp and other social media channels. The perception of the development of awareness in health of the general population may be hypothesised as a perceived motivating factor for the participant Indian HCPs.

### 3 Usefulness

The analysis and subsequent coding of the interviews with *NVivo12Pro* found that all but one of the participant HCPs agreed on the inherent perceived usefulness of telehealth, including telemedicine, as well as online consultations. Usefulness is related to the utility and functionality of telehealth as perceived by the Indian HCPs. A text search query generated the interconnected of the various concepts.

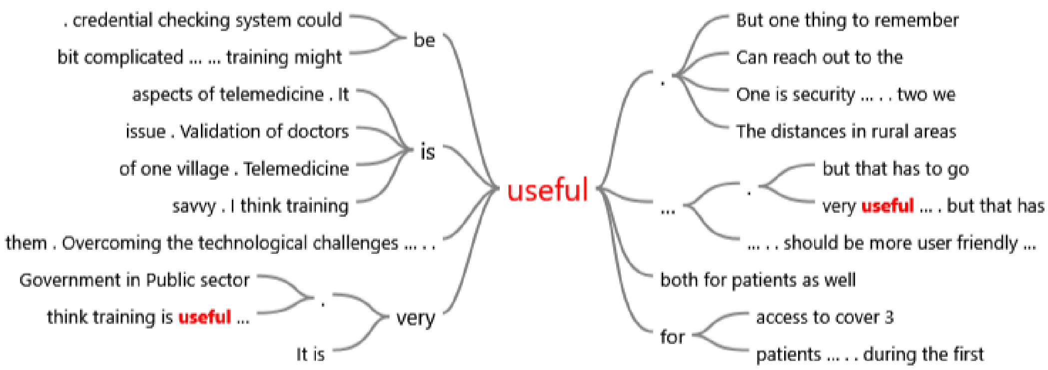



*Figure 43 NVivo12Pro text search query for usefulness*

### 4. Healthcare Facilities

The vast rural and remote areas of India are plagued by issues of accessibility to healthcare for patients and a shortage of healthcare professionals (Bodavala, 2002; Rathi, 2017). Further, the demographics and disease profile in urban and rural areas can be a significant driver for adoption of telehealth (West & Milio, 2004).

*"The distances in rural areas are huge and hardly doctors are available in rural areas. The disease burden is increasing day-by-day … telemedicine is useful for access to cover 3 villages at a time"* (Interview 1)

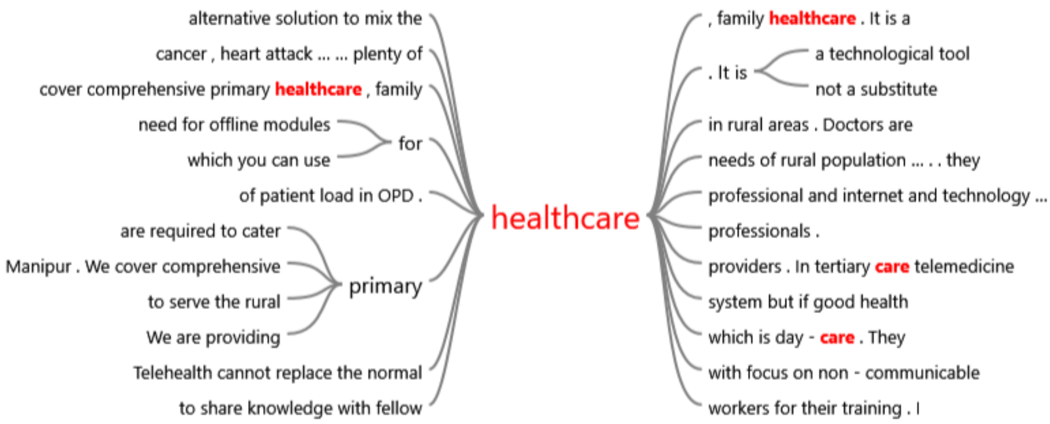



*Figure 44 NVivo12Pro text search query for healthcare facilities*

Current research investigating the cost effectiveness of telehealth programmes shows that telehealth can lessen the cost of healthcare services, thereby effecting affordable and accessible healthcare services (Torre-Díez et al., 2015). Thus, healthcare organisations can facilitate access to healthcare in rural and remote areas by adopting telehealth. The efficient use of telehealth can remove the prevailing health inequality in the Indian healthcare system. The data analysis of the current research revealed access to healthcare as a significant perceived driver to adopt telehealth.

**5. HCP Awareness**

This research identified several factors after examining the interviews through the lens of *NVivo 12 Pro*. The healthcare professionals' awareness levels, regarding the usage of telehealth services for access to information, is evident from the interview excerpts. The analysis did not judge the actual awareness levels of the healthcare professionals and the health care workers regarding telehealth but instead stressed the importance of the requirement of awareness of the healthcare professionals and workers.

> *"To fully explore the privileges of telemedicine training sessions are required for the doctors as well as for the health workers. Also, awareness in new technology are required."* (Interview 5)

Furthermore, the analysis revealed the need for education and training for healthcare professionals to raise their awareness levels regarding new technologies and their benefits and applications in providing efficient healthcare services.

*“Awareness should be created and have to teach people to use the same. Then it will be a great success.”* (Interview 3)

Further analysis revealed the need for awareness regarding telehealth application in collaboration with other healthcare professionals, which may facilitate soliciting HCP to HCP expert opinion. Moreover, this expert-opinion seeking may assist in addressing specific patient-level healthcare problems.

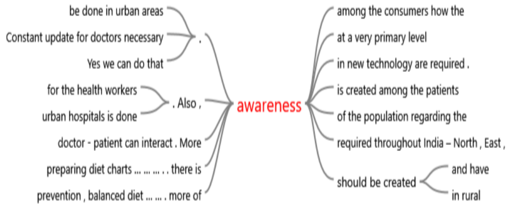



*Figure 45 NVivo12Pro text search query for hcp awareness*

## 6. Technology Motivators

The coding of interviews in *NVivo 12 Pro* revealed the evidence of technological appropriateness in healthcare in two ways. The healthcare professionals looked upon technology (in this research, telehealth) either positively, i.e., technology infrastructure is adequate and facilitates in providing healthcare services; or, the ICT infrastructure was deemed inadequate, which prohibits access or creates hindrance in providing healthcare services. This particular theme of technology motivators is based upon the positive side of technology infrastructure prevailing in India.

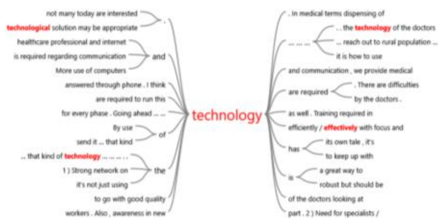



*Figure 46 NVivo12Pro text search query for technology motivators*

The ideas generated from the interview transcripts were high-speed broadband services which enable hassle-free telehealth services between HCP and patient. It was evident that the ICT infrastructure in the urban areas of India is robust and is a perceived motivator or enabler of telehealth services for the HCPs. A choice of several telehealth service platforms is available in India for providing telehealth services, and as such, this is a perceived enabler of telehealth for the HCPs.

> *"Technology is robust but should be implemented in a consistent manner over a vast area. The challenge is … human resources are required to run this technology efficiently/effectively with focus and institutional interest. Software/EMRs are good though differs from western countries … saves times for patients … need for improvement in software."* (Interview 1)

Other ideas include robust technology as a motivator to provide services to the rural and remote areas, to disabled or immobile persons and as a support system during natural disasters and emergencies.

**7. Competitiveness (Competitive Advantage)**

Another theme that cropped up while analysing the interview transcripts on *NVivo12Pro* is Competitiveness.

> *"It saves time and energy offcourse … it's very quick … and if you are well planned you can reach to more patients if you wish … these are the positives … and the negatives are the medical professional fees … as well as the advantages of face-to-face consultations. Advantage is it's quick, it's fast, it can save life, and in emergencies it definitely works."* (Interview 7)

In this research on telehealth adoption in India, competitiveness refers to the competitive advantage in using telehealth over face-to-face health consultations, albeit for a limited purpose. The advantage of telehealth lies in the time-saving and distance-saving capability of telehealth in the case of an initial enquiry, appointment scheduling and post-consultation follow-up.

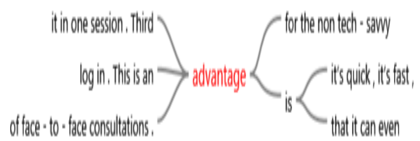



***Figure 47 NVivo12Pro text search query for competitiveness (competitive advantage)***

Also, there are inherent benefits for disabled or immobile persons to have a consultation with a health care professional without the need for travelling, at least at the post-treatment follow-up stage. The health care professionals can too save time and travelling distance for their follow-up visits to the patients.

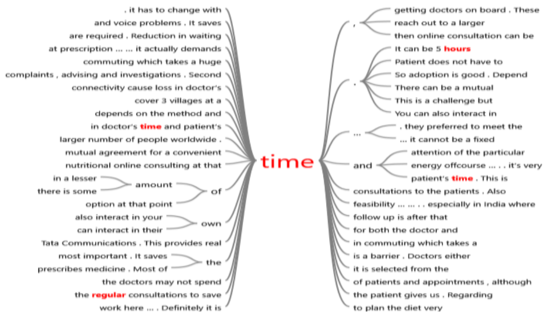



***Figure 48 NVivo12Pro text search query for time-saving***

Further to this, telehealth can cater to persons residing abroad, providing information to patients about the healthcare facilities available in India.

**8. Technology Inhibitors**

The technology inhibitors identified in this research relate to connectivity issues in rural and remote areas, indicated by limited ICT infrastructure, and identifies the scope of improvement needed to address this issue.

> *"It is still a huge challenge. The use of internet is very high in India and we still do not have that bandwidth to cope up with the huge demand. The signals becomes poor, the lines get cut, these technological problems we still face today."* (Interview11)

Further, the analysis reveals issues concerning data security and confidentiality of information. Additionally, the lack of ethical standards regarding technology usage in healthcare is another challenge that hinders telehealth adoption.

> *"As far as I can understand to have a non-breaching electronic medium is impossible ... but it should be secured ... the main challenge is who owns the data-government-corporates-individual doctor-that is the big issue. Validation of doctors is useful for patients ... during the first consultation ... credential checking system could be useful"* (Interview7)

The analysis reveals the inconvenience of using technology that is not upgraded and is not robust, hindering the adoption of telehealth by the HCPs.

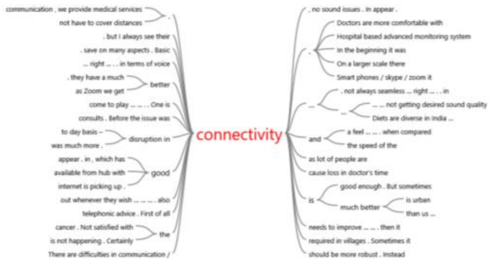



*Figure 49 NVivo12Pro text search query for connectivity*

Furthermore, reliable and consistent technical support is required to maintain an efficient ICT infrastructure. Adoption by HCPs may increase with the availability of online telehealth platforms that avoid the above-mentioned inconvenience associated with unreliability.

### 9. Organisational Issues

Organisational issues, which affect telehealth adoption by HCPs, are identified in this part of the research on telehealth adoption. The organisational issues vary from remuneration policy for the uptake of telehealth by HCPs to organisational and technical support services for telehealth.

> *"Organisation policy is required regarding communication and technology. In medical terms dispensing of medicines and conveying doctors' messages by the health workers are needed. There are need for specialists. To fully explore the privileges of telemedicine training sessions are required for the doctors as well as for the health workers. Also, awareness in new technology are required. There are difficulties in communication/connectivity."* (Interview 5)

Further, it is identified that a fundamental organisational policy is required beforehand to tackle the issues and challenges of the adoption of telehealth by the HCPs.


*Figure 50 NVivo12Pro text search query for organisation*

Top-level management support to uptake telehealth by HCPs, is perceived as necessary for the successful adoption of telehealth by the HCPS. As is promotion to raise awareness about the benefits of telehealth for HCPs, health workers and patients.

**10. State Leadership**

This research on telehealth adoption by Indian HCPs also identified the role of the government in promoting and developing telehealth services. When analysed, the perceived opinions of the HCPs reveal that the government can formulate standardised guidelines for telehealth.

> *"Government engagement is necessary for successful policy making. Government have the resources but failed in implementing telemedicine."* (Interview 5)

Additionally, the government can play a role in healthcare awareness development via telehealth and promote the inherent benefits of telehealth.

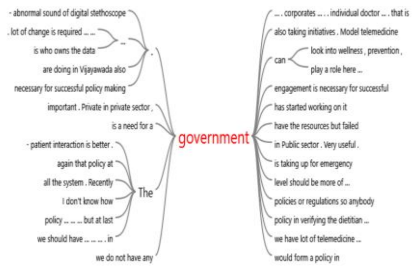



***Figure 51 NVivo12Pro text search query for government***

It also revealed that the current policies are impractical and have to be revised according to the needs of the healthcare environment in India. It is perceived from the study that government may influence the demand and supply of telehealth services to some extent.

**11. Communication Issues**

Communication issues theme emerged from the analysis as a reason for the reluctance of adoption by the HCPs, and why there is a preference for face-to-face consultations.

*“Also for me, accustomed with face-to-face consultations, it was uneasy, could not see the body language. The doctors’ touch is missing, I can understand more when I see them, constant typing in chat box these are the challenges.”* (Interview 11)

This issue of ineffective communication has been perceived as a barrier to the adoption of telehealth by the HCPs. Further, it was perceived that the doctor’s touch is vital for both the HCP and the patient. This perception is more related to emotional well-being and varies according to the person. This research well recognises the inherent benefits of telehealth in initial enquiry, post-treatment follow-up and providing support services during natural disasters and emergencies.

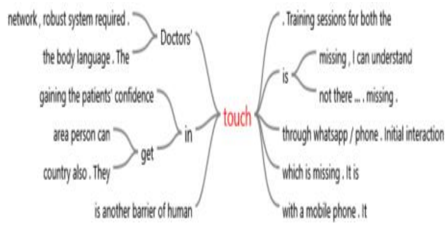



***Figure 52 NVivo12Pro text search query for touch***

However, as India is a multilinguistic country, sometimes language barriers are created between the HCP and the patient (Mukherjee et al., 2017).


***Figure 53 NVivo12Pro text search query for communication***

Also, a few HCPs rely on telehealth only as a medium for scheduling appointments or viewing diagnostics reports, creating a barrier to telehealth adoption. Overall, communication issues are a minor issue affecting telehealth adoption, which needs to be confirmed by further research.

After the three stages of qualitative analysis, the final themes perceived as drivers (enablers) and barriers of telehealth adoption in Indian healthcare are summarised as shown in Table 8 at the beginning of the analysis. After reviewing the HCPs' perceptions regarding telehealth adoption, these themes were generated but cannot be viewed as conclusive evidence, unless further research on these themes are conducted. As such, this research will continue to collect quantitative data for further analysis of the hypotheses revealed from the qualitative dataset, to confirm or reject the hypotheses. Finally, an overall picture of telehealth adoption has been presented from *NVivo12Pro* to summarise the qualitative findings in a final text search query.

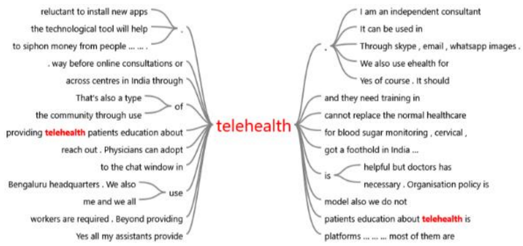



***Figure 54 NVivo12Pro text search query telehealth***

The first search query captures telehealth as a technological tool that can be used in healthcare effectively. The second query captures the adoption phenomena and the apprehensions of HCPs in telehealth adoption.


***Figure 55 NVivo12Pro text search query for adoption***

The following section will develop the hypotheses from the qualitative findings to help the research progress further into the quantitative stage.

## 5.8 Development of Hypotheses

The qualitative analysis helped form overarching themes from ideas and concepts generated from the interview transcripts. While the erstwhile literature review generated the hypotheses from the TOE framework, an additional framework, Bronfrenbrenners ecological framework, was also applied to find explanation for the themes. The themes were analysed at the micro (individual), meso (technical and organisational) and the macro levels (national culture and policies) adapted from the socioecological framework (Bronfenbrenner, 1992; Sallis et al., 2015). Further, the meso and macro levels are the contextual perceived factors influencing the telehealth adoption process (Ly et al., 2017).

To test statistical hypotheses, a four-step process is used. The analyst must first state the two hypotheses, with only one of them being correct. The next step is to draft an analysis plan outlining how the data will be analysed. The third step is to put the plan into action and physically analyse the sample data. The final step is to examine the data and either reject the null hypothesis or claim that the observed differences are purely coincidental (Cashen & Geiger, 2004).

Analysts reject the null hypothesis because it is a strong conclusion. This necessitates strong evidence in the form of a statistically significant difference that cannot be explained by chance alone. Failure to reject the null hypothesis, which states that the results can be explained solely by chance, is a weak conclusion because it allows for the possibility that other factors are at work but aren't strong enough to be detected by the statistical test. It is important to note that the null hypothesis is being tested because its validity is being questioned. The alternative hypothesis captures any information that contradicts the stated null hypothesis. The alternative hypothesis, in other words, is a direct contradiction of the null hypothesis (Cashen & Geiger, 2004; Cramer, 2003).

Following are the hypotheses generated after the literature review and qualitative analysis in this research.

Various studies have highlighted the importance of telehealth in the early detection of medical conditions (Thielst 2010; Weinstein et al. 2014; Taylor et al. 2015). This study's findings support the notion that, at least as a reason for first contact or initial consultation diagnosis, Indian HCPs see the benefits of telehealth as a motivator to adopt it. Treatment, monitoring, referral, rehabilitation, expert opinion and counselling have also received positive feedback in previous healthcare organisation-level research (Ahmed et al. 2010; Finkelstein et al. 2011; Bowman et al. 2013; Ashburner et al. 2016; Bee et al. 2016; Anwar et al. 2019; Ganapathy et al. 2019). The following hypotheses have been proposed in light of the qualitative findings, which corroborate the findings in the telehealth adoption literature.:

**$H1_0$** Healthcare Practices (HP) do not act as enablers for telehealth adoption in Indian healthcare

**$H1_1$** Healthcare Practices (HP) act as enablers for telehealth adoption in Indian healthcare

Telehealth can be used to promote health education, disease prevention, especially non-communicable diseases and healthy diets, according to the findings. As a result, telehealth is thought to play a role in promoting patient wellness and disease self-management, resulting in improved health outcomes. The concept of patient empowerment has previously been investigated in the context of developing an integrated telehealth system (Suter et al. 2011). Furthermore, gaining knowledge can be beneficial to patients in the long run (Standing et al. 2014). Additionally, the government (State Leadership in this research) may play a role in promoting patient awareness and the use of telehealth for improved health outcomes of the population as per the qualitative findings and literature (Dinesen et al., 2016; Zailani et al., 2014).

**$H2_0$** Patient Awareness (PA) does not act as an enabler for telehealth adoption in Indian healthcare

**$H2_1$** Patient Awareness (PA) acts as an enabler for telehealth adoption in Indian healthcare

The concept of accessibility and the presence of minimal healthcare infrastructure in rural and remote parts of India gave rise to the theme of healthcare facilities. In addition to the disease profile, a lack of doctors in India's rural and remote areas has long been a problem in providing uniform healthcare services across the country. As a result, the lack of healthcare facilities in rural and remote areas, as well as the distance to the nearest hospital, all serve to motivate HCPs to use telehealth. However, standardised policies and remuneration are required for such adoption. Previous research on telehealth adoption has found that telehealth can be useful in providing affordable healthcare services to rural and remote areas. Telehealth adoption also ensures that uniform healthcare facilities are available.

**$H3_0$** Healthcare Facilities (HF) do not act as enablers for telehealth adoption in Indian healthcare

**$H3_1$** Healthcare Facilities (HF) act as enablers for telehealth adoption in Indian healthcare

A key finding of the qualitative analysis is that HCPs in India who work with telehealth and mobile technology applications see it as a functional tool rather than an explicit tool. Telehealth and mobile healthcare technologies are being used for clinical purposes, such as viewing diagnostic reports and providing initial information to patients, among other things. HCPs do not sufficiently understand the concept of explicit and tacit knowledge. As a result, telehealth's ability, including mobile healthcare technologies, to share knowledge is underappreciated and underutilised (Chowdhury et al., 2020; Räisänen et al., 2009).

**$H4_0$** HCP Awareness (HCPA) does not act as an enabler for telehealth adoption in Indian healthcare

**$H4_1$** HCP Awareness (HCPA) acts as an enabler for telehealth adoption in Indian healthcare

In the literature, many information-technology motivators have been identified, including the desire for integration, access to real-time data, modernisation and dissatisfaction with older systems, image concerns, decision-making and complexity, process performance and productivity, response time, reduced operating costs, strategic decision-making, management reporting, business flexibility and transparency (Avison & Young, 2007; De Rosis & Seghieri, 2015). Various healthcare professionals, such as physicians, surgeons, dietitians, dentists and physiotherapists, have begun to offer online consultations in urban areas, at least at the initial level. Online consultations have a large reach across India (Brindha, 2013; Sivagurunathan et al., 2015). The qualitative input of this research highlights several technology motivators such as robust ICT infrastructure, broadband services and ICT-based health services as an alternative support solution. However, research is scarce in the Indian healthcare domain that examines the combined perspectives of HCPs and organisational or government foresight experts. Because of their importance, both individually and collectively, eliciting perspectives from HCPs, which is the focus of this study, is critical. Besides the latter group's inclusion, foresight experts (also HCPs/Policy Makers), in this research on telehealth adoption in Indian healthcare is explanatory. Foresight experts help healthcare organisations navigate potential changes by providing an early assessment of upcoming opportunities (and obstacles). However, these experts do more than forecast; they investigate various current phenomena and processes, such as networks, because optimising planning and decision-making requires a thorough understanding of current and historical practices.

**$H5_0$** Technology Motivators (TM) do not act as enablers for telehealth adoption in Indian healthcare

**$H5_1$** Technology Motivators (TM) act as enablers for telehealth adoption in Indian healthcare

Doctors and health care workers are in short supply in rural and remote areas of India, which is a widespread issue (Bhandari and Dutta, 2007; Goel et al., 2019; Sachan, 2013). The qualitative input from this research notes while this was once a motivator for healthcare professionals to adopt telehealth, it may also act as a barrier. This is due to a lack of proper organisational infrastructure, healthcare professionals' aversion to virtual adoption and a lack of a revenue model and salary for providing additional services. These reasons are why healthcare professionals have been slow to adopt telehealth. Other qualitative and literature inputs being time and distance-saving for both the HCPs and patients and being economical as compared to normal healthcare services (Hafeez-Baig & Gururajan, 2010; Liu Sheng et al., 1998; Loane et al., 1998; Wootton, 2009). In consideration of the above findings with literature support, a hypothesis can be formed as follows.

**$H6_0$** Competitiveness (CA) does not act as an enabler for telehealth adoption in Indian healthcare

**$H6_1$** Competitiveness (CA) acts as an enabler for telehealth adoption in the Indian healthcare

The ease of use construct has been criticised by Chau and Hu (2002); Chismar and Wiley-Patton (2003); Keil et al. (1995). The researchers believe that physicians rely on the utility of ICT rather than its ease of use. Physicians place a higher value on utility, functionality and effective patient outcomes. Lin et al. (2012) obtained results which show usefulness outweighing ease of use. Technology security can be an impediment to an organisation's adoption of ICT. Physicians are concerned about the safety of the technology and equipment used to provide care to their patients (Hu et al., 2002). A risky technology is one that has the potential to affect the outcome of a patient's care. Despite significant improvements in India's urban ICT infrastructure, there is still room for improvement in broadband speed and increasing rural connectivity, both of which are still lacking (Confederation of Indian Industry & KPMG, 2017). In consideration of the views above it may be hypothesised as follows.

**$H7_0$** Technology Issues (TI) do not act as barriers for telehealth adoption in Indian healthcare

**$H7_1$** Technology Issues (TI) act as barriers for telehealth adoption in Indian healthcare

The collective attitude of healthcare staff was discovered to be the most significant factor influencing ICT adoption in a telehealth environment (Hu et al., 2002). According to the same study, organisational policies and management are insignificant. The collective attitude of the healthcare workforce towards telehealth can influence an organization's readiness to adopt ICT. The collective attitude could include a willingness to share knowledge as well as a willingness to learn from training. A healthcare organization's primary goal is to provide services to people who require medical care due to a lack of access or poor-quality healthcare. There is a huge disparity in health in India, according to Balarajan et al. (2011). Investigating alternative service delivery arrangements is one of a healthcare organization's top priorities. In view of the above the following hypotheses have been formulated for this research.

**$H8_0$** Organisational Issues (OI) do not act as barriers for telehealth adoption in Indian healthcare

**$H8_1$** Organisational Issues (OI) act as barriers for telehealth adoption in Indian healthcare

Government policies and regulations, particularly in developing countries, are critical to the adoption and spread of telemedicine technology (Zailani et al., 2014). Similar to other developing countries, one of the main challenges for Indian healthcare in adopting and implementing telehealth is a lack of funds and adequate ICT infrastructure, which can be addressed by appropriate governmental policies. Furthermore, because it can create the legal framework to address issues such as confidentiality, dependability, liability and cross-border authority, once telehealth services are implemented, the government has significant capacity for developing telehealth rules and regulations (Judi et al., 2009). As a result of this, the following hypothesis is proposed.

**$H9_0$** State Leadership (SL) does not act as a barrier for telehealth adoption in Indian healthcare

**$H9_1$** State Leadership (SL) acts as a barrier for telehealth adoption in Indian healthcare

Furthermore, **H9** may be elaborated in terms of the government's role in promoting and empowering patient awareness through telehealth. The concept of patient empowerment has previously been investigated in the context of developing an integrated telehealth system (Suter et al. 2011). Gaining knowledge can benefit patients in the long run (Standing et al. 2014). The government (State Leadership in this research) may play a role in promoting patient awareness and the use of telehealth for improved population health outcomes, according to the qualitative findings and literature (Zailani et al. 2014; Dinesen et al. 2016).

**$H10_1$** State Leadership (SL) may not play a mediating role via Patient Awareness to influence telehealth adoption in Indian healthcare

**$H10_2$** State Leadership (SL) may play a mediating role via Patient Awareness to influence telehealth adoption in Indian healthcare

The qualitative findings of this research stressed the disadvantages of telehealth in regard to online communications. Many of the HCPs perceptions were regarding the advantage of face-to-consultations as compared to online communications. From an organisational point of view the HCPs reluctance to offer telehealth becomes a hindrance in offering such services. Further, there is concern that telehealth services may provide misleading information to the patients, as there may be communications gap related to the procedures. The HCPs' opinions reflect the benefits of telehealth only favouring viewing diagnostic reports or scheduling appointments. According to Wootton and Darkins (1997), there is no consensus on whether telehealth improves or harms the therapeutic relationship or traditional medical practice. Bashshur (1995) agreed, stating that it is still unknown whether telemedicine facilitates or inhibits patients' communication of their discomfort, symptoms and socio-emotional state, or whether it facilitates or inhibits doctors' communication of treatment instructions or expressions of empathy and caring. Because of the scarcity of data on the relational aspects of telehealth, many people believe that changes in the nature and content of doctor–patient communication should be a key component of any telehealth evaluation. Interpersonal communication between doctors and patients is also essential for establishing comfort and trust, exchanging information that will be used to make health-care decisions and negotiating patient and physician decision-making roles. As a result, telehealth may have an impact on the level of patient and doctor participation during a medical encounter, either facilitating or reinforcing it. Haug and Lavin (1983); Moskop (1981)'s patient-centred and consumer-oriented patterns, or reinforcing traditional, paternalistic patterns first described by Freidson (1988); Parsons (1951) and later elaborated by Waitzkin (1991). In view of the considerations an hypothesis has been formulated as follows.

**$H11_0$** Communication Issues (CI) do not act as barriers for telehealth adoption in Indian healthcare

**$H11_1$** Communication Issues (CI) act as barriers for telehealth adoption in Indian healthcare

## 5.9 Chapter Conclusion

The eleven hypotheses were developed for this research by relating the qualitative findings to published literature. The hypotheses reflect the themes generated from the three stages of qualitative analysis. The developed hypotheses will provide the backbone for the planning of quantitative data collection and analysis. The next chapter will focus on the planning of quantitative data collection and creating a survey instrument for said purpose.

# CHAPTER 6 QUANTITATIVE DATA COLLECTION

## 6.1 Chapter Overview

The previous chapter analysed the qualitative data and proposed themes to refine the preliminary conceptual framework derived from the literature review. The previous chapter, along with the literature review, formed the basis to develop a quantitative tool to measure the statistical validity of the perceived factors influencing telehealth adoption in Indian healthcare. This chapter will discuss the various techniques involved in quantitative data collection and analysis and justify the selected technique. Furthermore, it will also discuss the process involved to develop a measuring tool for testing the perceived factors in the Indian healthcare environment. Additionally, this chapter will discuss the selection of participants, the sample size to conduct quantitative data collection and the protocol for collection of quantitative data. Finally, discussion will focus on statistical data screening, preparation and analysis plan and the software to be used.

## 6.2 Introduction

Most of the quantitative data collection techniques used for research studies involve numerical data collection (Cramer, 2003). The utilisation of numbers to examine large data sets allows the investigator to evaluate the outcomes, using statistical analysis, to find the deeper meaning hidden in the data set (Blalock, 1979). The primarily used quantitative data collection techniques are comprised of, but not limited to, probability sampling, non-probability sampling, questionnaires, surveys, rating scales and census (Henry, 1990). Usually, the quantitative information is collected and documented methodically so that it can be analysed afterwards. Analysis is done using statistical software to generate tables and graphs and to disclose significant trends and patterns that sustain, confirm or invalidate theories, hypotheses and constructs (J W Creswell, 2014). Finally, quantitative data can be used to either refute a theory-based point of view or to more precisely estimate the potential scope of a particular area of interest (Berenson et al., 2012). The two data collection sampling methods listed below are generally used to generalise, summarise, compare and contrast (Henry, 1990; Zikmund, 2003).

### 6.2.1 Probability sampling

Researchers can make probability statements based on sample data collected at random, from a target demographic, using probability sampling, a type of random selection. At its core, probability sampling is collecting representative sample data from the people required for the research. As the data is collected at random, this quantitative data collection method eliminates the possibility of sampling bias (Adwok, 2015). Probability sampling is classified into three types (Acharya et al., 2013). Simple random sampling entails giving every member of the target demographic an equal chance of being chosen for inclusion in the sample. Systematic random sampling differs from simple random sampling in that, instead of utilising random number tables to select the participants for inclusion in the sample, the participants are chosen in an ordered fashion, such as one in every ten people on a list. Stratified random sampling is used when a specific group within the target demographic, such as doctors or nurses, are of particular interest. This type of sampling gives each unit an equal chance of being chosen from a specific target demographic group when creating a sample.

### 6.2.2 Non-probability sampling

Individuals are chosen in a non-probability sample based on non-random criteria and not every individual has a chance of being included. This sample is less expensive and easier to obtain but it has a higher risk of sampling bias. As a result, weaker population inferences can be drawn than with probability samples, and the conclusions may be more limited. Hence, if working with a non-probability sample, it is essential to make it as representative of the population as possible. Non-probability sampling techniques are frequently used in exploratory and qualitative research. Rather than testing a hypothesis about a large population, the goal of this type of research is to develop an initial understanding of a minor or under-researched population. Non-probability sampling is classified into four types as discussed below (Vehovar et al., 2016).

#### 6.2.2.1 Convenience sampling

A convenience sample is comprised of people who are most easily accessed by the researcher. This is a quick and low-cost method of gathering preliminary data. However, there are limitations of knowing if the sample is reflective of the desired population, therefore, the results are not usually generalisable (Etikan & Bala, 2017).

#### 6.2.2.2 Voluntary response sampling

A voluntary response sample, like the example above, is primarily motivated by convenience. People volunteer themselves rather than being chosen by the researcher. An example of this would be responding to a public online survey. Voluntary response samples are always skewed because some people are inherently more likely to volunteer than others (Murairwa, 2015) .

#### 6.2.2.3 Purposive sampling

This type of sampling, also known as judgement sampling, involves the researcher using his or her knowledge to select a sample that will be most useful to the goals of the research. It is commonly used in qualitative research, particularly when the researcher wants to learn more about a specific phenomenon rather than making statistical inferences, or when the population is small and specific. A purposive sample must have clear inclusion criteria and rationale in order to be effective (Etikan & Bala, 2017; Henry, 1990).

#### 6.2.2.4 Snowball sampling

If the population is difficult to reach, snowball sampling can be used to recruit participants through other participants. Snowballing depends on the number of people to whom the researcher has access in the target sector. At the same time, the researcher continues to network with more people in the target sector and, as a result of the snowball effect, the number of participants increases (Etikan & Bala, 2017; Henry, 1990).

### 6.3 Data Collection Techniques

After reviewing the different sampling methods which can be used in this research, the different data collection techniques are outlined below. Due to the fact that research approaches or designs are roughly orthogonal to data collection techniques, any type of data collection technique could theoretically be used with any research approach or design. Some types of data collection, however, are more commonly used with experimental approaches. Other types of quantitative data collection are more common in quantitative research, while many others are more common in comparative or associational (survey) research. Hence, it is imperative to use instruments that have been proven to be reliable and valid with the intended types of participants and for similar purposes in previous studies (Morgan & Harmon, 2001).

#### 6.3.1 Questionnaires and surveys

Questionnaires are used to measure and validate the attitudes and behaviours of individuals. Two types of questionnaires are commonly used to collect quantitative data for research: mail and web-based (online) questionnaires. Mail questionnaires have the advantage of quickly reaching a large number of people, as well as eliminating the need to spend time and money interviewing each respondent individually. Because all responses are anonymous, respondents are often more honest about their beliefs. Web-based questionnaires can be just as cost-effective, with the added benefit of being able to send surveys more quickly and provide more information for the respondent participants. The concern with both direct mail and web-based (online) questionnaires is that it is more challenging to get all participants to respond. It is common to have only a few people complete the questionnaire, using these methods. Furthermore, the validity of such questionnaires is sometimes called into question because response accuracy cannot be guaranteed.

#### 6.3.2 Rating scales

When respondents are queried about their satisfaction with a product or service, as indicated by intention to accept or adopt, rating scales are helpful. It is a quick way to determine whether there is a general bias and enables the researcher to form an opinion about the significant factors. However, survey data is only as good as the questions asked (indicators or items for measuring a perceived construct), so rating scales must be simple for respondents to understand. Respondents should understand each scale point, and there should be enough scale points for respondents to accurately differentiate between. A five-point rating scale (strongly disagree, disagree, neutral, agree and strongly agree) works well in most cases.

### 6.3.3 Census

A census is the most comprehensive and systematic way of acquiring and recording information about the target demographic. It is a quantitative data collection method on an enormous scale. This approach is most commonly used for national population and housing data collection but it is also used to acquire agricultural, business and traffic information. Since the early twentieth century, censuses have been conducted to record household data, as well as a variety of employment indicators for governments, to analyse and plot growing trends on the largest possible scale. Smaller-scale censuses are now conducted in a variety of formats, allowing anyone to participate, from teachers and charities to the media and local government.

#### 6.3.1.1 Drop and Collect Survey Technique

The primary survey method used in this research on telehealth adoption in Indian healthcare was the traditional in-person distribution of paper-based questionnaires, also known as a drop and collect survey (DCS). It is the only data collection method in developing countries that appears to avoid the majority of the drawbacks of other survey methods, such as online, telephone and postal. By combining the strengths and avoiding the weaknesses of face-to-face and postal surveys, DCS provides a quick, inexpensive and dependable research tool (Brown, 1987). Each survey statement was rated on a Likert scale of 1 to 5 (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree). Thus, the survey was structured and closed-ended, making it suitable to generate quantitative data for statistical analysis. The survey questionnaire items were chosen carefully to reflect the hypotheses generated from the erstwhile literature review and qualitative analysis. All healthcare professionals and healthcare administration staff were invited to participate in the study by the head-of-unit or in-charge of the hospital or medical centres. Additionally, the survey was distributed by these same heads-of-unit or those in-charge, with whom the researcher made early contact. The researcher also sent online survey links to prospective healthcare professionals in consultation with those in-charge Later, it was found that the online responses were few. In contrast, reasonable response rates were received in the paper-based drop and collect method implemented as above.

### 6.4 Population, Sampling and Sample size

A Cross-sectional study was conducted at a single point of time to examine the relationship between the determinants of ICT Adoption in the Indian Telehealth environment (Kijsanayotin, Pannarunothai, & Speedie, 2009; Schmeida, McNeal, & Mossberger, 2007; Shin, Lee, & Hwang, 2017). Random convenience sampling was used for the selection of participants who took part in the semi-structured interviews. This was based on ease, accessibility, speed and low cost (Acharya, Prakash, Saxena, & Nigam, 2013; Creswell, 2014) .

The proposed sample size for the online and paper-based survey was between three hundred to five hundred participants. The reason for a large sample size was to establish the determinants with a minimal margin of error. Further, it also increased the confidence level of the results or, in other words, reduced the uncertainty accompanying the estimate (Creswell 2014).

The number of participants for the quantitative analysis relied upon the responses from the participants. A number of studies analysed (Mairinger et al. 1996; Gschwendtner et al. 1997; Durrani 2009; Ghia 2013; Iyer 2014), were found to be low in population and response. As such, considering the limitations of small sample sizes, a large sample size of three hundred to five hundred participants was proposed to be fit for this study.

Further, pre-testing of the survey instrument and pilot study were conducted before the full-scale survey administration, to testify and confirm the reliability and validity of the respective dataset / instruments (Creswell 2014; Saunders et al. 2016).

## 6.5 Recruitment Strategy

It was deemed necessary that the selected healthcare professionals, for both the interview and survey, should have some exposure in telehealth projects. This included healthcare professionals with varied roles in the Indian healthcare system. A participant information sheet for the study, which included the research objective, was sent to potential participants routed through the supervisors or heads-of-unit beforehand. Initial contact was established through the supervisors or heads-of-unit by an email or personal visit. Prior to the interview and survey, participants were provided with the consent form detailing the project objectives, nature of the interview and survey and their rights. The participants were informed about their right to withdraw at any time, both from the research study and data collection, without any consequences.

## 6.6 Ethical dimensions

The literature review identified several governmental and non-governmental organisations providing telehealth services (Appendix C). Before the research began ethical approval was undertaken from the respective authorities in the government health departments, as well as from the management body of the health organisations involved. As the research is conducted from an Australian University, an ethics application was submitted to the University of Southern Queensland's Human Ethics Committee. Approval was obtained in due course under reference H18REA086 (v3). After the ethics approval, both from Australia and India, the participants were contacted from the identified organisations providing telehealth.

## 6.7 Development of a Survey Instrument to explore the adoption of telehealth/mobile technologies by healthcare professionals

Healthcare challenges are a known phenomenon in developing countries. Such challenges can be in the form of inequalities and inaccessibility to the normal healthcare system. Lack of infrastructure, physical and ICT, coupled with a shortage of healthcare professionals in the rural and remote areas, are additional challenges of the healthcare system in developing countries. The introduction and success of communication technologies in the modern era has the potential to ease such effects. Regarding healthcare, the application of ICT to telehealth/telemedicine/M-health, etc., has the potential to serve as a useful alternative, or as an associated healthcare service, to eliminate the challenges of inequality and inaccessibility (Chandwani & Dwivedi, 2015). Developed countries, such as USA, Canada, UK, Australia, New Zealand and the Scandinavian region, have already established and utilised their ICT infrastructure to cater to the healthcare sector (Anwar & Prasad, 2018; Raza et al., 2017). In India, there have been telehealth and telemedicine service providers, however, little information is known about the determinants or the factors influencing the telehealth adoption process by healthcare professionals and healthcare organisations (Chowdhury, Hafeez-Baig, Gururajan, & Chakraborty, 2019). The most important focus for this research was to identify the significant factors influencing telehealth adoption by Indian healthcare professionals and healthcare organisations.

The purpose of this section was to describe the process of developing a validated and reliable survey instrument to explore the determinants of telehealth adoption in the Indian healthcare domain. Technical and contextual differences are significant shortcomings in previously developed tools for exploring telehealth adoption (Rani et al., 2019). Further, previous studies focus on the adoption of telehealth by patients (Paslakis et al., 2019) or the adoption of specialised telehealth services (Janda et al., 2019; Zhou et al., 2019). While surveys are the usual method for exploring the adoption of telehealth by healthcare professionals, shortfalls in conducting and reporting survey studies are expected (Langbecker et al., 2017; Whitten et al., 2007). Furthermore, tools for measuring telehealth adoption in the context of developing countries are few (Chowdhury et al., 2019; Ghia et al., 2013). The development of a survey instrument is imperative to measure the determinants of telehealth adoption by healthcare professionals in developing countries. To establish such perceived drivers and barriers, a research design was conceived whereby three stages of methodologies were applied to establish and confirm the determinants. The stages were literature review, qualitative data collection and analysis and a survey for quantitative analysis. The final stage was completed to generalise the findings over a large population to validate the findings of the first two stages.

The review of extant literature identified the general perceived drivers and barriers to the adoption models of telehealth around the world. The qualitative aspect of the research involved conducting semi-structured interviews of healthcare professionals in India. Interviews were transcribed, the data analysed, and the perceived determinants were interpreted from the analysis. This process of qualitative analysis was done with rigour so as to establish content validity and construct validity. The qualitative analysis involved two stages: manual coding and NVivo coding. Subsequently, the resultant themes of manual coding process were matched with CAQDAS (Computer Assisted Qualitative Data Analysis Software) and consequently, the content and construct validity of the qualitative analysis was established.

The perceived determinants were comprised of several items which formed the basis of the next stage of research. This evolved into a survey of healthcare professionals in India, to measure and validate the perceived determinants interpreted from the literature review and the qualitative data. Further, the relationship between the perceived determinants was conceived.

A survey instrument was prepared for quantitative data collection with the literature review and the qualitative analysis as the base. The themes, along with the items, were measured with the help of the survey instrument. The measurement was done on a Likert scale with values ranging from 0 to 5 denoting "strongly disagree" to "strongly agree". The following diagram shows the development process of the survey.

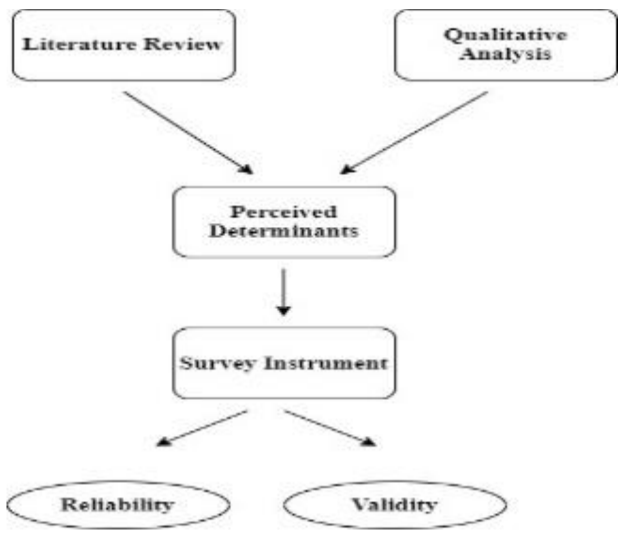



*Figure 56 Development process of the survey instrument*

### 6.7.1 First Stage: Literature Review

The literature review proposed a conceptual framework after exploring a range of published articles and theories on telehealth and ICT adoption in healthcare domains worldwide. One model, Technology-Organisation-Environment (TOE) (Depietro et al., 1990), has been tested in organisational settings in various domains of ICT adoption including healthcare. TOE is a comprehensive framework (Hu et al., 2002) and yields a consistent conclusion or results, regarding ICT adoption in the healthcare and other domains. This is supported by the research of (Ahmadi et al., 2015; Alaboudi et al., 2016; Brancheau & Wetherbe, 1990; Bretschneider, 1990; Cooper & Zmud, 1990; Fichman, 1992; Ghani & Jaber, 2015; Kimberly & Evanisko, 1981; Lian et al., 2014; Zmud, 1982). The barriers around knowledge and technology (Adamson, 2016; Faber et al., 2017; Paul et al., 1999; Tanriverdi & Iacono, 1998; Zailani et al., 2014) are well represented in the literature, through the TOE framework. Since this study aimed to identify the different drivers and barriers of telehealth technology adoption in an organisational setting, the TOE framework, adapted from Depietro et al. (1990); Hu et al. (2002), was used to create a new theoretical framework for telehealth technology adoption in the Indian healthcare domain. The different constructs of the TOE framework are ease of use, technology safety, service benefits, service risks, collective attitude of healthcare staff, organisational policies and management and service needs (Hu et al., 2002).

The themes formulated for the conceptual framework, to study Indian telehealth adoption are, Technology, Organisation, Environment, Knowledge, Innovation and Healthcare Specific. The conceptual framework which emerged by thematically arranging the drivers and barriers is presented below.

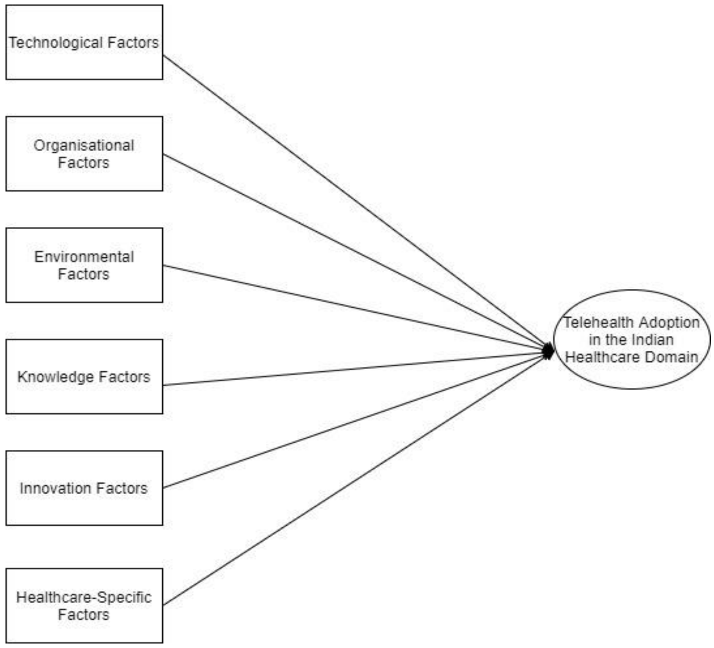



*Figure 57 Conceptual framework for telehealth adoption*

### 6.7.2 Second Stage: Qualitative Data Collection and Analysis

The second stage of the research developed a qualitative framework to assist in recognising the measurable constructs. An open-ended, semi-structured and in-depth interview questionnaire was developed with the help of the themes generated from the literature review. The interviews of healthcare professionals in India were conducted from the month of February 2019 to May 2019. A total of 12 interviews were completed. The framework was developed after analysing the qualitative interviews in two stages: manual analysis and NVivo coding. The manual analysis yielded some a-priori codes which were helpful in analysing the data through NVivo. The themes were divided into drivers and barriers and consist of several concepts or items which became the basis of measurement of the perceived constructs. Final coding revealed a framework consisting of meso, macro and micro level themes which is presented below.

*Table 9 Emerging themes from Qualitative Analysis*

**Table**

**Emerging Themes from Qualitative Analysis**

| Perceived driver themes | Perceived barrier themes |
|---|---|
| 1. Healthcare Practices (Meso level) | 1. Technology Inhibitors (Meso level) |

| | |
|---|---|
| 2. Patient Awareness (Meso level) | 2. Organisational Issues (Meso level) |
| 3. Usefulness (Micro level) | 3. State Leadership (Macro level) |
| 4. Healthcare Facilities (Meso level) | 4. Communication Issues (Micro level) |
| 5. Healthcare Professional (HCP) Awareness (Meso level) | |
| 6. Technology Motivators (Meso level) | |
| 7. Competitiveness (Meso level) | |

### 6.7.3 Third Stage: Survey Instrument Development

The themes developed from the qualitative analysis were analysed further to generate hypotheses to be generalised over a large population, through the survey instrument. These eleven hypotheses formed the basis for the survey instrument. A copy of the survey instrument was prepared and, altogether, 134 scales pertaining to the hypotheses were framed, based on the literature review. Before administering the survey instrument, an initial content validity test was performed (Haynes et al. 1995; Wynd et al. 2003). By presenting a comprehensive survey instrument with 134 items (appendix), experts in healthcare research as well as healthcare professionals were consulted. The pre-testing participants were asked to indicate how comfortable they were with answering the questionnaire survey. Their feedback was taken into account, and a total of 97 items (independent and dependent variables), as well as six demographic questions were eventually included in the administered instrument (see Appendix).

For establishing and demonstrating rigour in preparation of survey instruments, validity and reliability should be established before and after the data collection process (Dwivedi et al., 2006; Straub et al., 2004). The aspects of validity and reliability recommended in creating a new survey instrument were construct validity, content validity and reliability. The final 97 items of the survey represented several constructs. One difference is that the survey focussed on the determinants instead of solely measuring behavioural intention and attitude. This is because telehealth is already in use at a certain level in Indian healthcare. Instead, HCP Awareness was found to be an accurate determinant to measure and predict the adoption levels. Globally, TAM and UTAUT were used extensively for ICT adoption studies and generated almost the same results, except for difference based on cultural variations

(Terry, 2021; Sobrepera, 2007, Hu et al., 2002; Saigí-Rubió et al., 2016). This study focused on finding the enablers (drivers) and barriers to telehealth adoption.

The resultant 97 items had the potential to predict various determinants of telehealth adoption such as patient awareness, hcp awareness, technology motivators and inhibitors etc. The determinants can thus be explained from the lens of the TOE framework. Further, healthcare-specific determinants were identified, along with medical education, and state leadership, which can be measured. Though innovation was found to be significant in the literature review, it was found to be somewhat dependent on the determinants of telehealth adoption in Indian circumstances. Instead, knowledge and HCP awareness found support in relevant literature.

The survey was created as there was limited existing research regarding the determinants of Indian telehealth adoption. The exploratory survey was prepared in stages dealing with content and construct validity, pre and pilot testing and principal component analysis. The suggested validities for a newly constructed survey were content and construct validity, internal consistency and reliability, manipulation validity and common method bias (Straub et al., 2004). This research addressed the above-mentioned requirements, including manipulation validity and common method bias. A confirmatory factor analysis and structural equation modelling can only confirm the constructs of the survey thus created. The relationship between the variables also needed to be understood. The resultant framework required further testing and generalisation over large populations, and in diverse contexts.

## 6.8 Conclusion

The contribution of the survey development process lies with providing a validated and reliable survey instrument for research into telehealth adoption or ICT adoption in healthcare domains in developing countries. Further, the comprehensive nature of the instrument can provide researchers in telehealth or ICT adoption in healthcare domain, with a validated and reliable instrument measuring diverse constructs of ICT adoption in a single survey instrument.

# CHAPTER 7 QUANTITATIVE DATA ANALYSIS

## 7.1 Chapter Overview

The previous chapter outlined a discussion on the various methods to be employed, and the strategies to be adopted, to mitigate the challenges while collecting the quantitative data from healthcare professionals in India. Additionally, the mode of preparation and pilot testing of the survey instrument to be tested in this research study was examined. This chapter will provide details of how the data was collected and the subsequent analysis and review of the data collected from healthcare professionals in India. Further, this chapter will attempt to answer the research questions which are as follows:

**Research Question:**

What are the determinants of telehealth adoption by Indian healthcare professionals?

**Research Sub-Questions:**

a) What are the drivers of telehealth adoption by Indian healthcare professionals?

b) What are the barriers to telehealth adoption by Indian healthcare professionals?

c) What is the relationship between the drivers and barriers of telehealth adoption by Indian healthcare professionals?

In order to answer the research questions, a rigorous quantitative (statistical) analysis in a step-by-step approach was undertaken, as propounded by various authors of statistical methodologies (Bryman & Cramer, 2005; Cohen, 2013; Cohen et al., 2013; Cramer, 2003; Treiman, 2014). Thus, the chapter will begin with an explanation of how the data was collected. This will be followed by arranging the data for descriptive statistical analysis and ultimately advanced statistical analysis, such as principal component analysis and multiple regression (Hair et al., 1998). This discussion envisions a model that will interpret multiple regression and correlation values on the coded factors as tested by the survey instrument, to gain an understanding of their statistical significance. Furthermore, for exploratory factor analysis purposes, this chapter addresses developing a model deriving multiple regression and correlation values from the composites obtained from the principal component analysis. Finally, this chapter identifies the statistical significance of the composite factors.

## 7.2 Introduction

Quantitative (statistical) analysis of the data is required to establish if statistical significance of the factors, measured by the survey instrument, exists. Statistical analysis also helps to explore and identify latent variables in the collected dataset. It also helps to develop a predictive model for adoption, based on several assumptions, tools, techniques and analysis. A number of statistical tools and techniques were employed to arrive at several conclusions. This was done to and justify the difference in results based on the choice of technique and to arrive at a framework which describes telehealth adoption in India most accurately. As discussed in the previous chapter, firstly, a survey instrument was prepared and subjected to a pre-test and pilot test to judge the instrument's reliability and validity before the survey instrument was administered.

## 7.3 Quantitative Data Collection in India

After preparing the survey instrument, and setting up adequate protocols for the quantitative data collection in India as outlined in the previous chapter, the survey instrument was distributed. This was done online and through a paper instrument to numerous healthcare professionals situated throughout India. Altogether, 1000 health professionals were approached, either by sending online survey links or by sending the paper survey to them, along with the participant information sheet. In both cases, the head of the hospital or private medical centre was consulted beforehand. The primary investigator initiated the data collection by personally visiting the hospitals and private medical centres. The paper surveys were later collected in person, a scanned copy sent via email, or by post. An initial examination of the paper and online surveys revealed that 343 completed responses were received. This equates to 34.3% of the total population targeted by the survey, which conforms to standard response rates, according to published healthcare research literature (Cunningham et al., 2015). There was a low response rate to completing the survey in online mode (only 11 completed responses). This indicates that, though online operation of surveys is significantly low in cost, it is still way behind the success rates of paper-based survey completion in the Indian healthcare domain (Hohwü et al., 2013).

## 7.4 Pre-testing

An initial content validity test was conducted before administering the survey instrument (Haynes et al., 1995; Wynd et al., 2003). Experts in healthcare research, as well as healthcare professionals, were consulted using a comprehensive survey instrument with 134 items, presented in the appendix. The participants for the pre-testing were asked to indicate their comfortability in answering the questionnaire survey. Their opinions were considered and 97 items (independent and dependent variables) and 6 demographic questions were finally included in the administered instrument, presented in the appendix.

## 7.5 Pilot-testing

A pilot test was conducted by taking the initial results of the survey into account. The first 30 responses were captured to identify the Cronbach's Alpha generated. The Cronbach Alpha value was .902 for all the 97 items of the survey for the first 30 cases. The Cronbach's Alpha values for overall items which were measured by the survey instrument are presented below.

***Table 10 Cronbach's Alpha for the pilot test***

**Table**

**Cronbach's Alpha for the pilot test**

| Indicators | Cronbach's Alpha | No. of Cases |
|---|---|---|
| 97 Items | .902 | 30 |

**Source: Developed for the study using IBM SPSS Statistics v.27**

As, .902 was a highly satisfactory overall value, it was decided to continue with the survey without altering any of the items or demographic questions.

## 7.6 Data Preparation

The first procedure adopted for the data analysis of the survey responses was capturing the numerical responses on a Microsoft Excel spreadsheet. Afterwards, the spreadsheet data was transferred and subsequently analysed using statistical software IBM SPSS

Statistics version 26. The steps followed before analysing the data were cleaning the data and labelling. Cleaning the data ensured that there were no errors in entering all the responses (Andreadis, 2014; Van den Broeck et al., 2005). This ensured entry of proper values according to the specific numerical answers to the survey questionnaire. Furthermore, labelling of the data ensured that the origin of the data could be traced later in the analytical and discussion stage (Elliott et al., 2006; Fink, 2003). These initial stages of preparation of the data led to the demographic and descriptive analysis of the data set. Subsequently, any anomalies in the dataset, used to perform descriptive analysis, were removed through the use of the "output generated" in SPSS. Demographic information of age bracket (in years), gender, educational qualifications, occupation, work experience bracket (in years) and employment, were given particular attention. Univariate normality within the dataset was verified through a data check; a prerequisite to perform factor analysis. Descriptive statistical tools, such as frequencies, valid percentage reports, cross tabs and Chi-square test for several associations, were used in conducting the analysis. This was a way to gain understanding of the relevance of the dataset. The characteristics of the descriptive statistical analyses are presented below in a sequential manner.

### 7.7 Reliability and Validity of the Collected Data

Content validity was established by consulting academicians, healthcare research experts and healthcare professionals discussed in the pre-testing section. The reliability of the overall survey instrument was generated to ascertain the ability of the dependent and independent variables to measure consistently (Tavakol et al., 2008). Cronbach's Alpha score of all items of the survey = .909 (without outliers), which is an excellent measure of internal consistency. The score indicates all the items in the test measuring the identical concept or construct and therefore connected to the inter-relatedness of the items within the test (Tavakol & Dennick, 2011). Statistical definitions of good internal consistency levels differ, although all recommended values are .7 or higher (DeVellis, 2016; Kline, 2015). Since the overall Cronbach's Alpha value is excellent and above .90, all the indicators were considered for the EFA. Though the Cronbach's Alpha value =.911 is higher with the outliers, it was decided to continue without outliers because multi-collinearity might arise in the due process (Hair et al., 1998).

*Table 11 Cronbach's Alpha (with and without outliers)*

**Table**
**Cronbach's Alpha (with and without outliers)**

| Indicators | Cronbach's Alpha with outliers | No. of Cases with outliers | Cronbach's Alpha without outliers | No. of Cases without outliers |
|---|---|---|---|---|
| 97 Items | .911 | 325 | .909 | 295 |

**Source: Developed for the study using IBM SPSS Statistics v.27**

## 7.8 Assumptions

Generally, several assumptions are involved in preparing the dataset before any statistical analysis can be performed (Berenson et al., 2012; Blalock, 1979). The assumptions are particularly important for correlation analysis, multiple regression and exploratory factor analysis (EFA). The activities include evaluating missing data values, dealing with outliers, multi-collinearity, homoscedasticity and univariate skewness and kurtosis. These assumptions are enumerated below.

### 7.8.1 Missing data

The survey questionnaire was collected and initially scrutinized for completion levels. The number of surveys rejected for partial submission is 4 for the online mode and 14 for the paper mode. Afterwards, the data was entered into a spreadsheet (MS Excel) for initial verification. The next step was uploading the data to IBM SPSS Statistics 26 for data analysis and interpretation. After uploading, the missing values were checked further. There were 7 missing values but as it was less than 5% of the total number of survey questions, the missing values were replaced by median values of the respective dataset (Brick & Kalton, 1996).

### 7.8.2 Outliers

In statistical analysis, an outlier is defined as a data point that significantly differs from other observations. A variability in the measurement may cause an outlier, or an outlier may be present due to errors in experiment; the latter are sometimes removed from the data set. Serious problems might occur by the presence of outliers during statistical analyses when an observation lies at a distance which is abnormal from other observation values, within a randomly sampled population. Consequently, the treatment of outliers depends on the scope of abnormality within observations, and their treatment (Andreadis, 2014; Brick & Kalton, 1996; Fink, 2003; Jones & Hidiroglou, 2013; Krishnan et al., 2016; Meade & Craig, 2012; Van den Broeck et al., 2005). Further, abnormal observations can be filtered out only after normal observations are characterised. Healthcare literature raises a concern about dealing with outliers in survey data. Detecting outliers in multivariate datasets is a way to improve upon the statistical significance of the results or, in other words, it leads the results to be closer to the truth. Without the elimination of outliers, the results have the chance to represent a false positive (Leys et al., 2018). However, there are other concerns criticising the removal of outliers, as it might lead to biased results. Outliers might represent important observations, having an effect on correlation analysis. In the case of this research, a filter was enabled in IBM SPSS Statistics 26 to deselect cases with Mahalanobis Distance Probability values less than 0.001 ($p<0.001$), in the calculation process for the multiple regression on the coded factors, exploratory factor extraction employing principal component analysis (PCA) and regression analysis of the derived composites from PCA. The demographic descriptive analysis was initially analysed without enabling the outlier filter. As a result, 4 cases were filtered out by this process, reducing the number of cases to 321. In the later stage, another 26 cases were filtered out as most of the participants were, by occupation, doctors (299 participants). Since the number of doctors is sufficient in representing the true nature of the dataset, the small number of participants from other occupations might create outliers in the dataset. As such, the number of cases were reduced to 295. In this way of filtering out, instead of deleting the identified outliers, two sets of results can be easily produced to compare the results with or without the outliers.

### 7.8.3 Multi-collinearity

Multi-collinearity was checked before conducting further statistical analysis after the EFA. A two-part process was involved to examine the degree of multi-collinearity and its effect on the results (Alin, 2010; Farrar & Glauber, 1967; Hair et al., 1998; Mansfield & Helms, 1982). The process examined the condition indices and the decomposition of the coefficient variances. The threshold value for condition indices is usually in the range of 15 to 30 with 30 as the most common value used (Berenson et al., 2012; Hair et al., 1998). In this analysis, the examination of condition indices selected a single variable. Next, the selected single variable did not show a substantial proportion of variance (highest value TI 28%, value .28, Condition Index 43.458). Moreover, as a single value is associated with it, no collinearity exists for this coefficient (Hair et al., 1998; Schroeder et al., 1990; Vatcheva et al., 2016).

***Table 12 Collinearity diagnostics***

**Collinearity Diagnostics[a]**

| Condition Index | HP | HF | OI | SL | TI | USFL |
|---|---|---|---|---|---|---|
| 1.000 | .00 | .00 | .00 | .00 | .00 | .00 |
| 13.343 | .02 | .03 | .04 | .00 | .00 | .72 |
| 19.168 | .59 | .28 | .02 | .00 | .03 | .00 |
| 20.476 | .07 | .54 | .37 | .01 | .02 | .00 |
| 22.535 | .10 | .08 | .10 | .63 | .02 | .23 |
| 28.974 | .01 | .04 | .37 | .23 | .65 | .01 |
| 43.458 | .21 | .03 | .10 | .13 | .28 | .04 |

a. Dependent Variable: Telehealth Adoption

**Source: IBM SPSS Statistics v.27 Output**

Simultaneously, the analysis of the data showed the variance inflation factors (VIF) and the tolerance values were less than 10, and explained less than 10% of any independent variable's variance, respectively. As such, the VIF and tolerance values indicate collinearity which is inconsequential (Farrar & Glauber, 1967; Hair et al., 1998). Even if the minimum threshold value of 15 is taken into account (from the 3rd condition index with value of 19.168, 20.476, 22.535, and 28.974 from the Collinearity Diagnostics table presented above), then only one coefficient of the variable HP loads moderately (.59). Therefore, it may be concluded that no support for existing multi-collinearity is present in these results for checking multi-collinearity, as indicated by the VIF and tolerance values.

*Table 13 Coefficients collinearity statistics*

**Coefficients** [a]
Collinearity Statistics

| Model | | Tolerance | VIF |
|---|---|---|---|
| 1 | (Constant) | | |
| | HP | .943 | 1.060 |
| | HF | .784 | 1.275 |
| | OI | .860 | 1.162 |
| | SL | .876 | 1.142 |
| | TI | .797 | 1.255 |
| | USFL | .913 | 1.096 |

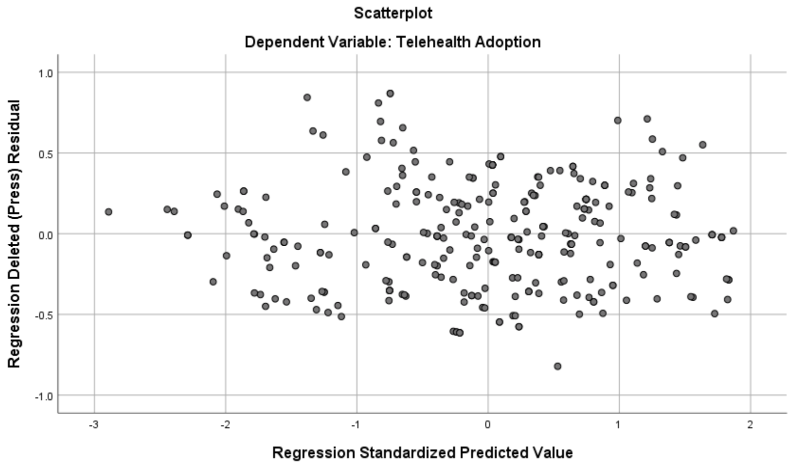
a. Dependent variable: Telehealth Adoption

**Source: IBM SPSS Statistics v.27 Output**

Thus, the multi-collinearity was checked for the EFA composites and further discussion about the EFA will be in a separate section.

### 7.8.4 Homoscedasticity

Before conducting multiple regression, the testing for homoscedasticity of the data is essential. This indicates the variance of the errors or residuals is constant across all the values of the independent variable, which in the case of this research is Telehealth Adoption (TA) (Hair et al., 1998; Montgomery et al., 2012). One way of analysing the residuals is to produce a scatterplot showing the regression deleted residuals against the regression standardized predicted value (Draper & Smith, 1998; Kutner et al., 2005). Due to the manner in which the residuals act as the errors, this assumption of equal error variances across the standardized predicted values (fitted values) can be checked by inspection of the scatterplots, which would exhibit no pattern. Further, the scatterplots would exhibit the regression deleted residual scores on the y-axis across the standardized predicted values (fitted values) on the x-axis and will be approximately constant spread across the fitted values. The residuals in this case appear randomly scattered. Moreover, the scatterplots exhibit a greater spread of points for mid-range predicted values, but not by very much. Therefore, having the conditions met, it can be assumed that the dataset exhibits homoscedasticity, as it appears from the analysis and visual inspection of the scatterplot below. For further verification, visual inspection found the scatter plot taking an approximately rectangular shape, and the scores are concentrated in the centre (along the 0 point) and distributed in a rectangular pattern. Precisely, scores will be scattered randomly along a horizontal line. In contrast, any systematic pattern or clustering of scores is considered a violation (Tabachnick et al., 2007).




**Source: IBM SPSS Statistics v. 27 Output**

***Figure 58 Homoscedasticity***

### 7.8.5 Univariate Skewness and Kurtosis

Skewness and kurtosis are two terms that are commonly used to describe the shape of a distribution. Skewness measures the symmetry of a distribution. A symmetrical dataset will have no skewness. As a result, the skewness of a normal distribution is 0. Skewness is a metric for comparing the sizes of the two tails. Skewness is a metric for determining a dataset's symmetry, or lack thereof. The normal distribution has a skewness = 0 (West et al., 1995).

Some skewness guidelines are as follows (Kim & White, 2004):

a) The data is fairly symmetrical if the skewness is between -0.5 and 0.5.

b) Data are considered moderately skewed if the skewness is between -1 and –0.5 or between 0.5 and 1.

c) Data are considered highly skewed when the skewness is less than -1 or greater than 1.

Kurtosis is frequently calculated by comparing the distribution to a normal distribution. When the kurtosis is close to zero, a normal distribution is commonly assumed. These are known as mesokurtic distributions. The distribution is called a platykurtic distribution if the kurtosis is less than zero and it has light tails. Because the tails are heavier when the kurtosis is greater than zero, the distribution is called a leptokurtic distribution. Kurtosis measures the combined size of the two tails. It computes the amount of probability in the tails. The value is frequently compared to the kurtosis of a normal distribution, which is equal to 3. If the kurtosis > 3, the dataset has heavier tails than a normal distribution (more in the tails). If the kurtosis < 3, the dataset has lighter tails than a normal distribution (less in the tails). Excess kurtosis is another term for kurtosis. Excess kurtosis is obtained by deducting 3 from the kurtosis. As a result, the normal distribution's kurtosis is equal to zero. Kurtosis was originally thought to be a metric for determining a distribution's peakness (Groeneveld & Meeden, 1984; Hair et al., 2006; Joanes & Gill, 1998).

A univariate investigation of skewness of the data after conducting the EFA exhibits skewness for all the factors except OI and TI. The skewness values of HP, HF, SL and TA are ranging from -1 to -0.5 and USFL ranging between .5 to 1. According to the guidelines of Kim (2015); Kim and White (2004) the data is moderately skewed. Again, Kurtosis < 3 for all the variables which denotes a lighter tail than a normal distribution (Groeneveld & Meeden, 1984). These results indicate that the data is not normally distributed, or the data is non-normal (West et al., 1995).

***Table 14 Skewness and kurtosis***

**Skewness and Kurtosis**

| | | HP | HF | OI | SL | TI | USFL | TA |
|---|---|---|---|---|---|---|---|---|
| N | Valid | 295 | 295 | 295 | 295 | 295 | 295 | 295 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Skewness | | -.192 | -.365 | -.542 | -.380 | -.734 | .468 | -.213 |
| Std. Error of Skewness | | .142 | .142 | .142 | .142 | .142 | .142 | .142 |
| Kurtosis | | -.449 | -.654 | -.033 | -.358 | .558 | -.713 | -1.007 |
| Std. Error of Kurtosis | | .283 | .283 | .283 | .283 | .283 | .283 | .283 |

**Source: IBM SPSS Statistics v.27 Output**

### 7.9 Demographic characteristics

The overall demographic characteristics statistics showed 295 (after removing the outliers) valid survey responses for all the six demographic questions. It also calculated the median values which showed the mid-values of the dataset numbers sorted in either ascending or descending order. This can define the entire dataset and might be more descriptive than the mean or average, especially when there are outliers which might skew the dataset. (Blalock, 1979). The median values identified 40-49 years of age, male, PG doctor with 10-19 years of experience and working in the private sector, as the most significant demographic characteristics of the dataset. The defined dataset are the main users of telehealth in India according to the sample of data collected from few states in India. The SPSS output of the demographic characteristics of the participant Indian healthcare professionals is depicted below. Afterwards, the individual demographic characteristics are described.

**Demographic Characteristics Statistics**

| | | Age Bracket (in years) | Gender | Educational Qualifications | Occupation | Experience (in years) | Employment |
|---|---|---|---|---|---|---|---|
| N | Valid | 295 | 295 | 295 | 295 | 295 | 295 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Median | | 3.00 | 1.00 | 2.00 | 1.00 | 2.00 | 2.00 |

**Source: IBM SPSS Statistics v.27 Output**

The SPSS output for age showed the most critical value for age is the 40-49 age bracket (43%). In Indian circumstances, this can be interpreted as a phenomenon where the experienced healthcare professionals are confident with using telehealth as part of their practice (Singh et al., 2016; Sood et al., 2007). Furthermore, in India, the medical education is comprised of several stages. As a result, it takes 8-10 years or more to complete the undergraduate course of MBBS and pursue higher specialities at the post-graduate level (Solanki & Kashyap, 2014). For some, it may take even more time as it is very competitive to get into post-graduate specialisation. Many enter the PG stream after several years of experience as an MBBS doctor. Furthermore, it might take more years if the doctors choose a post-doctoral specialisation which is pursued after the post-graduate level (Sood & Adkoli, 2000). As such, the age group of 40-49 years is quite young for a medical professional in India, who also has sufficient experience along with PG and/or post-doctoral specialisation (Ananthakrishnan, 2010; Deswal & Singhal, 2016; Solanki & Kashyap, 2014; Sood & Adkoli, 2000; Sood et al., 2007; Supe & Burdick, 2006). Below is the SPSS output for age bracket (in years).

**Age Bracket (in years)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | (20-29) | 7 | 2.4 | 2.4 | 2.4 |
| | (30-39) | 45 | 15.3 | 15.3 | 17.6 |
| | (40-49) | 134 | 45.4 | 45.4 | 63.1 |
| | (>=50) | 109 | 36.9 | 36.9 | 100.0 |
| | Total | 295 | 100.0 | 100.0 | |

**Source: IBM SPSS Statistics v.27 Output**

Thus, the results reflect the nature of the medical profession in conformity to the medical environment prevailing in India. The results are also in conjunction with the results of the predominant experience level of 10-19 years who are comfortable enough to adopt telehealth (Anand & Fan, 2016; Sood et al., 2007). Below is the SPSS output for experience (in years).

**Experience (in years)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | (0-9) | 26 | 8.8 | 8.8 | 8.8 |
| | (10-19) | 162 | 54.9 | 54.9 | 63.7 |
| | (20-29) | 95 | 32.2 | 32.2 | 95.9 |
| | (>=30) | 12 | 4.1 | 4.1 | 100.0 |
| | Total | 295 | 100.0 | 100.0 | |

**Source: IBM SPSS Statistics v.27 Output**

The SPSS output for gender of the participant Indian healthcare professionals showed that nearly 72% of the respondents are male, whereas there are 28% female respondents. The sex-ratio is lower in India. Further, the male-female ratio in medical professions varies.

**Gender**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Male | 214 | 72.5 | 72.5 | 72.5 |
| | Female | 81 | 27.5 | 27.5 | 100.0 |
| | Total | 295 | 100.0 | 100.0 | |

**Source: IBM SPSS Statistics v.27 Output**

Though female admissions to the medicine profession have increased in the current years to 50% it reduces to 1/3 (33.33%) at PG levels (Bhadra, 2011). This is due to cultural reasons prevalent in India where women still struggle to balance work and family (Bhadra, 2011). This also varies between the southern, western, northern, eastern and north-eastern states (Solanki & Kashyap, 2014; Sood & Adkoli, 2000; Supe & Burdick, 2006). The response figure derived from the survey is in close conformity to the Indian circumstances as the data were collected from two northern and eastern states of India by paper mode surveys. The online surveys sent throughout India had few responses. As such the response rates of female doctors (27.5%) with a difference of 5% from normal (33.33%) is in close conformity to the actual circumstances prevailing in the PG medical education environment in the Indian healthcare domain (Bhadra, 2011).

**Educational Qualifications**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | UG | 34 | 11.5 | 11.5 | 11.5 |
| | PG | 261 | 88.5 | 88.5 | 100.0 |
| | Total | 295 | 100.0 | 100.0 | |

**Source: IBM SPSS Statistics v.27 Output**

As the data was collected mostly from private medical centres in urban areas, there were more responses from PG doctors. Most of the urban private practitioners are PGs (Anand & Fan, 2016; Nallala et al., 2015; Rao et al., 2012; Sood et al., 2007). In India, technological awareness amongst specialised healthcare professionals is greater (Ganapathy, 2015a; Meher et al., 2009; Movva, 2013).

**Occupation**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Doctor | 295 | 100.0 | 100.0 | 100.0 |

**Source: IBM SPSS Statistics v.27 Output**

The insignificant responses received from other healthcare professionals were removed as outliers. As such the whole dataset represents 295 doctors (100%). The completed responses included in the dataset were 299 doctors (92%), 11 paramedics (3.38%), seven healthcare administration staff (2.15%), six healthcare technical support staff (1.85%), and two other staff (0.62%), totalling 325 cases. The low response rates of the healthcare professionals other than doctors were removed from the dataset in the outlier detection stage, as these might later present abnormality in the dataset (Andreadis, 2014; Brick & Kalton, 1996; Fink, 2003; Jones & Hidiroglou, 2013; Krishnan et al., 2016; Meade & Craig, 2012; Van den Broeck et al., 2005). Furthermore, four cases from doctors were removed as outliers by using the Mahalanobis distance method, as enumerated earlier in the outliers section, taking the number of doctors to 295.

**Employment**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Public | 40 | 13.6 | 13.6 | 13.6 |
| | Private | 255 | 86.4 | 86.4 | 100.0 |
| | Total | 295 | 100.0 | 100.0 | |

**Source: IBM SPSS Statistics v.27 Output**

The data were mostly collected from private hospitals and medical centres. The reluctance of healthcare professionals to serve in rural areas is one of the reasons for private medical centres in urban areas. Moreover, for the need of practice efficiency, saving time, scheduling appointments, telehealth adoption is more common in private capacities (Dasgupta & Deb, 2008; Ganapathy; Rao et al., 2012; Sood et al., 2007). The insufficient ICT infrastructure and facilities in public hospitals also hinders telehealth adoption in the public sector (Ganapathy; Ganapathy, 2002, 2014).

As the assumptions of collinearity, homoscedasticity and elimination of outliers have been dealt with previously, and following on from descriptive statistics, the next section moves on to exploratory factor analysis and correlation analysis of the extracted factors.

## 7.10 Exploratory Factor Analysis

The previous section established the essential assumptions before conducting further statistical analysis. Nevertheless, as this research on telehealth adoption in the Indian healthcare domain is exploratory, a statistical method known as exploratory factor analysis (EFA) can be employed (Hair et al., 1998). EFA has the ability to identify latent constructs measured by the variables. One of the assumptions made in conducting an exploratory factor analysis is that there exists no a-priori hypotheses. Another assumption for EFA is that there exists insignificant correlations between the independent variables. EFA estimates the factors and underlying constructs that cannot be measured directly (Costello & Osborne, 2005; G. Kootstra, 2004). Factor analysis reduces the dimension of the variables to find a better fit. There are several factor analysis fitting methods to choose from, such as principal axis factoring (PAF) and maximum likelihood (ML). PAF and ML are two extraction methods that interpret the best results, with assumption that the data are normally distributed (Kootstra, 2004). The univariate skewness and kurtosis tests (explained in section 7.8.5) conducted beforehand exhibited that the dataset was not subject to normal distribution. To overcome this shortcoming another statistical method principal component analysis (PCA) can be employed. The difference between EFA and PCA is that in PCA it is assumed the communalities are 1, initially. Specifically, PCA assumes that the total variance of the variables can be accounted for by means of its factors or components, hence the error variance is none. In contrast, factor analysis assumes error variance, in which the communalities have to be estimated. This makes factor analysis more complicated and conservative than PCA. In practical situations, however, it is evident that the solutions generated from PCA have minimal difference from those derived from factor analysis (Field, 2017). Rietveld and Van Hout (1993) further opines that the decrease in difference between PCA and factor analysis is reflected when there is increased number of variables coupled with increase of the magnitudes of the factor loadings.

Due to the non-normal nature of the dataset coupled with the exploratory nature of the research, a PCA was conducted on the dataset, which is described below. Additionally, factor extraction by employing PCA would show construct validity of the composite scale when it is applied to a new context.

### 7.10.1 Principal Component Analysis

One of the preliminary assumptions for PCA is to consider the number of factors to be retained. A rule of thumb, as suggested by Field (2017); Rietveld and Van Hout (1993), is to follow the Guttman-Kaiser rule of retaining only those factors whose eigenvalues are larger than 1. Additionally, the factors which account for about 70%-80% of the variance are to be retained, as are all factors before the breaking point or elbow of the scree plot. Furthermore, low communalities mean the extracted factors accounting for only a small portion of the variance might need to be retained, in order to provide a better account of the variance (Kootstra, 2004; Kootstra, 2004). The sample size is also determining in this case having at least 50 observations and a minimum of five times as many observations as variables (Habing, 2003).

Before conducting the PCA, a parallel analysis was also conducted to assess the number of factors that can be retained. The parallel analysis predicted 12 factors to be retained.

***Table 15 Parallel Analysis***

**Table**
**Parallel Analysis**

| **Root** | **Raw Data Initial Eigenvalues** | **Random Data Means** | **Eigenvalues Prcntyle** |
|---|---|---|---|
| 1 | 12.856 | 2.388818 | 2.477213 |
| 2 | 9.559 | 2.284690 | 2.359467 |
| 3 | 6.246 | 2.210139 | 2.278430 |
| 4 | 5.358 | 2.152367 | 2.204709 |
| 5 | 4.361 | 2.098230 | 2.151474 |
| 6 | 4.116 | 2.046242 | 2.097790 |
| 7 | 3.454 | 1.998027 | 2.038748 |
| 8 | 3.210 | 1.956010 | 1.991057 |
| 9 | 2.522 | 1.914829 | 1.954447 |
| 10 | 2.369 | 1.874423 | 1.913945 |
| 11 | 2.194 | 1.836370 | 1.865160 |
| 12 | 2.065 | 1.797570 | 1.836315 |
| 13 | 1.730 | 1.763699 | 1.792730 |

**Source: Developed for this study from IBM SPSS Statistics v.27 output**

Afterwards the PCA was conducted on IBM SPSS Statistics v26 through the varimax rotation technique. The matrix first retained 19 factors as was specified by the eigenvalues, total variance explained and the scree plot. The final rotated component matrix was obtained after rotating the matrix for 53 times, deleting the variables with small coefficients and negative values one by one. The dimension reduction of the dataset was achieved by retaining only 38 items out of 97 items. Finally, seven factors (including the DV) were retained. When inspecting the measuring variables several new constructs emerged, either by rejecting the original factors or by rearranging the factors into a new one (Ringnér, 2008; Wold et al., 1987). The rotation of the items emerged into seven composite variables which were renamed according to the significance of what they measured (Hair et al., 2006; Ringnér, 2008; Wold et al., 1987).

The KMO measure of sampling adequacy and Barlett's test of sphericity proved to be of significant values. The KMO of .777 is an acceptable measure of sample adequacy and p = .000 denotes the validity of the rotated component matrix (Hair et al., 1998).

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .777 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 7137.270 |
| | df | 703 |
| | Sig. | .000 |

**Source: IBM SPSS Statistics v.27 Output**

The extracted factors were renamed as Healthcare Practices [HP], Healthcare Facilities [HF], Organisational Issues [OI], , State Leadership [SL], Technology Issues [TI], Usefulness [USFL], and the Dependent Variable (DV) Telehealth Adoption [TA (DV)].

*Table 16 Principal Component Analysis*

## Principal Component Analysis

**Rotated Component Matrix[a]**

| Indicators | HP[1] | HF[2] | OI[3] | TA (DV)[4] | SL[5] | TI[6] | USFL[7] |
|---|---|---|---|---|---|---|---|
| HP2 Beneficial to provide preliminary information to the patients | .819 | | | | | | |
| HP10 Prescribe diagnostic reports for the patients | .819 | | | | | | |
| HP6 Referral services for emergency conditions of patients | .772 | | | | | | |
| HP11 Prescribing medicines | .756 | | | | | | |
| HP12 Scheduling appointments, for follow-up | .756 | | | | | | |
| HP13 Monitoring of patients | .754 | | | | | | |
| HP4 Early detection of patient conditions | .737 | | | | | | |
| HP8 Examining cameras | .652 | | | | | | |
| HP7 Information regarding prevention of diseases | .616 | | | | | | |
| HP5 Expedite referrals in rural/remote areas for long-term care patients | .565 | | | | | | |

| | | | | |
|---|---|---|---|---|
| TINTERVIEW 2 Robust ICT infra can be encouraging | .762 | | | |
| HF6 Can lessen the cost of healthcare services | .743 | | | |
| TI8 Usage can increase if the online platforms are easy to use | .717 | | | |
| HF4 Lack of facilities in rural/remote areas | .707 | | | |
| HF5 Distance to the nearest hospital in rural/remote areas | .697 | | | |
| HF3 Providing emergency services in the rural/remote areas | .647 | | | |
| CA8 Useful tool to provide allied healthcare services | | .826 | | |
| CA4 Cater to overseas Indians | | .769 | | |
| OI6 Requirement of organisational policy | | .754 | | |
| TM7 Alternative support solution during natural disasters | | .658 | | |
| TA16 Provide a better understanding of patient profile | | | .758 | |
| TI1 Reliable ICT infrastructure is important | | | .724 | |
| TA15 Going to be an essential part of healthcare services in the near future | | | .717 | |
| HF2 Facilitate promoting nutrition and hygiene in rural/remote areas | | | .691 | |
| OINTERVIEW 2 Additional remuneration is required to provide telehealth services | | | .675 | |
| SL5 Government can promote the benefits of telehealth/online services | | | | .812 |
| SL4 Government can influence the supply for telehealth/online services | | | | .780 |
| SL3 Government can influence the demand for telehealth/online services | | | | .699 |
| HP15 Can be beneficial to provide post-treatment rehabilitation services | | | | .667 |
| PA3 Can be beneficial to promote healthy diets | | | | .648 |

| | | |
|---|---|---|
| TI14 Risk for the patient to get ill advice from quacks posing as HCPs online | .834 | |
| TI13 Validation of doctors' credentials is essential to provide telehealth/online services | .782 | |
| TI12 Lack of ethical standards hinder telehealth/online services usage | .696 | |
| TI11 Hacking of health data hinders telehealth/online services usage | .685 | |
| TI10 Confidentiality of information is necessary to start using telehealth/online services | .651 | |
| TA3 Using telehealth/online services would make it easier to do my job | | .850 |
| TA4 Would increase my job efficiency | | .815 |
| TA7 Facilitate improved health outcomes | | .734 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 7 iterations.

1. **HP** Healthcare Practices
2. **HF** Healthcare Facilities
3. **OI** Organisational Issues
4. **TA (DV)** Telehealth Adoption (Dependent Variable)
5. **SL** State Leadership
6. **TI** Technology Issues
7. **USFL** Usefulness

### 7.10.2 Reliability Analysis of Composites

The internal reliability of the composites was tested by Cronbach's Alpha values which resulted in significant values ranging from **.786** to **.902**. The overall Cronbach's Alpha of the composites stood at **.843** which is a good overall score and establishes the reliability of the constructs (Hair et al., 1998).

***Table 17 Cronbach's Alpha of Composites***

| **Composites** | **No. of Items** | **Cronbach's Alpha** | **No. of Cases** |
|---|---|---|---|
| Overall | 38 | .843 | 295 |
| Healthcare Practices [HP] | 10 | .902 | 295 |
| Healthcare Facilities [HF] | 6 | .839 | 295 |
| Organisational Issues [OI] | 4 | .786 | 295 |
| State Leadership [SL] | 5 | .819 | 295 |
| Technology Issues [TI] | 5 | .835 | 295 |
| Useful [USFL] | 3 | .790 | 295 |
| Telehealth Adoption (DV) [TA] | 5 | .802 | 295 |

**Source: Developed for this study using IBM SPSS Statistics v.27**

### 7.10.3 Chi-Square Test of Independence

The Chi-Square test of independence has been used in this research to examine whether or not the nominal (categorical) variables have a significant relationship. The frequency of each category for three nominal variables (demographic characteristics) is compared to the frequency of the composite variable's categories. The data has been displayed in a table, with each row representing a demographic category and each column representing a composite variable. The relationship between gender, age and experience, in relation to exogenous and endogenous variables, was investigated in this study. This was done using the chi-square test of independence. This tests the null hypothesis statement that there is no relationship between gender, age, experience and the variables (IV and DV). The alternative hypothesis embraces that there is a correlation between gender, age, experience and the variables (IV and DV) (McHugh, 2013; Preacher, 2001; Zibran, 2007). As such, Null hypothesis: Assumes that no relationship exists between the two variables. Alternative hypothesis: Assumes a relationship exists between the two variables. Hypothesis testing is used for the chi-square test of independence in the same way that it is for other tests such as ANOVA, where a test statistic is computed and compared to a critical value. The chi-square statistics' critical value is determined by the level of significance (typically .05) and the degrees of freedom. The formula used to calculate the degrees of freedom for the chi-square is: df = (r-1)(c-1) where r characterizes the number of rows and c represents the number of columns. The null hypothesis can be rejected if the observed chi-square test statistic is greater than the critical value (McHugh, 2013; Preacher, 2001; Zibran, 2007).

*Table 18 Chi-square tests*

**Table**
**Chi-Square Tests**

| | Pearson Chi-Square Asymptotic Significance (2-sided) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Crosstabs** | **HP** | **HF** | **OI** | **SL** | **TI** | **USFL** | **TA** |
| **Age Bracket (in years)** | .000 | .041 | .984 | .036 | .038 | .650 | .016 |
| **Experience (in years)** | .000 | .046 | .445 | .006 | .096 | .489 | .000 |
| **Gender** | .001 | .019 | .014 | .006 | .001 | .097 | .171 |

**Source: Developed for this study using IBM SPSS Statistics v.27**

If Asymptotic Significance (2 - sided) $< 0.05$, the association between two variables is statistically significant, which is clearly the case here. The probability of observing the sample outcome if the variables are independent in the entire population is referred to as significance (abbreviated "p"). In this case, this probability is 0.000. Finally, the null hypothesis, that the variables are independent across the entire population, has been rejected. In this research, it is clearly observed from the table above that almost every exogenous variable has some unique relationship against the demographic variables of age, gender and experience, except in the case of age and experience against OI, experience against TI, age, experience and gender against USFL and gender against TA.

### 7.10.4 Correlation Analysis of the composites

The Pearson product-moment correlation can be used to look for the strength and direction of any linear relationship between two continuous variables. The test generates a coefficient called the Pearson correlation coefficient, denoted as 'r', which measures the strength as well as the direction of any linear relationship between two continuous variables. Its value can range between -1 for a perfect negative linear relationship to +1 for a perfect positive linear relationship. A value of 0 (zero) implies no relationship between the two continuous variables. This test is also known by the Pearson correlation or Pearson's correlation, which are used interchangeably. The p value represents the likelihood that the current result would have been discovered if the correlation coefficient was zero (null hypothesis). If the probability is less than the standard 5 percent, the correlation coefficient is said to be statistically significant ($p > 0.05$). However, it is critical to distinguish between correlation and causation. When two variables are correlated, a causal relationship may or may not exist, and it may be indirect. Correlation can be interpreted as causation only if the variables under investigation provide a logical (biological) basis for such interpretation. The 95% confidence interval (CI) of the Pearson correlation coefficient is the range of values that contains the 'true' correlation coefficient with 95 percent confidence (Altman, 1990; Armitage et al., 2008; Bland, 2015).

Before conducting a correlation analysis, certain assumptions are to be met. The assumptions are dealt with in the previous sections including testing for normality of the data (univariate skewness and kurtosis). Though correlation analysis is robust to non-normal data, it is essential to know whether the data exhibits normality. The Shapiro-Wilk test judges the normality of the data by measuring the null-hypotheses. All the p values of the null hypotheses of the composite factors are significant and support the null-hypotheses. The implication of this is that the alternative hypotheses are rejected. As such the data conforms to non-normality.

***Table 19 Shapiro-Wilk test***

| | Shapiro-Wilk | | |
|---|---|---|---|
| | Statistic | df | Sig. |
| HP | .943 | 295 | .000 |
| HF | .932 | 295 | .000 |
| ORGR | .915 | 295 | .000 |
| SL | .921 | 295 | .000 |
| TI | .887 | 295 | .000 |
| Usefulness | .921 | 295 | .000 |
| TA | .949 | 295 | .000 |

**Source: IBM SPSS Statistics v.27 Output**

Though the data exhibits non-normality, correlation analysis can still be carried out without transforming the dataset, as it is one of the robust methods to endure non-normality of data. Correlation analysis does not assume normality of the data although it does assume both finite variances and covariances (Cohen et al., 2013).

After checking the Cronbach's Alpha scores of the composites, the next step was to find the correlation coefficients to establish the direction of the relationship between the independent variables and the dependent variables. The Pearson correlation denoted as 'r', measures the strength as well as the direction of any linear relationship between two continuous variables. Its value can range between -1 for a perfect negative linear relationship to +1 for a perfect positive linear relationship. The results were bootstrapped over 5,000 samples for deriving the range of values that contains, with a 95% confidence, the 'true' correlation coefficient.

*Table 20 Correlations*

**Correlations**

| | | HP | HF | OI | SL | TI | USFL |
|---|---|---|---|---|---|---|---|
| TA | Pearson Correlation | -.071 | .191** | -.152** | .351** | .015 | .386** |
| | Sig. (2-tailed) | .226 | .001 | .009 | .000 | .799 | .000 |
| | N | 295 | 295 | 295 | 295 | 295 | 295 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Four composites, Healthcare Facilities [HF] Pearson Correlation r=.191 (p<.01, 95% CI .066 to .312), Organisational Issues [OI] Pearson Correlation r= -.152 (p<.01, 95% CI -.281 to -.024), State Leadership [SL] Pearson Correlation r=.351 (p<.01, 95% CI .248 to .448) and Usefulness [USFL] Pearson Correlation r=.386 (p<.01, 95% CI .273 to .498), generated significant correlation values p<.01 with the DV. In contrast, Healthcare Practices [HP] Pearson Correlation=-.071, p>.01 and Technology Issues [TI] Pearson Correlation=.015, p>.01 had an insignificant correlation value p>.01 with the DV.

### 7.10.5 Principal Components Regression (PCR)

Principal components regression is a technique applied for analysing multiple regression data that exhibits multicollinearity. When multicollinearity is present in the data, least squares estimates remain unbiased, but there are large variances. As such, the true value might be distant. Principal components regression reduces the standard errors, adding a degree of bias to the regression estimates. This might account for the net effect to predict more reliable estimates (Hadi & Ling, 1998; Jolliffe, 1986; Massy, 1965). As the first step of regression analysis of the composites, a linear regression model has been developed, followed by a multiple regression model. All the assumptions of conducting the multiple regression were followed with respect to the composites, as was done with the original factors discussed previously.

#### 7.10.5.1 Linear regression Model

After testing the data for multiple regression assumptions, a linear regression model was built up based on the composite factors. This was done to assess the individual linear relationship between the independent variables and the dependent variables and their statistical significance. A simple linear regression evaluates the linear relationship between two continuous variables to forecast a dependent variable value based on the value of an independent variable. More specifically, it allows researchers to: (a) determine whether the linear regression between these two variables is significant statistically; (b) determine how much variation of the DV can be explained by the predictor variables; (c) interpret the direction and extent of any relationship; and (d) determine values of the DV based on different values of the predictor variable. This test is also called bivariate linear regression, but normally referred to as 'linear regression'. Furthermore, the DV is also referred to as the outcome, target or criterion variable and the independent variable as the predictor, explanatory or regressor variable (Montgomery et al., 2012; Weisberg, 2005). The equation for linear regression is depicted by:

$$Y = a + bX$$

where Y is the dependent variable (Y axis), X is the independent variable (X axis), ‘b’ represents slope of the line and ‘a’ reperesents the y-intercept.

Normally, in linear regression, R is the general measure of multiple correlation coefficients. As there is a single independent variable in a simple linear regression, R is merely the (absolute) Pearson correlation coefficient among the dependent variable and the independent variable. It is a measure of the strength of association between the two variables. In contrast $R^2$ is the proportion of variation explained by the model. The $R^2$ value signifies the proportion of variance in the dependent variable that can be explained by the independent variable. Specifically, it is the proportion of variation accounted for by the regression model above and beyond the mean model. $R^2$ has been criticized, but is still considered by some to be a good starting measure to understand the results (Draper & Smith, 1998). Adjusted $R^2$ is the percentage of variation explained by the model in the population. The adjusted $R^2$ value corrects positive bias to provide a value that would be expected in the population. Adjusted $R^2$ is, moreover, an estimate of the effect size (Akossou & Palm, 2013; Harel, 2009; Miles, 2014). In this research study, linear regression was used to predict the outcome variable of Telehealth Adoption [TA] based on the values of the predictor variables of Healthcare Practices [HP], Healthcare Facilities [HF], Organisational Issues [OI], State Leadership [SL], Technology Issues [TI] and Usefulness [USFL]. The linear regression summary of statistically significant or non-significant values is depicted below.

*Table 21 Summary of simple linear regression*

**Table**

**Summary of Simple Linear Regression**[a]

| PCA Factors | R/Beta Value | $R^2$ | Adjusted $R^2$ | df | Sig. | B | t | Sig. |
|---|---|---|---|---|---|---|---|---|
| Healthcare Practices [HP] | .071 | .005 | .002 | [F (1, 293) = 1.473] | .226 | -.077 | -1.214 | .226 |
| Healthcare Facilities [HF] | .191 | .037 | .033 | [F (1, 293) = 11.124] | .001 | .183 | 3.335 | .001 |
| Organisational Issues [OI] | .152 | .023 | .020 | [F (1, 293) = 6.965] | .009 | -.166 | -2.639 | .009 |
| State Leadership [SL] | .351 | .123 | .120 | [F (1, 293) = 41.169] | .000 | .412 | 6.416 | .000 |
| Technology Issues [TI] | .015 | .000 | -.003 | [F (1, 293) = .065] | .799 | .020 | .255 | .799 |
| Usefulness [USFL] | .386 | .149 | .146 | [F (1, 293) = 51.309] | .000 | .330 | 7.163 | .000 |

a. Dependent Variable: Telehealth Adoption

**Source: Developed for this study using IBM SPSS Statistics v.27**

The linear regression proved statistically significant for 3 factors out of the six composite factors. The R/Beta values ranged from .071 to .386 for these six factors depicting individual linear relationship among the predictor variables and the dependent variables. The independent variables Healthcare Facilities [HF], State Leadership [SL] and Usefulness [USFL] yielded significant linear relationships with the criterion variable Telehealth Adoption [TA]. The R and B values obtained in the linear regression model shows that only three factors have significant p values, p<=.001. The independent variables of Healthcare Practices [HP], Organisational Issues [OI], and Technology Issues [TI] yielded insignificant linear relationships with the dependent variable Telehealth Adoption [TA]. The figure below presents the statistically significant linear relationship model of the six independent variables on the dependent variable Telehealth Adoption.

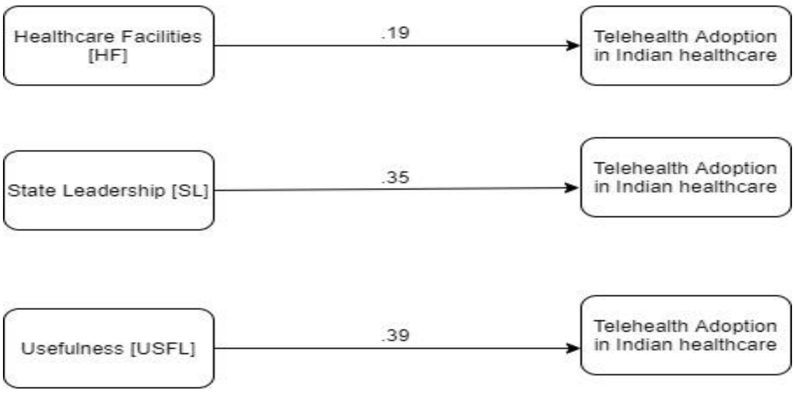



***Figure 59 Simple Linear Regression Model of PCA composites***

The significant linear relationships established by the linear regression model also satisfies the assumption of linearity among the predictor variables and the dependent variable of Telehealth Adoption [TA]. This would prompt development of a multiple regression model, based on the predictor variables, which is discussed in the next section.

#### 7.10.5.2 Multiple Regression Model

The multiple regression equation is depicted by

$$\hat{Y} = b_0 + b_1 X_1 + b_2 X_2 + \ldots + b_p X_p$$

where $\hat{Y}$ represents the predicted or expected value of the DV; $X_1$ through $X_p$ are p distinct predictor variables; $b_0$ represents the value of Y when all of the predictor variables ($X_1$ through $X_p$) = 0; and $b_1$ through $b_p$ are the estimated coefficients of multiple regression. Each of the regression coefficients represent the change in Y relative to a one-unit change in the respective predictor variable. Further, statistical tests can be performed to assess whether each regression coefficient is significantly different from zero. Multiple regression can be applied for fitting a predictive model to an observed dataset of values of the DV and predictor variables. The advantage of the model is that, if additional values of the predictor variables are collected without an accompanying response value, the fitted model can be used to make a prediction of the outcome (DV) (Hadi & Ling, 1998; Jolliffe, 1986; Massy, 1965).

After the demographic characteristics of the dataset were analysed, and the assumptions for linear-regression analysis were met, the dataset was subjected to a multiple-regression for verifying the statistical significances of the composite factors. Initially, the multiple regression was run with all six factors on the dependent variable Telehealth Adoption, in which three factors returned a favourable score ($p<.05$). The factors are Healthcare Facilities [HF], State Leadership [SL] and Usefulness [USFL]. The three predictor multiple regression model then generated a result of $R^2=.23$. The F statistics had degrees of freedom of 3 and 291 [$F(3, 291) = 28.903$], $P = 0.000$ $P < 0.005$. The $R^2$ value suggests that the independent variables are able to explain a variance of 23% of the dependent variable of Telehealth Adoption.

*Table 22 Multiple linear regression model summary*

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .479[a] | .230 | .222 | .54797 |

a. Predictors: (Constant), Usefulness, HF, SL

b. Dependent Variable: TA

**Source: IBM SPSS Statistics v.27 Output**

In a regression model, each term is an estimated parameter that uses 1 degree of freedom. In the multiple regression output below, it can be seen how each term requires a df. There are 294 observations and the three independent variables use a total of 3 degrees of freedom. The output displays the remaining 291 degrees of freedom in residuals (Error). The residual (error) degrees of freedom are the independent pieces of information that are available for estimating multiple regression coefficients. For precise coefficient estimates and powerful hypothesis tests in regression, there have to be many error degrees of freedom, which equates to having many observations for each model term (Henderson & Velleman, 1981; Mendenhall et al., 1996; Walker, 1940). As such, 3 df and 291 error df with an F value of 28.903, $p<.01$, rejects the null hypotheses for the predictors and establishes the model fit.

*Table 23 ANOVA*

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 26.036 | 3 | 8.679 | 28.903 | .000[b] |
| | Residual | 87.379 | 291 | .300 | | |
| | Total | 113.416 | 294 | | | |

a. Dependent Variable: TA

b. Predictors: (Constant), Usefulness, HF, SL

***Source: IBM SPSS Statistics v.27 Output***

The β (beta) value represents the slope of the line between the predictor variable and the dependent variable. Therefore, for the predictor variable Healthcare Facilities [HF], this would mean that for every one unit increase in HF, the dependent variable increases by .111 units (11.1%). Similarly, the rule applies to all the predictor variables (Bryman & Cramer, 2005; Cramer, 2003; Draper & Smith, 1998).

The standard error (SE β) for the unstandardized β (beta) coefficient values are alike standard deviations for a mean. The greater the mean value, the more spread out the points are from the regression line. The more spread out the values are, the less likely that significance will be found. The model for this research depicts SE β ranging from .046 to .064 which represents closer values (Bryman & Cramer, 2005; Cramer, 2003; Draper & Smith, 1998).

Standardized beta (β) coefficient works alike to a correlation coefficient. It may range from 0 to 1 or 0 to -1, which depends on the relationship direction. The relationship is stronger when the value is closer to 1 or -1. Standardized beta (β) can compare the variables to see which is strongest in relationship to DV, since each one of them are on the 0 to 1 scale (Bryman & Cramer, 2005; Cramer, 2003; Draper & Smith, 1998).

In the table below, predictor variable three [USFL] exhibits a relationship, which is the strongest (.315).

The t-test statistic (t), calculated for the individual predictor variable, is used to calculate the p value, which identifies whether or not a predictor variable significantly predicts the DV. The t-test signifies how many times larger the coefficient is than the average error of the values it estimates (Bryman & Cramer, 2005; Cramer, 2003; Draper & Smith, 1998). A significant model may include a non-significant predictor variable. Typically, if $p<.05$, the value is considered significant.

*Table 24 Coefficients*

**Coefficients[a]**

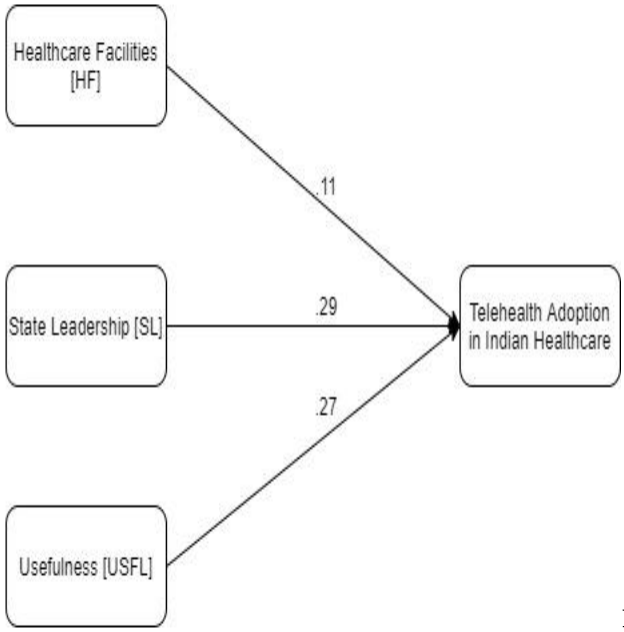
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 1 | (Constant) | 1.207 | .313 | | 3.854 | .000 |
| | HF | .111 | .050 | .116 | 2.205 | .028 |
| | SL | .287 | .064 | .244 | 4.491 | .000 |
| | USFL | .269 | .046 | .315 | 5.910 | .000 |

a. Dependent Variable: TA

**Source: IBM SPSS Statistics v.27 Output**

The multiple regression model for telehealth adoption in India is below. Out of the six composite factors, which were extracted by PCA, only three factors turn out to be statistically significant where $p<.05$.

The final multiple regression model of the composites is represented below.




**$R^2$ = .23**

*Figure 60 Multiple linear regression model of the PCA composites for telehealth adoption in Indian Healthcare*

### 7.11 Conclusion:

The quantitative analysis has conducted parametric tests such as correlation analysis, linear and multiple regression analysis and non-parametric tests such as the chi-square test of independence, univariate skewness and kurtosis and the Shapiro-Wilk test of normality. Additionally, PCA was conducted to explore the factors measured by the survey instrument and a final multiple regression model has been developed. Three factors were found to significantly influence telehealth adoption, which are HF, SL and USFL. TA has obtained an $R^2$ value=.23 which is a moderate effect (Berger, 2003). This section has applied linear and multiple regressions to find out the predictive capacity of the significant factors that can influence telehealth adoption in Indian healthcare. The next chapter will introduce structural equation modelling to overcome the inherent limitations of multiple regression modelling.

# CHAPTER 8 STRUCTURAL EQUATION MODELLING

## 8.1 Chapter Overview

The previous chapter developed a predictive model of telehealth adoption using quantitative data collected from Indian healthcare professionals. The chapter discussed the various demographic characteristics and gradually developed a telehealth adoption model in the Indian healthcare domain. This was achieved by employing several statistical techniques such as correlation analysis, simple linear regression and multiple regression. Further, it assessed various assumptions inherent in performing quantitative analysis, such as testing the normality of the data, various parametric tests and non-parametric tests and collinearity. This current chapter will focus on deploying structural equation modelling (SEM) to determine the predictive relevance of the constructs thus identified. The various first-generation statistical techniques employed in the previous chapter have inherent limitations, which can be overcome by deploying SEM. This chapter will firstly introduce the need to deploy SEM, the two types of SEM generally deployed and justifications for the deployment of PLS-SEM. Finally, this chapter will discuss the measurement model, structural model and the validity of the PLS model, thus developed.

## 8.2 Introduction

The limitations of a multiple-regression, predictive model are that the model does not assume a measurement error, nor does it assume indirect effects (Jeon, 2015). Since the dependent variable in a regression analysis is one, a measurement error occurs. A researcher typically creates a dependent variable by taking the mean of a set of variables. Measurement error is standard when estimating abstract concepts like self-concept, depression levels, or self-esteem, and it affects the predictive power of regression equations. When using SEM, the problem of measurement error can be reduced (Jeon, 2015). Although regression analyses reveal relationships between variables, they do not imply causation. A strong relationship between variables could be caused by several factors, including the influence of unmeasured variables. The results of a regression analysis do not imply that the independent and dependent variables are causally related. Regression analysis can only provide evidence from which readers can draw causal conclusions (Jeon, 2015).

SEM deployment assists in developing an alternative model simultaneously, minimising the limitations of a multiple-regression model. Thus, combining factor analysis with multiple regression analysis, SEM analyses the structural relationship between measured and latent constructs (Astrachan et al., 2014; Hair Jr et al., 2016; Jeon, 2015; Urbach & Ahlemann, 2010). The advantage of using SEM as a multivariate analysis technique is that it estimates the multiple and interrelated dependence in a single analysis. Two types of SEM are generally deployed: covariance-based structural equation modelling (CB-SEM) and variance-based or partial least squares-based structural equation modelling (VB-SEM / PLS-SEM) (Afthanorhan, 2013; Hair Jr et al., 2017).

### 8.3 Covariance-based structural equation modelling (CB-SEM)

The covariance-based structural equation model (CB-SEM) with latent variable accounts for the above limitations of regression analysis (Cheng, 2001; Gefen et al., 2000; Jeon, 2015; Keith, 2014). The two primary components of SEM are measurement equations (via confirmatory factor analysis) and structural equations (by path analysis). Confirmatory factor analysis (CFA), a type of SEM, is widely used in measurement for various purposes. CFA testing can be used to assess designs for construct validation, scale refinement and measurement inconsistency. In each component's analysis, measurement error and structural error are taken into account (Brown & Moore, 2012; Harrington, 2009). Unlike path analysis, which only considers structural errors, SEM takes into account both types of errors. Multiple indicators in SEM have the advantage of allowing the study of relationships between latent variables to be done without being tainted by indicator measurement errors. In this case, the structural error should be taken into account in the model. This is analogous to the proportion of variance that remains unexplained in multiple regression analysis. This is referred to as "residual," "disturbance," "equation error," or "prediction error." Endogenous latent variables are not solely influenced by exogenous latent variables introduced into the model, resulting in structural error. SEM combines and estimates multiple statistical methods, such as confirmatory factor analysis, path analysis and correlation analysis, in a single model (Brown & Moore, 2012; Harrington, 2009).

For decades, CB-SEM has been widely used in the field of social science, and it is still the preferred data analysis method for confirming or rejecting theories through hypothesis testing today. This is particularly the case when the sample size is large, the data is normally distributed and, most importantly, the model is correctly specified. The appropriate variables are chosen and linked together during the process of converting a theory into a structural equation model (Astrachan et al., 2014; Hair et al., 2012; Hair Jr et al., 2017; Hair Jr et al., 2014; Henseler et al., 2014; Rigdon et al., 2017; Ringle et al., 2012; Thakkar, 2020). However, many industry practitioners and researchers point out that finding a data set that meets these criteria is frequently difficult. Furthermore, the research goal could be exploratory, implying limited knowledge about the relationship of the variables. In this case, the researchers should consider PLS (Hair Jr et al., 2017). The primary software programmes for deploying CB-SEM are IBM SPSS Amos v.27 (Analysis of Moment Structures), LISREL (Linear Structural Relations), EQS (Equation Systems) and Mplus (Byrne, 2013; Kline, 1998). Open-source software packages such as Lavaan and OpenMx, which runs within the 'R' statistical programming environment, are also available (Boker et al., 2011; Rosseel, 2012).

### 8.4 Variance-based structural equation modelling (VB-SEM / PLS-SEM)

PLS is a soft modelling approach to SEM that makes no assumptions about data distribution (Hair et al., 2011). When the following circumstances exist PLS-SEM becomes a viable alternative to CB-SEM (Astrachan et al., 2014; Hair Jr et al., 2017; Rigdon et al., 2017),:

1. There is insufficient sample size.

2. There is a dearth of theory to support applications.

3. Prediction accuracy is critical.

4. There is no way to ensure that the model specification is correct.

It should be noted that PLS-SEM is not appropriate for all types of statistical analysis. Researchers should also be aware of PLS SEMs limitations (Astrachan et al., 2014; Hair Jr et al., 2017; Rigdon et al., 2017) such as:

1. High-valued structural path coefficients are required when the sample size is small.

2. If not handled properly, there will be a multicollinearity problem.

3. Because arrows are always single-headed, it cannot model undirected correlation.

4. Incomplete consistency in latent variable scores may result in incorrect component estimation, loadings and path coefficients.

5. It may result in large mean square errors when estimating path coefficient loading.

Despite these disadvantages, PLS is useful for structural equation modelling in applied research projects, especially when the number of participants is limited and the data distribution is skewed (Wong, 2011). PLS-SEM has been applied in many fields, including leadership (Bass et al. (2003), international marketing (Henseler et al. (2009), group and organisation research (Sosik et al. (2009), management information systems (Chin et al. (2003) and strategic management (Hulland (1999).

The Information Systems (IS) discipline studies socioeconomic systems defined by the interaction of hardware and software and individuals, groups and organisations (Urbach & Ahlemann, 2010). IS research, for example, frequently addresses issues such as technology adoption, acceptance and success, as well as the conditions that allow these to occur (Urbach & Ahlemann, 2010). In this research, the determinants of telehealth adoption in Indian healthcare were analysed, as there have been limited studies on the topic, as is evident from the literature review. In this study, partial least squares structural equation modelling (PLS-SEM) in telehealth adoption research was employed, as it can help researchers incorporate more realistic assumptions and better measurements.

PLS-PM was developed as a predictive modelling method (Rönkkö & Evermann, 2013) in the 1960s and 1970s. It is a structural equation modelling (SEM) technique similar to the covariance-based SEM techniques used by LISREL, EQS and IBM SPSS Amos (Chin & Newsted, 1999). It is a variance-based structural equation modelling (SEM) system of independent and response variables that is a substitute to ordinary least squares regression (OLS), canonical correlation and covariance-based structural equation modelling (SEM) (Garson, 2016). The partial least squares (PLS) algorithm is becoming increasingly popular in information systems research as well as other fields such as marketing (Albers, 2010). As a result, in this study, PLS is used to test both the measurement model (relationships between indicators and their corresponding constructs) and the structural model (relationships between constructs) (Gil-Garcia, 2008), as well as to verify how the data fits the model. While the results of OLS regression may resemble those of PLS (Temme et al., 2006), PLS-SEM models are path models in which some variables may be influenced by others while remaining causes of variable change later in the hypothesised causal sequence (Garson, 2016).

Mode A reflective models have long been the industry standard for structural equation modelling, whereas formative models (Mode B) have long been the industry standard for partial least squares modelling (Garson, 2016). Given that the indicators used to measure the latent variables in this study were highly correlated and interchangeable, they were considered reflective. Their reliability and validity were thoroughly investigated by relevant tests (Hair Jr et al., 2016; Petter et al., 2008), resulting in the reflective model being chosen as most appropriate (Hair Jr et al., 2016; Petter et al., 2007).

The primary software programmes used for deploying PLS-SEM are SmartPLS, ADANCO and WarpPLS (Henseler, 2020; Kock, 2015; Ringle et al., 2015) and open-source software as semPLS which runs within the 'R' statistical programming environment (Monecke & Leisch, 2012). The SmartPLS software (Ringle et al., 2015) has been used to deploy PLS-SEM in this research.

### 8.4.1 Model Development

A review of the literature on telehealth and ICT adoption in healthcare domains worldwide, was undertaken to establish a conceptual framework for this study. Technology-Organisation-Environment Model (TOE) (Depietro et al., 1990) has been tested in organisational settings in various domains of ICT adoptions including healthcare. TOE is a comprehensive framework (Hu et al., 2002) and yields a consistent conclusion or results, regarding ICT adoption in the healthcare and other domains. This is supported by the research of (Ahmadi et al., 2015; Alaboudi et al., 2016; Brancheau & Wetherbe, 1990; Bretschneider, 1990; Cooper & Zmud, 1990; Fichman, 1992; Ghani & Jaber, 2015; Kimberly & Evanisko, 1981; Lian et al., 2014; Zmud, 1982). The different knowledge and technological barriers found through literature review (Adamson, 2016; Faber et al., 2017; Paul et al., 1999; Tanriverdi & Iacono, 1998; Zailani et al., 2014) are well represented through the TOE framework.

Since the study aims to identify the different drivers and barriers of telehealth technology adoption in an organisational setting, the TOE framework adapted from Depietro et al. (1990); Hu et al. (2002) assisted modification and creation a new theoretical framework for telehealth technology adoption in the Indian healthcare domain. The different constructs of the TOE framework are ease of use, technological safety, service benefits, service risks, collective attitude of healthcare staff, organisational policies and management and service needs (Hu et al., 2002).

The themes formulated for the conceptual framework to study Indian telehealth adoption are Technology, Organisation, Environment, Knowledge, Innovation and Healthcare Specific (Chowdhury et al., 2019).

The framework was developed after analysing the qualitative interviews in three stages: manual analysis, Leximancer coding and NVivo coding. Manual analysis and Leximancer coding yielded some a-priori codes which were helpful in analysing the data through NVivo. The themes were divided into drivers and barriers and consist of several concepts or items which would become the basis of measurement of the perceived constructs. The final coding revealed a framework consisting of meso, macro and micro level themes (Bronfenbrenner, 1992).

### 8.4.2 Measurement Model Specification

The initial measurement model has been built up from the hypotheses generated from the literature review, qualitative analysis and quantitative analysis. It has been found that the constructs of the TOE framework, which are technology, organisation and environment, have a flexible ability to predict ICT adoption in different healthcare environments. The literature review and qualitative analysis has added another three constructs, of knowledge, innovation and healthcare-specific, to the framework. A survey was developed based on these hypotheses, and subsequently, quantitative data were collected in from the Indian HCPs. In the later stage, various quantitative analysis techniques were deployed and it was found that the collected data have non-normal distribution patterns. PLS-SEM is a non-parametric test and is robust against non-normal data (Cheng, 2001; Hair Jr et al., 2017).

The steps followed for the deployment of PLS-SEM as propounded by the PLS-SEM experts, Avkiran (2018); Hair Jr et al. (2016); Hair Jr et al. (2014), are as follows:

a) An initial measurement model (outer model) is developed from hypotheses.

b) The measurement model is assessed for confirming the factors.

c) The structural model (inner model) is developed and assessed for inner and outer model evaluation.

d) The model is assessed for significance.

After the development of the PLS model drawn from the hypotheses derived from the literature review and qualitative analysis input, further hypotheses have been drawn from an exploratory factor analysis (principal component analysis). Thus, the next section will deal with a model created deploying PLS-SEM with new constructs derived from the PCA.

### 8.4.3 Measurement Model Specification PCA Components

A measurement model has been conceived from the hypotheses generated from the Principal Component Analysis (PCA). A Shapiro-Wilk test was conducted to test the nature of the dataset. The Shapiro-Wilk test judges the normality of the data by measuring the null hypotheses (Jeon, 2015; Keith, 2014; Stevens, 2012). All the p values of the original factors' null hypotheses were significant and accepted the null hypotheses. The implication of this is that the alternative hypotheses are rejected. As such, the data conforms to non-normality. Due to the non-normal nature of the dataset, coupled with the research being exploratory, a PCA (EFA) was conducted on the dataset to derive relevant factors with adequate factor loadings. Additionally, factor extraction by employing PCA would show the validity of the composite scale's construct when applied to a new context. According to Urbach and Ahlemann (2010), unidimensionality cannot be measured directly with PLS but can be assessed using exploratory factor analysis (EFA). As a result, the goal of the EFA (in this research PCA) was to establish the convergence of measurement items to the corresponding constructs as well as each item loading with a high coefficient on one factor alone, with the factor being the same for all items that are supposed to measure it (Urbach & Ahlemann, 2010).

Given that the data was collected from only few states in India, common method variance (CMV) could be an issue in this study. As a result, various approaches were used during the post-collection statistical analysis to detect CMV, as suggested by Podsakoff et al. (2003). According to Chang et al. (2010), the Harman's single factor test was performed in SPSS (in SPSS, through "Analyze" – "Dimension reduction" – "Options: Extraction – Fixed Number of factors = 1, Rotation – Method") (PCA). The results showed that only one factor explained half (14.83%) of the variance, very well meeting the acceptable threshold and avoiding the threat that CMV imposes on empirical studies (Chang et al., 2010).

Further, according to the guidelines of Cain et al. (2017); Kim and White (2004); Liu (2013), univariate and multivariate skewness and kurtosis was calculated using Web Power software (Zhang & Yuan, 2018). The outcome can be found at https://webpower.psychstat.org/models/kurtosis/results.php?url=19aaa60fe0cef2f379dcbfc7dbd1bbb3. The results of Mardia's multivariate skewness and kurtosis analysis (Mardia, 1970) suggested that the data collected was not multivariate normal, as indicated by Mardia's multivariate skewness ( = 10.543, $p= 0.000$ $p<0.05$) and Mardia's multivariate kurtosis ( = 61.811, $p=.363$ $p> 0.05$). The skewness showed that that the dataset is moderately skewed. The kurtosis value showed that the dataset has lighter tails than a normal distribution (Groeneveld & Meeden, 1984; Hair et al., 2006; Joanes & Gill, 1998). The univariate skewness and kurtosis analysis, conducted in the previous chapter, indicated the same. As a result, SmartPLS (Ringle et al., 2015) was used in this research; a non-parametric analysis software for SEM (PLS method).

The PCA generated seven factors (including the dependent variable Telehealth Adoption [TA]). The indicators were reassessed and the factors were renamed accordingly. The hypotheses formed after a careful look at the indicators are as follows. The justifications for forming the hypotheses are outlined in Chapter 5, Qualitative Data Analysis.

**$H_1$** Healthcare Practices (HP) act as enablers for telehealth adoption in Indian healthcare

**$H_2$** Healthcare Facilities (HF) act as enablers for telehealth adoption in Indian healthcare

**$H_3$** Organisational Issues (OI) act as a barrier for telehealth adoption in Indian healthcare

**$H_4$** State Leadership (SL) acts as a barrier for telehealth adoption in Indian healthcare

**$H_5$** Technology Issues (TI) act as barriers for telehealth adoption in Indian healthcare

**$H_6$** Usefulness (USFL) acts as an enabler for telehealth adoption in Indian healthcare

### 8.4.4 PLS-SEM Results

The measurement model (Fig. 8.5) is developed for an initial evaluation in SmartPLS (v. 3.3.3) (Ringle et al., 2015). Afterwards, the measurement model was subject to a PLS algorithm run. The resultant model displayed the outer loadings as well as the inner path coefficients. The initial measurement model is displayed below.

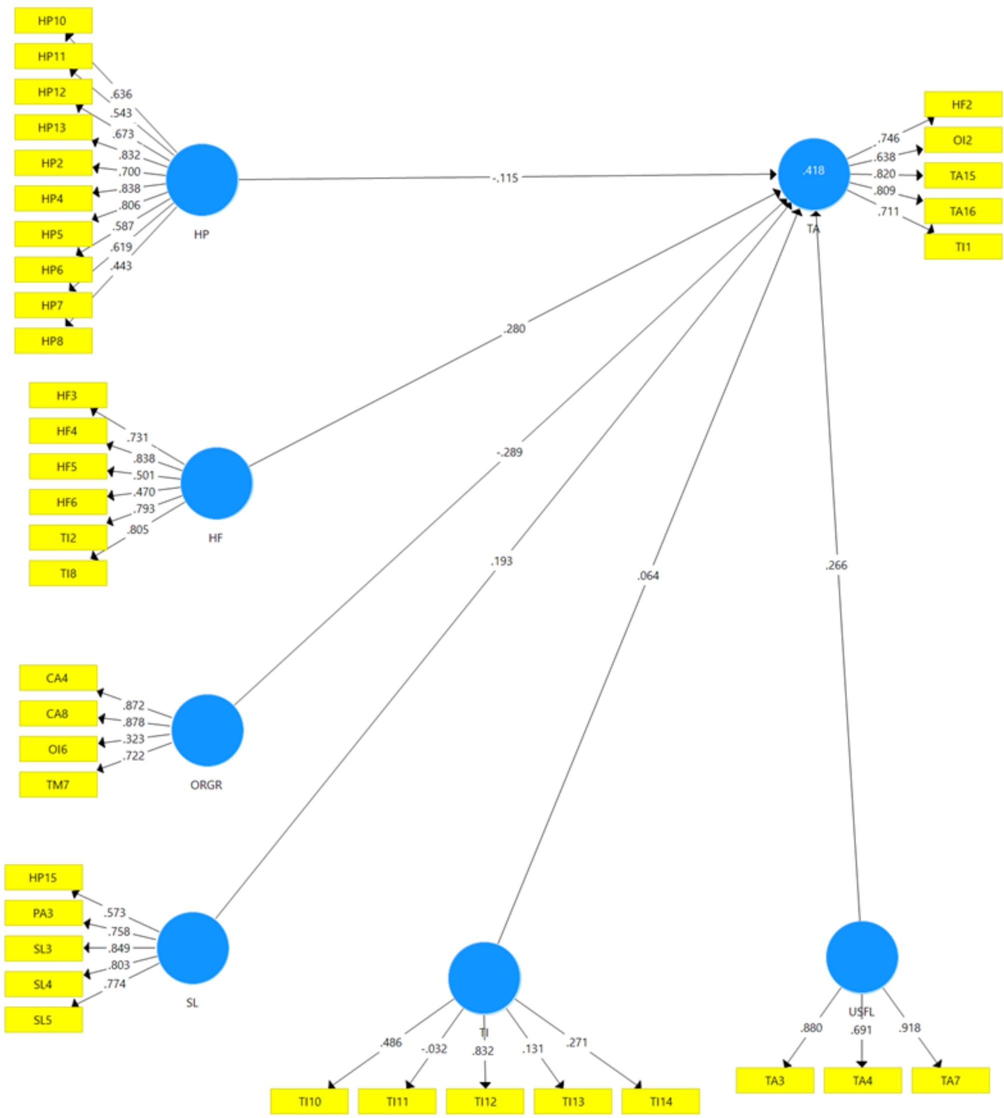



***Figure 61 Initial Measurement Model showing outer loadings and inner path coefficients***

Thereafter, items with loadings below .7 were removed one by one to increase the model reliability (internal consistency, convergent and discriminant validity) for the measurement model (Stevens 1996; Hair et al 2005 p 107; Hulland 1999). The range of factor loadings for the measurement model indicator loadings ranged from .482 to .917 whereby internal consistency, convergent and discriminant validity stood at acceptable levels. Fifty percent of the PCA indicators were removed to achieve acceptable measurement model.

*Table 25 Results summary for measurement model*

**Table**

**Results Summary for Measurement Model**

| **Latent Variables** | **Indicators** | **Loadings** | **Indicator Reliability** | **Cronbach's Alpha (α)** | **Dijkstra–Henseler's rho_A (ρA)** | **Composite Reliability** | **Average Variance Extracted (AVE)** | **Discriminant Validity** |
|---|---|---|---|---|---|---|---|---|
| **HF** | HF3 | .731 | .534 | .848 | .715 | .853 | .502 | YES |
| | HF4 | .839 | .704 | | | | | |
| | HF5 | .514 | .264 | | | | | |
| | HF6 | .482 | .232 | | | | | |
| | TINTERVIEW 2 | .794 | .630 | | | | | |
| | TI8 | .806 | .650 | | | | | |
| **SL** | SL3 | .850 | .723 | .820 | .868 | .869 | .573 | YES |
| | SL4 | .801 | .642 | | | | | |
| | SL5 | .770 | .593 | | | | | |
| | HP15 | .576 | .332 | | | | | |
| | PA3 | .760 | .578 | | | | | |
| **TA [DV]** | TA15 | .801 | .642 | .802 | .813 | .863 | .559 | YES |
| | TA16 | .804 | .646 | | | | | |
| | HF2 | .764 | .584 | | | | | |
| | OINTERVIEW 2 | .661 | .437 | | | | | |
| | TI1 | .699 | .489 | | | | | |
| **USFL** | TA3 | .880 | .774 | .799 | .960 | .873 | .699 | YES |
| | TA4 | .693 | .480 | | | | | |
| | TA7 | .917 | .841 | | | | | |

Items removed: for Measurement Model 2, 50% of the PCA indicators were removed to achieve acceptable measurement model

### 8.4.5 Measurement model evaluation

The statistical criteria as suggested by Avkiran (2018); Hair et al. (2012); Hair Jr et al. (2016) was followed for assessment of the reflective measurement models. The criteria suggested by the above-mentioned authors for reflective measurement model evaluation are internal consistency, indicator reliability, convergent validity and discriminant validity.

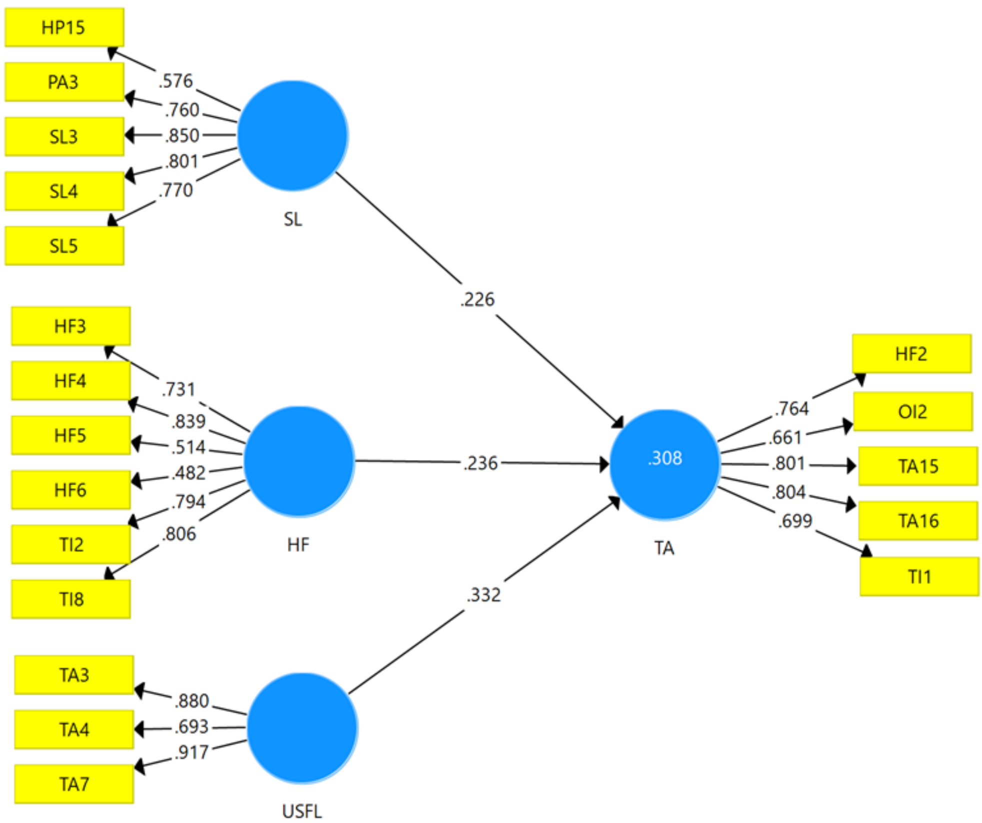



*Figure 62 Final Measurement Model showing the path coefficients, outer loadings and $R^2$*

### 8.4.6 Internal Consistency

Composite reliability, according to Avkiran (2018); Hair et al. (2012); Hair Jr et al. (2016); Hair Jr et al. (2014), is a better measure of internal consistency because it avoids the underestimation seen with Cronbach's alpha and accommodates the differences in indicator reliabilities expected by PLS-SEM. A composite reliability of .708 or higher is desirable, but in exploratory research .6 is considered acceptable (Hair et al., 2012) but values above 0.95 indicate redundancy (Hair Jr et al., 2016). Only the reflective measurement model is concerned with composite reliability. Composite reliability is also known as Dillon–Goldstein's ρ or Jöreskog's ρ (Benitez et al., 2020). The composite reliability in this research varies from .853 to .873 for the measurement model and within the desirable range.

### 8.4.7 Indicator Reliability

Outer loadings greater than 0.7 are preferable (Hair et al., 2011; Hair Jr et al., 2016). The square of this standardised outer loading represents communality, or how much variation in the indicator can be explained by the endogenous construct, and 1 minus communality represents measurement error variance (Avkiran, 2018). However, Hair Jr et al. (2016) claim that outer loadings as low as .4 are acceptable in exploratory research. Further, the authors suggested that outer loadings between .4 and .7 can be removed if this leads to an improvement in composite reliability and average variance extracted (AVE). Again, if the reflective indicator is less than .4, it can be removed (at the very least, all remaining loadings should be statistically significant) (Avkiran, 2018). In this research, 19 indicators (50%) were removed out of the 38 indicators derived from PCA, which improved the composite reliability, and AVE, to the desired levels.

### 8.4.8 Convergent Validity

It is preferable to have an average variance extracted (AVE) greater than .5. This ratio indicates that the latent variable accounts for more than 50% of the reflective indicators' variance (Hair et al., 2011; Hair Jr et al., 2016). AVE affects only the reflective measurement model. Higher loadings in a narrow range indicate that all items explain the underlying latent construct, indicating convergent validity (Hair Jr et al., 2016). The AVE ranged from .502 to .699 for the measurement model.

### 8.4.9 Discriminant Validity

Hair Jr et al. (2016) suggested that an indicator's outer loadings on a latent construct should be higher than all its cross-loadings, with other latent constructs to satisfy discriminant validity. The authors suggested another method of establishing discriminant validity where the square root of the AVE of each latent construct should be higher than its highest correlation with any other latent construct (Hair Jr et al., 2016). This is known as the Fornell-Larcker criterion. In this research, the cross-loadings and the Fornell-Larcker criterion was well satisfied for the measurement model. Tables 9.4 & 9.5 show the cross-loadings and the Fornell-Larcker criterion of the measurement model, respectively.

*Table 26 Cross loadings measurement model*

**Table**

**Cross Loadings Measurement Model**

| | HF | SL | TA | USFL |
|---|---|---|---|---|
| HF2 | 0.331 | 0.303 | 0.764 | 0.364 |
| HF3 | 0.731 | 0.064 | 0.213 | -0.092 |
| HF4 | 0.839 | 0.322 | 0.292 | 0.089 |
| HF5 | 0.514 | -0.030 | 0.017 | 0.049 |
| HF6 | 0.482 | 0.041 | -0.097 | 0.070 |
| HP15 | 0.400 | 0.576 | 0.096 | 0.116 |
| OI2 | 0.267 | 0.165 | 0.661 | 0.269 |
| PA3 | 0.066 | 0.760 | 0.327 | 0.288 |
| SL3 | 0.346 | 0.850 | 0.401 | 0.310 |
| SL4 | 0.245 | 0.801 | 0.305 | 0.212 |
| SL5 | 0.222 | 0.770 | 0.210 | 0.047 |
| TA15 | 0.109 | 0.378 | 0.801 | 0.404 |
| TA16 | 0.273 | 0.318 | 0.804 | 0.299 |
| TA3 | 0.106 | 0.247 | 0.301 | 0.880 |
| TA4 | -0.039 | 0.174 | 0.182 | 0.693 |
| TA7 | 0.111 | 0.280 | 0.471 | 0.917 |
| TI1 | 0.285 | 0.286 | 0.699 | 0.203 |
| TI 2 | 0.794 | 0.152 | 0.249 | 0.188 |
| TI8 | 0.806 | 0.391 | 0.201 | 0.101 |

*Table 27 Fornell-Larcker Criterion Measurement Model*

**Table**

**Fornell-Larcker Criterion Measurement Model**

| | HF | SL | TA | USFL |
|---|---|---|---|---|
| HF | 0.709 | | | |
| SL | 0.304 | 0.757 | | |
| TA | 0.336 | 0.394 | 0.748 | |
| USFL | 0.093 | 0.289 | 0.420 | 0.836 |

Recent authors such as Benitez et al. (2020) on PLS-SEM has suggested another alternative method known as heterotrait-monotrait ratio which overcame the Fornell-Larcker criteria's consistent factor loading estimates (Henseler et al., 2014; Ringle et al., 2012). Henseler et al. (2015) suggested that HTMT can be examined to see if it is significantly less than 1 or less than other smaller values, such as .85 or .90. In this research, the measurement model exhibits HTMT ratios lower than .85.

*Table 28 HTMT Ratio Measurement Model*

**Table**

**HTMT Ratio Measurement Model**

| | HF | SL | TA | USFL |
|---|---|---|---|---|
| HF | | | | |
| SL | 0.371 | | | |
| TA | 0.311 | 0.427 | | |
| USFL | 0.165 | 0.312 | 0.462 | |

Thus, after satisfying the three criteria of discriminant validity (cross-loadings, Fornell-Larcker criteria, and HTMT), it can be concluded that the measurement model has achieved discriminant validity.

The measurement model has satisfied the evaluation criteria of the outer model as suggested by Benitez et al. (2020); Hair et al. (2011); Hair et al. (2012); Hair Jr et al. (2016); Hair Jr et al. (2014); Marcoulides et al. (2009). The following section will evaluate the inner model, or the structural model, as specified by PLS experts such as Hair Jr et al. (2016); Henseler et al. (2014), and others.

## 8.5 Structural Model

The statistical criteria as suggested by Avkiran (2018); Hair et al. (2012); Hair Jr et al. (2016) was followed for assessment of the structural models. The criteria suggested by the above-mentioned authors for inner model evaluation are assessing VIF value, using bootstrapping to assess the significance of path coefficients, $R^2$, effect size $f^2$, and blindfolding. The variance inflation factor (VIF) reflects collinearity among indicators, which inflates standard errors and variances. Hair Jr et al. (2016) suggest VIF values of the indicators higher than 0.20 and lower than 5. In this research the structural model exhibits VIF values 1.359 to 2.091. Thus, the VIF values of the structural model are within the suggested range.

*Table 29 Outer and inner VIF values for structural model*

**Table**

**Outer VIF values Structural Model**

| Indicators | VIF |
|---|---|
| HF2 | 1.494 |
| HF3 | 1.487 |
| HF4 | 1.873 |
| HF5 | 1.762 |
| HF6 | 1.873 |
| HP15 | 1.359 |
| OI 2 | 1.387 |
| PA3 | 1.506 |
| SL3 | 1.838 |
| SL4 | 1.820 |

| | |
|---|---|
| SL5 | 1.838 |
| TA15 | 1.920 |
| TA16 | 1.921 |
| TA3 | 2.237 |
| TA4 | 1.542 |
| TA7 | 1.833 |
| TI1 | 1.481 |
| TIN 2 | 2.091 |
| TI8 | 1.936 |

**Table**

**Inner VIF values Structural Model**

| **Indicators** | **HF** | **SL** | **TA** |
|---|---|---|---|
| HF | | | 1.102 |
| SL | | | 1.192 |
| TA | | | |
| USFL | | | 1.091 |

$R^2$ has a value between 0 to 1, with a higher value indicating greater predictive accuracy. $R^2$ values greater than 0.67 indicate high predictive accuracy, $R^2$ values between 0.33 and 0.67 indicate moderate effect, R2 values between 0.19 and 0.33 indicate low effect, and $R^2$ values less than 0.19 indicate unacceptable predictive accuracy (the exogenous variables inability to explain the endogenous variable), according to Chin (2010a, 2010b); Hair Jr et al. (2016); Henseler et al. (2014). A $Q^2$ value greater than zero for a specific reflective endogenous latent variable indicates the path model's predictive relevance for a particular dependent construct (Hair et al., 2016).

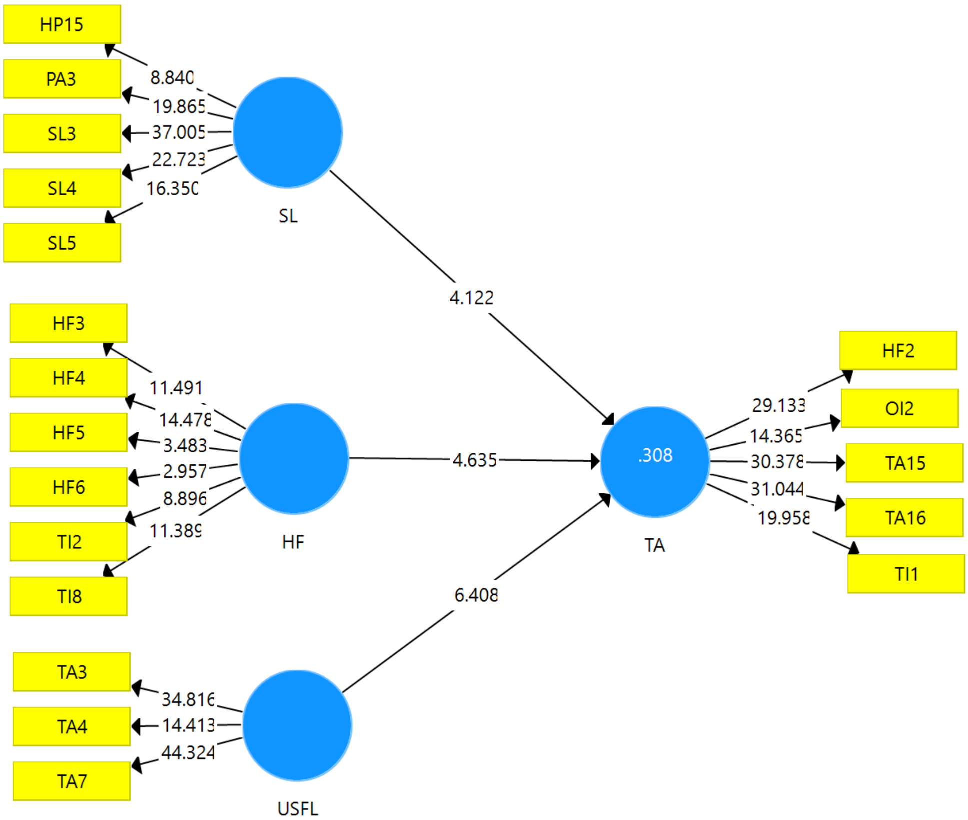



*Figure 63 Structural Model 2 showing the t values*

The structural model has $R^2$ value of TA = .308, indicating a low but very close to moderate effect. The path coefficients have achieved significant p values in bootstrapping over 5000 samples as suggested by Hair et al. (2011); Hair Jr et al. (2016). Further, the effect size ($f^2$) for the model has achieved significant confidence intervals (CI) and p values after bootstrapping. The $Q^2$ value is TA= .161 for the structural model.

*Table 30 Bootstrapped path coefficients p values, bootstrapped $f^2$ and CI, and $Q^2$*

**Table**

**Bootstrapped path coefficient p values Structural Model**

| | Original Sample (O) | Sample Mean (M) | Standard Deviation (STDEV) | T Statistics (\|O/STDEV\|) | P Values |
|---|---|---|---|---|---|
| HF -> TA | 0.236 | 0.251 | 0.051 | 4.635 | 0.000 |
| SL -> TA | 0.226 | 0.227 | 0.055 | 4.122 | 0.000 |
| USFL -> TA | 0.332 | 0.335 | 0.052 | 6.408 | 0.000 |

**Table**

**Bootstrapped effect size ($f^2$) p values Structural Model**

| | Original Sample (O) | Sample Mean (M) | CI 2.5% | CI 97.5% | Standard Deviation (STDEV) | T Statistics (\|O/STDEV\|) | P Values |
|---|---|---|---|---|---|---|---|
| HF -> TA | 0.073 | 0.088 | .038 | .171 | 0.033 | 2.180 | 0.029 |
| SL -> TA | 0.062 | 0.068 | .017 | .142 | 0.032 | 1.912 | 0.056 |
| USFL -> TA | 0.146 | 0.157 | .070 | .269 | 0.053 | 2.772 | 0.006 |

**Table**

**Construct cross-validated redundancy**

| | **SSO** | **SSE** | **$Q^2$ (=1-SSE/SSO)** |
|---|---|---|---|
| HF | 1770 | 1770 | |

| | | | |
|---|---|---|---|
| SL | 1475 | 1475 | |
| TA | 1475 | 1236.888 | 0.161 |
| USFL | 885 | 885 | |

PLS-SEM deployment has helped to form a statistical decision regarding accepting or rejecting the hypotheses tested through PLS-SEM. The hypotheses accepted and rejected are shown in Table 31 below:

***Table 31 Hypotheses accepted and rejected***

| **Constructs** | **Alternative Hypotheses** | **Statistical Decision** |
|---|---|---|
| Healthcare Practices (HP) | **$H_1$** Healthcare Practices (HP) act as enablers for telehealth adoption in Indian healthcare | **$H_1$** Rejected |
| Healthcare Facilities (HF) | **$H_2$** Healthcare Facilities (HF) act as enablers for telehealth adoption in Indian healthcare | **$H_2$** Accepted |
| Organisational Issues (OI) | **$H_3$** Organisational Issues (OI) act as barriers for telehealth adoption in Indian healthcare | **$H_3$** Rejected |
| State Leadership (SL) | **$H_4$** State Leadership (SL) acts as a barrier for telehealth adoption in Indian healthcare | **$H_4$** Accepted |
| Technology Issues (TI) | **$H_5$** Technology Issues (TI) act as barriers for telehealth adoption in Indian healthcare | **$H_5$** Rejected |
| Usefulness (USFL) | **$H_6$** Usefulness (USFL) acts as an enabler for telehealth adoption in Indian healthcare | **$H_6$** Accepted |

Thus, while the alternative hypotheses of SL, HF and USFL are accepted, the validity of these constructs and their effect on telehealth adoption in Indian healthcare may be perceived to be statistically significant.

## 8.6 Post-Hoc Analysis

In keeping with previous research, a post-hoc analysis, namely importance performance matrix analysis (IPMA), is used to determine telehealth adoption implications (Samar; Rahi, Khan, and Alghizzawi 2020; Samar Rahi et al. 2019). The IPMA estimates the importance and performance of the constructs by rescaling the construct scores from 0 to 100. (Hair et al. 2016; Samar Rahi, Abd.Ghani and Hafaz Ngah 2019). When it comes to adopting telehealth in the Indian healthcare, the findings show that SL is the most critical factor in determining telehealth adoption. Also, due to good quadrant values and the higher positive side, HF and USFL play a sufficient role in predicting the willingness of HCPs to use telehealth services. USFL had the highest performance-index values, but it is still high on the importance index though lower than SL and HF. The IPMA map, shown in Figure 64, depicts the importance and performance of the constructs. The IPMA map clearly shows that the most crucial factor in determining HCP intent to adopt telehealth services was SL. This implies that State Leadership has a vital role to play in developing healthcare facilities. Further, HF and USFL also play a significant role in predicting telehealth adoption in the Indian context.

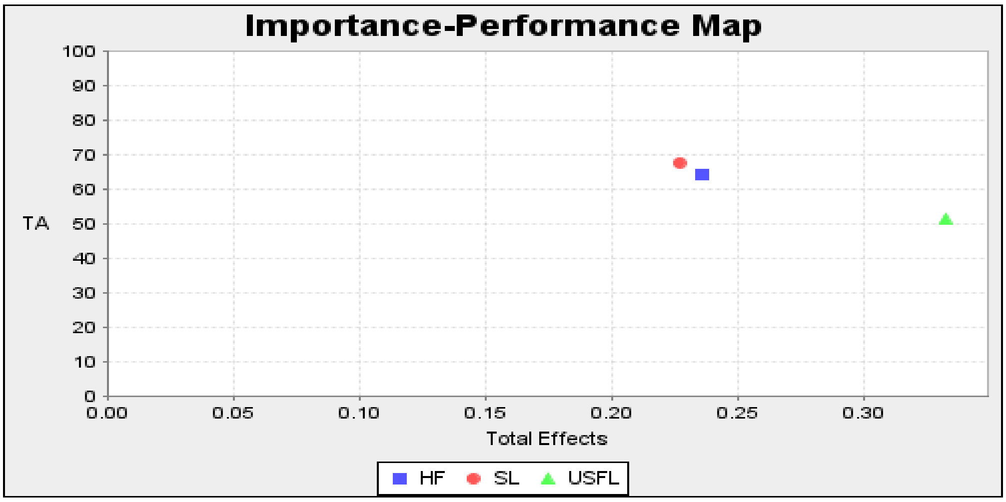



*Figure 64 Importance-Performance Map*

## 8.7 Model Conclusion

This research study on telehealth adoption in India attempted to explore the determinants of telehealth adoption in the Indian healthcare domain. Results indicate that State Leadership plays an important role and the results suggest that it can play a major role in the successful adoption of telehealth. In the context of developing an integrated telehealth system, the concept of patient empowerment has previously been investigated (Suter et al. 2011). The state leadership's role in patient empowerment is widely acknowledged. In addition, gaining knowledge can help patients in the long run (Standing et al. 2014). Further, the lack of healthcare facilities, including physical infrastructure, ICT infrastructure and shortage of healthcare professionals can be enough motivation for HCPs to adopt telehealth. Moreover, the inherent usefulness of telehealth has been established in the Indian context, reflecting conformity to other studies.

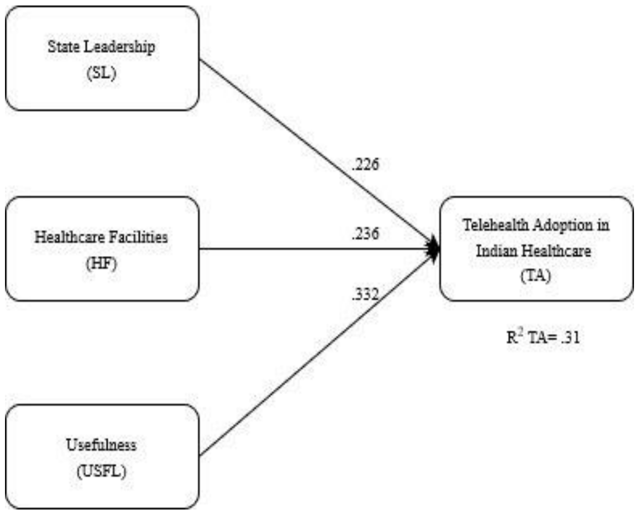



***Figure 65 Final PLS-SEM predictive model depicting the determinants of telehealth adoption in Indian Healthcare***

According to the qualitative findings and literature, the government (State Leadership in this research) may play a role in promoting patient awareness and the use of telehealth for improved population health outcomes (Zailani et al. 2014; Dinesen et al. 2016). The model further highlighted the usefulness and lack of healthcare facilities as the enablers of telehealth adoption. The State Leadership construct reflects the role of the government in developing practical policies for telehealth implementation. The resultant model is depicted in Figure 65.

## 8.8 Deploying Confirmatory Factor Analysis (CFA) and Covariance-based Structural Equation Modelling (CB-SEM)

This research study on telehealth adoption in Indian healthcare has analysed the quantitative data employing various parametric and non-parametric statistical methods. Predictive models have been created with linear and multiple regression, and by deploying structural equation modelling based on partial least squares. In this section, the predictive models will be further confirmed with confirmatory factor analysis (CFA) and covariance-based structural equation modelling (CB-SEM). This research study will employ the IBM SPSS Amos v.27 as the software for deployment of CFA and CB-SEM. Earlier, an exploratory factor analysis (PCA method) was done, and the resultant hypotheses were used to further confirm the constructs, analyse variances between the constructs, and analyse the path coefficients between the exogenous and endogenous variables (PLS-SEM). In this section, the overall model fit will be established for the model developed through CB-SEM. As CB-SEM is generally applied to prove theories behind the hypotheses, an established model fit was likely to explain the phenomena behind the validity of the constructs, in this particular research context of telehealth adoption in Indian healthcare.

### 8.8.1 Conceptual Model Testing with Confirmatory Factor Analysis (CFA)

As suggested by previous studies (Abrahim et al., 2019; Brown, 2015; Byrne, 2001, 2013; Harrington, 2009), this research study on telehealth adoption in the Indian healthcare domain employs a two-step approach before CFA for theory testing. Before testing all of the sub-models in the CFA and full SEM model, two steps were taken: first, a one-factor congeneric analysis was performed to test the validity of items in each construct; and second, each construct was put through a single relationship test with the dependent variable of telehealth adoption.

#### 8.8.1.1 Analysing Procedure

This research study conducts the analysis in two steps before testing the CFA, following the general guidelines of Anderson and Gerbing (1988) for CFA reporting. Prior to testing a CFA model, a congeneric analysis was performed in the first step to test the validity of elements for measuring the constructs. The second step was to run a single relationship test in a structural equation model between each construct and the dependent variable, telehealth adoption. In a later stage, five one-factor congeneric models were tested, between the predictor variables and the dependent variable, in a full measurement model (CFA).

#### 8.8.1.2 Validation of Constructs

According to Schreiber et al. (2006), construct testing should include the following components:

1) **Rate the level of internal consistency:** In this research study, Cronbach's alpha is used to demonstrate inter-item scale reliability. According to Fornell and Larcker (1981); Hair et al. (2006), the recommended cut off point for Cronbach's value is 0.70. A Cronbach's alpha value greater than 0.7 indicates that the constructs are trustworthy.

2) **The construct's convergent validity:** According to MacKenzie et al. (2011), latent constructs should be assessed for construct validity using AVE and Composite Reliability (CR) to see if the construct measures represent the phenomenon that they are supposed to represent. This research study employs Fornell and Larcker (1981) computing formulas to compute the values of AVE and CR. A construct with an AVE greater than 0.5 and a CR greater than 0.6 is desirable (Byrne, 2013; Fornell & Larcker, 1981).

3) **Determine the model's discriminant validity:** In this research study, factor loadings are used to assess model convergent and discriminant validity. According to Fornell and Larcker (1981), factor loadings greater than 0.5 indicate that the path coefficients from latent constructs to corresponding indicators are statistically significant. Further, the discriminant validity was established through the Fornell-Larcker criterion (Fornell & Larcker, 1981; Hair et al., 2006) and Heterotrait-Monotrait ratio or HTMT ratio analysis (Ab Hamid et al., 2017; Franke & Sarstedt, 2019; Voorhees et al., 2016). The suggested method of establishing discriminant validity is the square root of the AVE of each latent construct should be higher than its highest correlation with any other latent construct (Fornell & Larcker, 1981; Hair et al., 2006; Hair Jr et al., 2016). The HTMT criterion indicates that discriminant validity has been met, with values below .90 (Hair Jr et al., 2017; Henseler et al., 2015; Voorhees et al., 2016).

4) **The proposed model's data fit:** The chi-square to degrees of freedom ratio is used as a general guide in this research study to assess the fit of the proposed model to the data in the one factor congeneric model, single relationship testing, CFA model and the structural (causal) model. A chi-square to degrees of freedom ratio of less than 3 indicates a good fit of the proposed model, according to Schreiber et al. (2006). Further, SRMR, CFI, and RMSEA has been considered to judge the model fit (Anderson & Gerbing, 1988; Barrett, 2007; Brown, 2015; Hooper et al., 2008; R. B. Kline, 2013). Hooper et al. (2008); R. B. Kline (2013) suggested that a minimum of the following indices are to be reported Chi-square /Degrees of freedom (x2/df), SRMR, CFI and RMSEA.

The chi-square to df ratio, or $x^2$/df, is an old measure of fit. One issue with this fit index is that there is no universally accepted standard for what constitutes a good and bad fitting model. The chi-square statistic (along with its degrees of freedom) can be used to assess model fit; it is only the significance test that is ineffective. When variables have non-normal distributions, especially distributions with kurtosis, the chi-square test is too liberal (i.e., too many Type 1) errors. Furthermore, there are far too many Type 1 errors with small sample sizes (Barrett, 2007; Hu & Bentler, 1999; Schumacker & Lomax, 2004). Some researchers recommend using the chi-square divided by the degrees of freedom ($x^2$/df) as a model fit measure, with values of 5 or less being a common benchmark (Hu & Bentler, 1999; Schumacker & Lomax, 2004).

Fit indices are a source of considerable debate. Some researchers e.g., Barrett (2007) believe that fit indices add nothing to the analysis and that only the chi-square should be interpreted. The concern is that fit indices allow researchers to claim that a model that has been misspecified is not a bad model. Others e.g., Hayduk et al. (2007) argue that fit index cut offs can be misleading and misused. Most analysts believe in the utility of fit indices, but they warn against relying solely on cut offs. A cut off values for various indices has been provided below in the table recommended by various authors such as Ab Hamid et al. (2017); Anderson and Gerbing (1988); Barrett (2007); Bollen and Long (1993); Brown (2015); Browne and Cudeck (1992); Chen et al. (2008); Franke and Sarstedt (2019); Hair Jr et al. (2017); Harrington (2009); Hayduk et al. (2007); Hooper et al. (2008); Hu and Bentler (1999); R. B. Kline (2013); Park et al. (2002); Schreiber et al. (2006); Schumacker and Lomax (2004).

*Table 32 Threshold values for model fit*

**Table**

**Threshold values for model fit**

| **Indices** | **Threshold values** |
|---|---|
| Normed chi-square ($x^2$/df)=<br>Chi-square ($x^2$)/Degrees of freedom (df) | <3 Excellent, <5 Acceptable |
| Chi-square value (p) | >.05 Excellent, >.01 Acceptable |
| Root Mean Square Residual (RMR) | <.08 |
| SRMR | <.08 Excellent, <.10 Acceptable |
| Goodness of Fit Index (GFI) | <=95 Excellent, <=90 Acceptable |
| Tucker Lewis Index (TLI) | <=95 Excellent, <=90 Acceptable |
| Comparative Fit Index (CFI) | <=95 Excellent, <=90 Acceptable<br>CFI>TLI |
| Root mean Square Error of Approximation (RMSEA) | <.05 Excellent, < .08 Acceptable,<br><.10 to < .13 Acceptable as a poor fitting model |
| PClose | >.05 |
| Cronbach's Alpha | .7 Excellent<br>.6 Acceptable |
| Composite Reliability | .7 Excellent<br>.6 Acceptable |
| Average Variance Extracted (AVE) | .5<br>< .5 Acceptable if Composite Reliability > .6 |
| Factor Loadings | .5 Acceptable<br>< .5 Acceptable if Cronbach's Alpha > .6 |
| Discriminant Validity | Fornell-Larcker Criterion<br>HTMT Analysis |

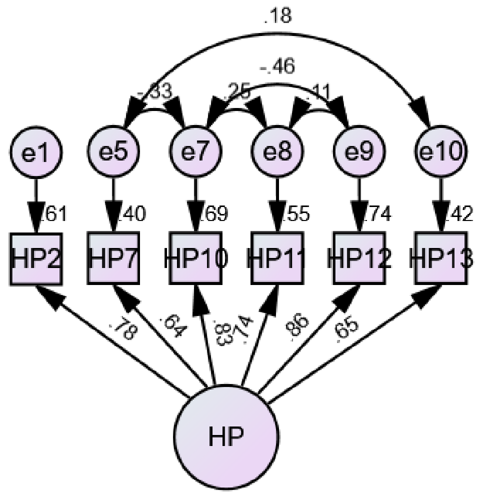
The above table depicted the threshold values for model fit applied to assess the model fit for the one-factor congeneric model, single relationship testing, CFA model and the causal model.

### 8.8.2 One-factor Congeneric Model

The one-factor congeneric model has been developed according to the hypotheses derived from the qualitative analysis and literature review in Chapter 5. The whole hypothesised model has been tested instead of relying on the EFA (PCA) results, which had reduced the number of factors and hypotheses. The purpose of EFA and CFA is not the same. EFA (exploratory factor analysis) can be defined as the systematic simplification of interrelated measures. Historically, EFA has been used to investigate the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome (Brown & Moore, 2012; Child, 1990; Koran, 2020; Marsh et al., 1998). The underlying factor structure is identified by performing EFA.

Confirmatory factor analysis (CFA) is a statistical technique that is used to confirm the factor structure of a set of observed variables. CFA enables researchers to test the hypothesis that there is a relationship between observed variables and their underlying latent constructs. The researcher employs theoretical knowledge, empirical research, or both to postulate the relationship pattern a priori and then statistically tests the hypothesis (Brown & Moore, 2012; Child, 1990; Koran, 2020; Marsh et al., 1998).

The one-factor congeneric models are presented below, along with the related information for determining convergent and discriminant validity and the model-fit.




Chi-square= 7.854

df= 4

p= .097, p>.001

$x^2$/df= 1.963

SRMR= .02,  < .08

RMR= .009, RMR<.08

GFI=.991, .95<GFI<1

TLI= .984, TLI>.95

CFI= .996, CFI>.90

RMSEA= .057, 0.05<RMSEA<0.08

Cronbach's Alpha= .879

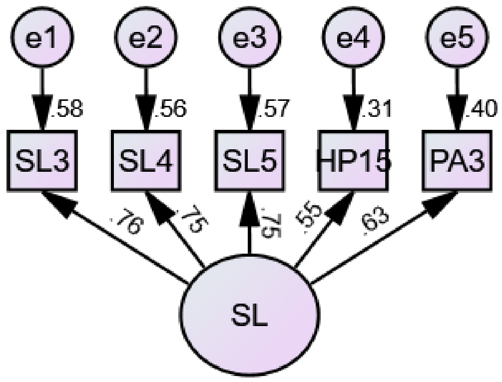
Composite Reliability (CR)= .887

Average Variance Extracted (AVE)= .570

Factor Loadings= .64 - .86  >.5

***Figure 66 HP***

HP achieved the model fit with $x^2$/df= 1.963, SRMR= .02, CFI= .996, RMSEA= .057. CR = .887 and AVE= .570 shows adequate convergent validity.




Chi-square= 6.651

df= 5

p= .248, p>.001

$x^2$/df= 1.330

SRMR=  .027,  < .08

RMR= .010, RMR<.08

GFI=.991, .95<GFI<1

TLI= .993, TLI>.95

CFI= .996, CFI>.90

RMSEA= .034, 0.05<RMSEA<0.08

Cronbach's Alpha= .819

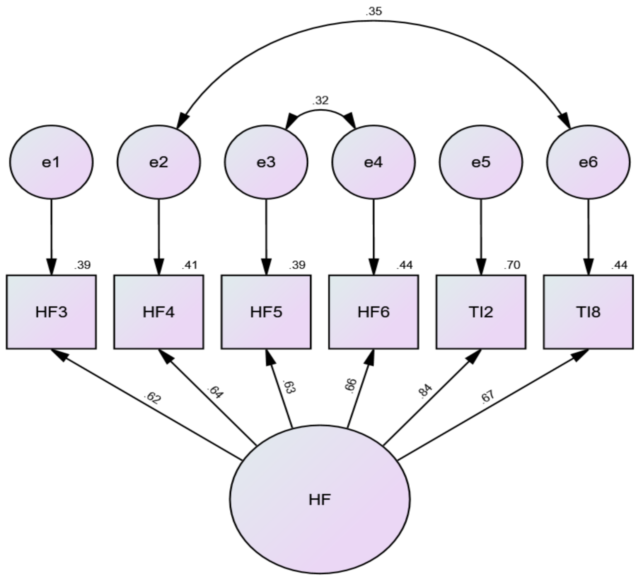
Composite Reliability (CR)= .820

Average Variance Extracted (AVE)= .481

Factor Loadings= .55 -.76  >.5

***Figure 67 SL***

SL achieved the model fit with $x^2$/df= 1.330, SRMR= .027, CFI= .996, RMSEA= .034. CR = .820 and AVE= .481 (< .5) shows adequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981).




Chi-square= 8.795

df= 7

p= .268, p>.001

$x^2$/df= 1.256

SRMR= .023, < .08

RMR= .016, RMR<.008

GFI=.990, .95<GFI<1

TLI= .994, TLI>.95

CFI= .997, CFI>.90

RMSEA= .030, 0.05<RMSEA<0.08

Cronbach's Alpha= .839

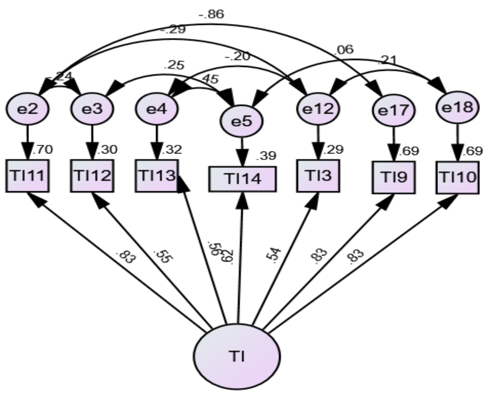
Composite Reliability (CR)= .837

Average Variance Extracted (AVE)= .464

Factor Loadings= .62 - .84 >.5

***Figure 68 SL***

HP achieved the model fit with $x^2$/df= 1.256, SRMR= .023, CFI= .996, RMSEA= .03. CR = .837 and AVE= .464 (< .5) shows adequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981).




Indicators Added TI3, TI9

Chi-square= 17.428

df= 6

p= .008, p>.001

$x^2$/df= 2.905

SRMR= .039, < .08

RMR= .014, RMR<.008

GFI=.983, .95<GFI<1

TLI= .958 TLI>.95

CFI= .988, CFI>.90

RMSEA= .080, 0.05<RMSEA<0.08

Cronbach's Alpha= .849

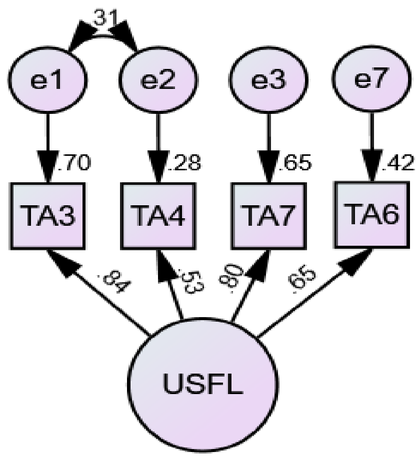
Composite Reliability (CR)= .862

Average Variance Extracted (AVE)= .480

Factor Loadings= .54 - .83 >.5

***Figure 69 TI***

TI achieved the model fit after adding indicators as per suggestions of Brown and Moore (2012); R. Kline (2013); Koran (2020); Marsh et al. (1998) with $x^2$/df= 2.905, SRMR= .039, CFI= .988, RMSEA= .08. CR = .862 and AVE= .480 (< .5) shows adequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981).

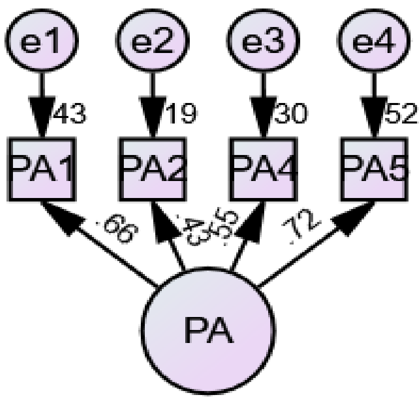



Chi-square= 2.991
df= 1
p= .084
$x^2$/df= 2.991
SRMR= .023, < .08
RMR= .012, RMR<.008
GFI= .995, .95<GFI<1
TLI= .972 , TLI>.95
CFI= .995, CFI>.90
RMSEA= .082, 0.05<RMSEA<0.08
Cronbach's Alpha= .804
Composite Reliability (CR)= .803
Average Variance Extracted (AVE)= .513
Factor Loadings= .53 - .84 >.5

Indicators Added: TA6

*Figure 70 USFL*

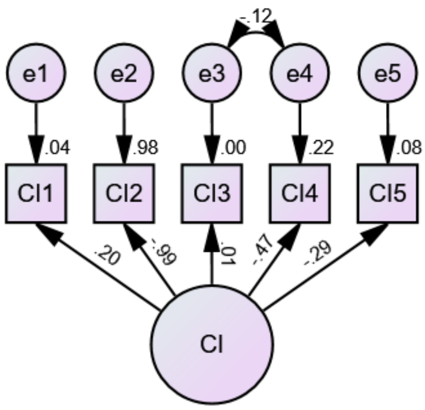
USFL achieved the model fit after adding indicators as per suggestions of Brown and Moore (2012); R. Kline (2013); Koran (2020); Marsh et al. (1998) with $x^2$/df= 2.991, SRMR= .023, CFI= .995, RMSEA= .082 (RMSEA <.10 to < .13 Acceptable as a poor fitting model). CR = .803 and AVE= .513 shows adequate convergent validity.




Chi-square= 12.140
df= 2
p= .002
$x^2$/df= 6.070
SRMR= .052, < .08
RMR= .026, RMR<.008
GFI= .982, .95<GFI<1
TLI= .835 , TLI>.95
CFI= .945, CFI>.90
RMSEA= .131, 0.05<RMSEA<0.08
Cronbach's Alpha= .666
Composite Reliability (CR)= .685
Average Variance Extracted (AVE)= .361
Factor Loadings= .43 - .72 >.5

*Figure 71 PA*

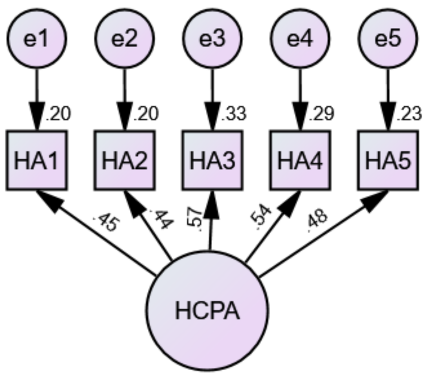
PA did not achieve model fit with $x^2$/df= 6.07 (<3 Excellent, <5 Acceptable), and RMSEA= .131 (< .10 to < .13 Acceptable as a poor fitting model). As such, the factor was discarded.




Chi-square= 6.775
df= 4
p= .148
$x^2$/df= 1.694
SRMR= .045, < .08
RMR= .022, RMR<.008
GFI= .991, .95<GFI<1
TLI= .937 , TLI>.95
CFI= .975, CFI>.90
RMSEA= .049, 0.05<RMSEA<0.08
Cronbach's Alpha= .315
Composite Reliability (CR)= .392
Average Variance Extracted (AVE)= .265
Factor Loadings= -.99 - .20 >.5

***Figure 72 CI***

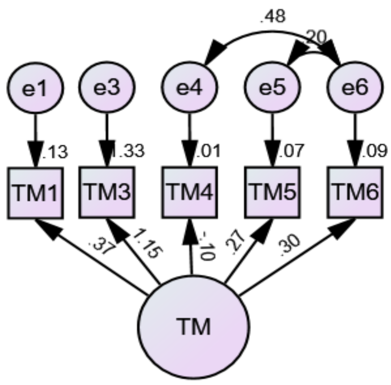
CI achieved the model fit with $x^2$/df= 1.694, SRMR= .045, CFI= .975, RMSEA= .049. CR = .392 and AVE= .265 (< .5) shows inadequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981). As such, CI has been discarded.




Chi-square= 9.445
df= 5
p= .093
$x^2$/df= 1.889
SRMR= .042, < .08
RMR= .019, RMR<.008
GFI= .988, .95<GFI<1
TLI= .933 , TLI>.95
CFI= .967, CFI>.90
RMSEA= .055, 0.05<RMSEA<0.08
Cronbach's Alpha= .611
Composite Reliability (CR)= .621
Average Variance Extracted (AVE)= .249
Factor Loadings= .44 - .57 >.5

**Figure 73 HCPA**

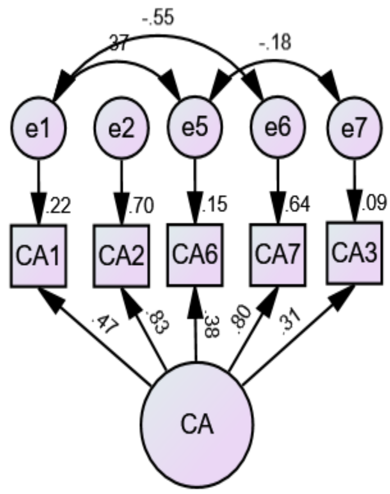
HCPA achieved the model fit with $x^2$/df= 1.889, SRMR= .042, CFI= .967, RMSEA= .055. CR = .621 and AVE= .249 (< .5) shows adequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981).




Chi-square= 4.924
df= 3
p= .177
$x^2$/df= 1.641
SRMR= .043, < .08
RMR= .024, RMR<.008
GFI= .994, .95<GFI<1
TLI= .971 , TLI>.95
CFI= .991, CFI>.90
RMSEA= .047, 0.05<RMSEA<0.08
Cronbach's Alpha= .536
Composite Reliability (CR)= .540
Average Variance Extracted (AVE)= .327
Factor Loadings= -.10 - 1.15 >.5

***Figure 74 TM***

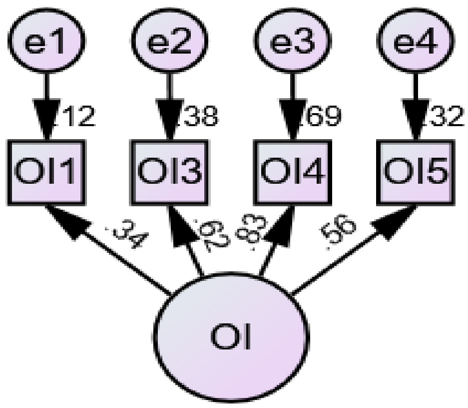
TM achieved the model fit with $x^2$/df= 1.641, SRMR= .043, CFI= .991, RMSEA= .047. CR = .540 and AVE= .327 (< .5) shows inadequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981). As such, TM has been discarded.




Chi-square= 5.667
df= 2
p= .059, p>.001
$x^2$/df= 2.834
SRMR= .033, < .08
RMR= .013, RMR<.008
GFI=.992, .95<GFI<1
TLI= .953, TLI>.95
CFI= .991, CFI>.90
RMSEA= .079, 0.05<RMSEA<0.08
Cronbach's Alpha= .666
Composite Reliability (CR)= .708
Average Variance Extracted (AVE)= .358
Factor Loadings= .31 - .83 >.5

***Figure 75 CA***

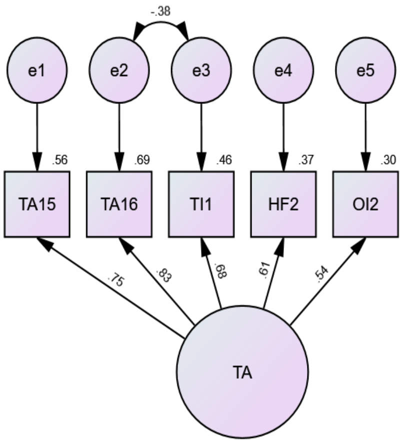
CA achieved the model fit with $x^2$/df= 2.834, SRMR= .033, CFI= .991, RMSEA= .079. CR = .708 and AVE= .358 (< .5) shows adequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981).




Chi-square= 6.33
df= 2
p= .042, p>.001
$x^2$/df= 3.165
SRMR= .039, < .08
RMR= .020, RMR<.008
GFI=.990, .95<GFI<1
TLI= .934, TLI>.95
CFI= .978, CFI>.90
RMSEA= .086, 0.05<RMSEA<0.08
Cronbach's Alpha= .677
Composite Reliability (CR)= .689
Average Variance Extracted (AVE)= .376
Factor Loadings= .34 - .83 >.5

***Figure 76 OI***

OI achieved the model fit with $x^2$/df= 3.165, SRMR= .039, CFI= .978, RMSEA= .086 (RMSEA <.10 to < .13 Acceptable as a poor fitting model). CR = .689 and AVE= .376 (< .5) shows adequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981).




Chi-square= 9.141
df= 4
p= .058, p>.001
$x^2$/df= 2.285
SRMR= .034, < .08
RMR= .019, RMR<.008
GFI=.988, .95<GFI<1
TLI= .970, TLI>.95
CFI= .988, CFI>.90
RMSEA= .066,
0.05<RMSEA<0.08
Cronbach's Alpha= .802
Composite Reliability (CR)= .816
Average Variance Extracted
(AVE)= .476
Factor Loadings= .54 - .83 >.5

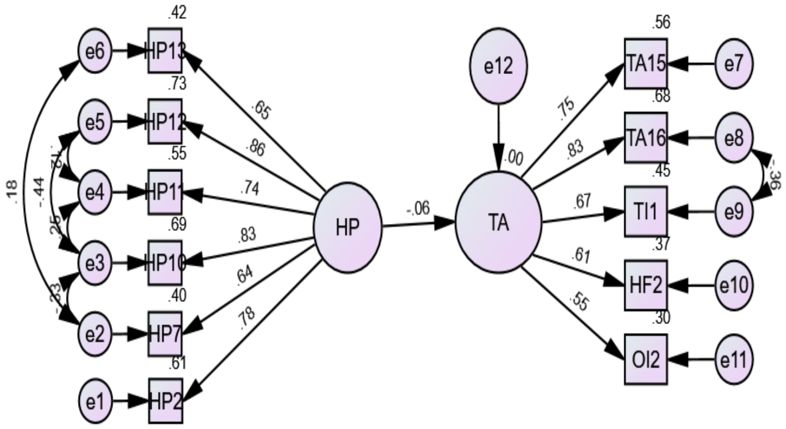
***Figure 77 TA***

The Dependent Variable TA achieved the model fit with $x^2$/df= 2.285, SRMR= .034, CFI= .988, RMSEA= .066. CR = .816 and AVE= .476 (< .5) shows adequate convergent validity (AVE < .5 Acceptable if Composite Reliability > .6), as per Fornell and Larcker (1981).

The above one-factor models were assessed according to the set criteria. Eight constructs (HP, SL, HF, TI, USFL, HCPA, CA, and OI) were validated according to the set criteria having met the internal consistency, convergent validity, and model fit.

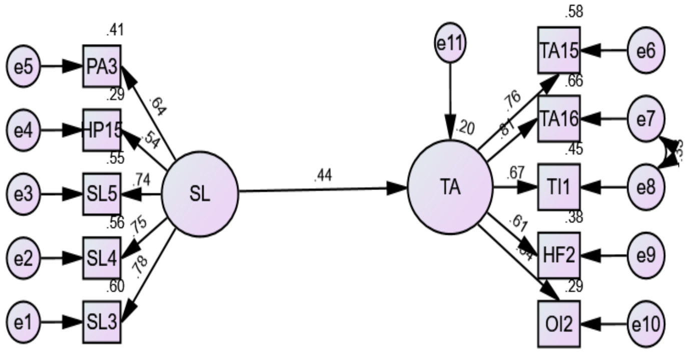
### 8.8.3 Single Relationship Testing

The eight constructs generated through the one-factor congeneric model were further tested in a single relationship testing with the Dependent Variable TA as per the recommendations of Anderson and Gerbing (1988). The model fits are reported along with the graphical representation of the models below.



| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 84.458 | -- |
| DF | 37.000 | -- |
| CMIN/DF | 2.283 | Excellent |
| CFI | 0.966 | Excellent |
| SRMR | 0.062 | Excellent |
| RMSEA | 0.066 | Acceptable |

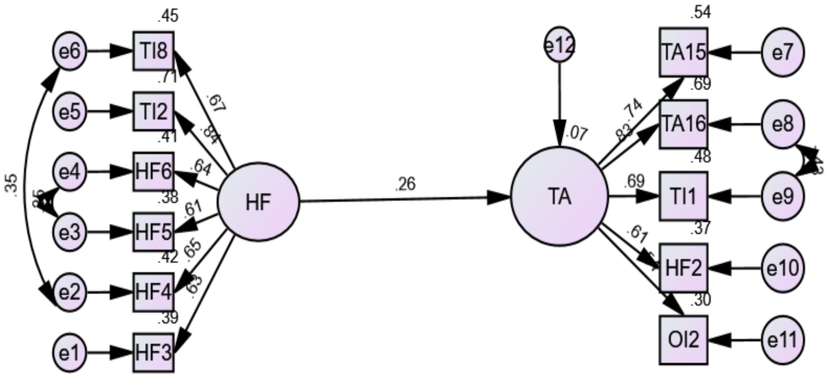
***Figure 78 HP to TA***



| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 94.622 | -- |
| DF | 33.000 | -- |

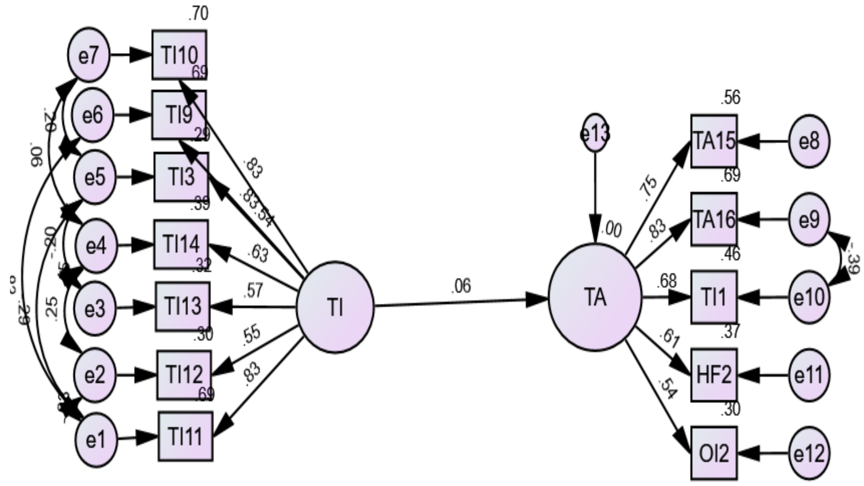
| | | |
|---|---|---|
| CMIN/DF | 2.867 | Excellent |
| CFI | 0.938 | Acceptable |
| SRMR | 0.065 | Excellent |
| RMSEA | 0.080 | Acceptable |

*Figure 79 SL to TA*



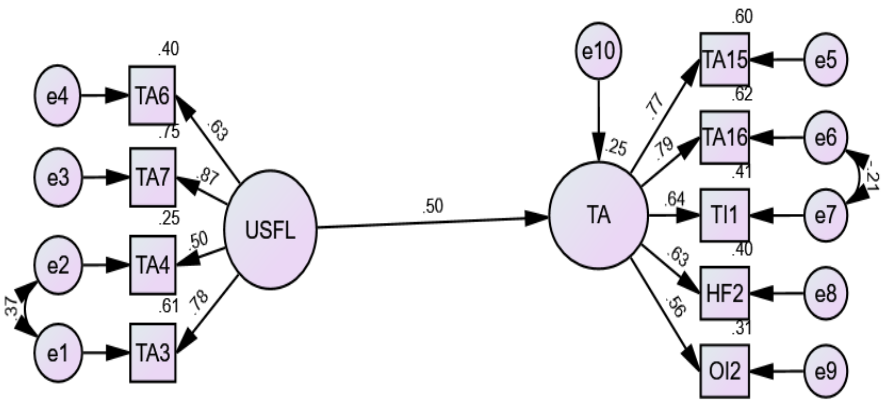

| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 182.894 | -- |
| DF | 40.000 | -- |
| CMIN/DF | 4.572 | Acceptable |
| TLI | .843 | |
| CFI | 0.886 | CFI > TLI |
| SRMR | 0.098 | Acceptable |
| RMSEA | 0.110 | Acceptable as poor fit |

*Figure 80 HF to TA*



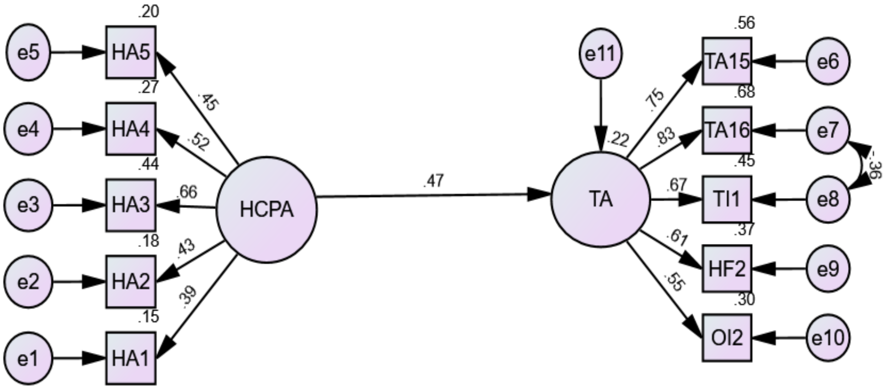
| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 202.642 | -- |
| DF | 44.000 | -- |
| CMIN/DF | 4.606 | Acceptable |
| TLI | .844 | |
| CFI | 0.896 | CFI > TLI |
| SRMR | 0.080 | Excellent |
| RMSEA | 0.111 | Acceptable as poor fit |

***Figure 81 TI to TA***



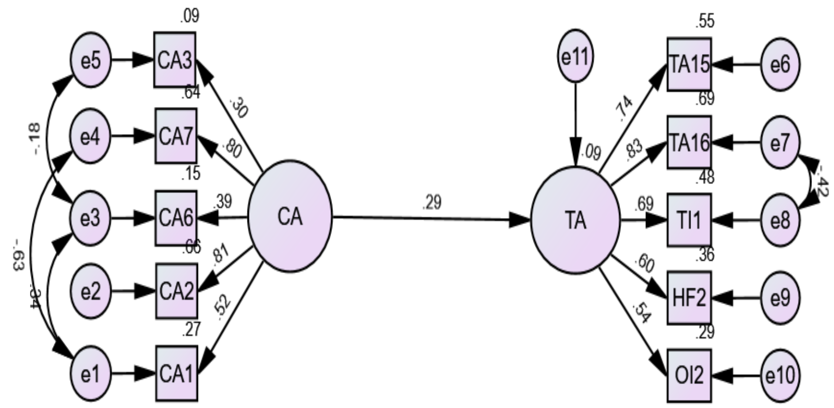
| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 75.542 | -- |
| DF | 24.000 | -- |
| CMIN/DF | 3.148 | Acceptable |
| CFI | 0.946 | Acceptable |
| SRMR | 0.057 | Excellent |
| RMSEA | 0.085 | Acceptable as poor fit |

***Figure 82 USFL to TA***



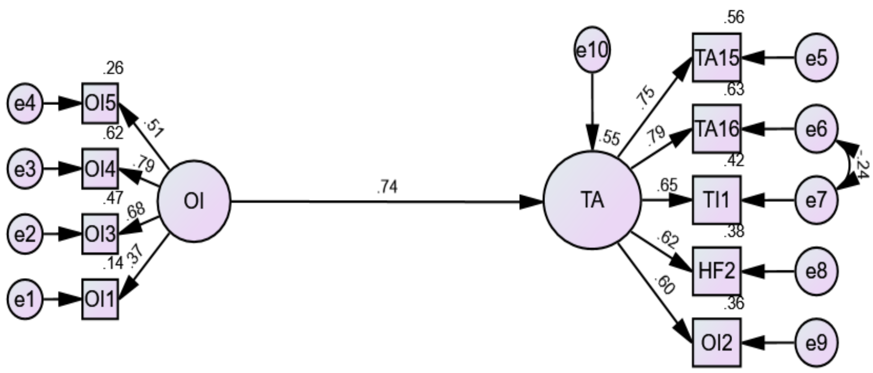

| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 90.400 | -- |
| DF | 33.000 | -- |
| CMIN/DF | 2.739 | Excellent |
| CFI | 0.911 | Acceptable |
| SRMR | 0.059 | Excellent |
| RMSEA | 0.077 | Acceptable |

***Figure 83 HCPA to TA***




| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 119.010 | -- |
| DF | 30.000 | -- |
| CMIN/DF | 3.967 | Acceptable |
| CFI | 0.903 | Acceptable |
| SRMR | 0.100 | Acceptable |
| RMSEA | 0.100 | Acceptable as poor fit |

**Figure 84 CA to TA**




| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 160.180 | -- |
| DF | 25.000 | -- |
| CMIN/DF | 6.407 | Not Acceptable |
| TLI | .777 | |
| CFI | 0.845 | CFI > TLI |
| SRMR | 0.084 | Acceptable |

| | | |
|---|---|---|
| RMSEA | 0.136 | Not Acceptable |

***Figure 85 OI to TA***

In the single relationship testing model only one factor OI did not achieve model fit, with $x^2$/df = 6.407 and RMSEA = .136.

## 8.9 CFA Model

After the single relationship testing the CFA model was built by incorporating the seven factors validated by the single relationship testing. After, subsequent analysis only four factors HP, USFL, HF, and SL attained convergent and discriminant validity. The AVE ranged from .501 to .572 and the CR ranged from .770 to .888. USFL and SL had significant correlations with the Dependent Variable TA. The CFA model is presented below.

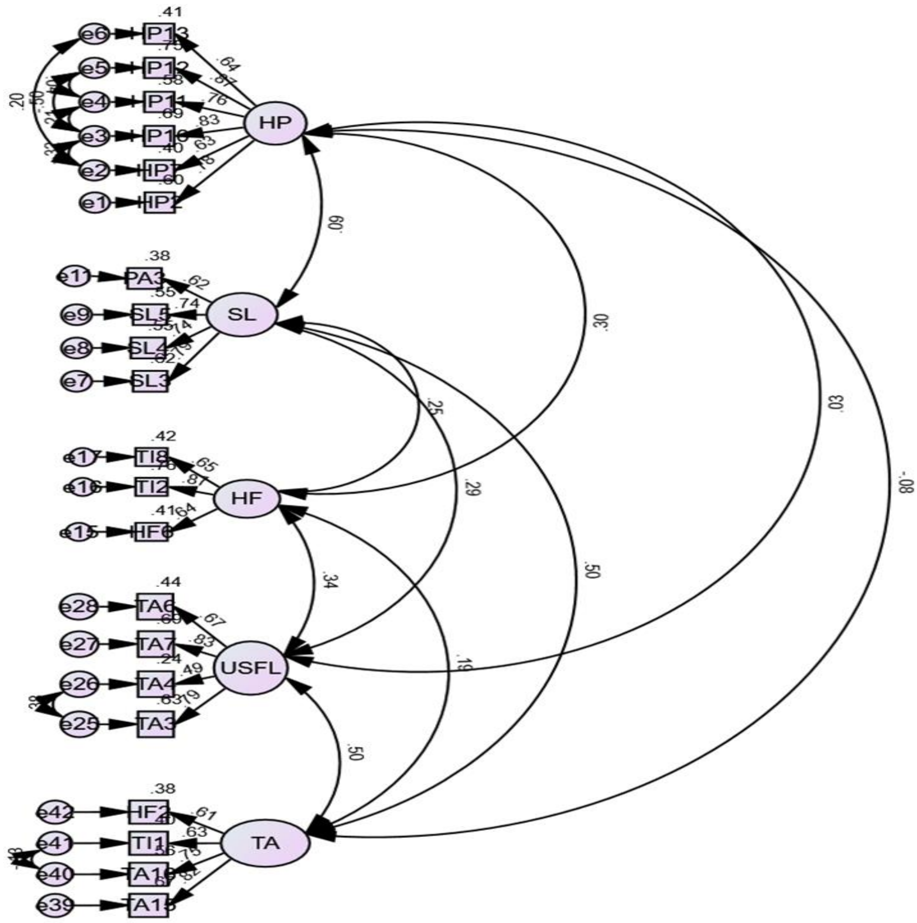



*Figure 86 Confirmatory Factor Analysis (CFA) Model*

*Table 33 Discriminant Validity Fornell-Larcker Criterion CFA Model*

| | CR | AVE | HP | SL | HF | USFL | TA |
|---|---|---|---|---|---|---|---|
| **HP** | 0.888 | 0.572 | **0.756*** | | | | |
| **SL** | 0.815 | 0.526 | 0.092 | **0.725*** | | | |
| **HF** | 0.770 | 0.532 | 0.299*** | 0.250** | **0.730*** | | |
| **USFL** | 0.795 | 0.502 | 0.027 | 0.293*** | 0.343*** | **0.709*** | |
| **TA** | 0.799 | 0.501 | -0.083 | 0.505*** | 0.195** | 0.503*** | **0.708*** |

* Square root of Average Variance Extracted (AVE)

Significance of Correlations:

† $p < 0.100$

* $p < 0.050$

** $p < 0.010$

*** $p < 0.001$

***Table 34 HTMT Analysis***

**HTMT Analysis**

| | **HP** | **SL** | **HF** | **USFL** | **TA** |
|---|---|---|---|---|---|
| **HP** | | | | | |
| **SL** | 0.061 | | | | |
| **HF** | 0.324 | 0.264 | | | |
| **USFL** | 0.045 | 0.266 | 0.340 | | |
| **TA** | 0.061 | 0.512 | 0.177 | 0.453 | |

Further, model fit measures according to the set criteria had been assessed for the CFA model which established the overall model fit of the CFA model.

*Table 35 Model Fit*

| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 748.436 | -- |
| DF | 172.000 | -- |
| CMIN/DF | 4.351 | Acceptable |
| TLI | .766 | |
| CFI | 0.809 | CFI > TLI |
| SRMR | 0.092 | Acceptable |
| RMSEA | 0.107 | Acceptable as poor fit |

## 8.10 Structural Model

After the CFA established the constructs of HP, USFL, HF, and SL, a causal model (structural model) was developed using the IBM SPSS Amos v27. The causal model along with the model fit is depicted below.

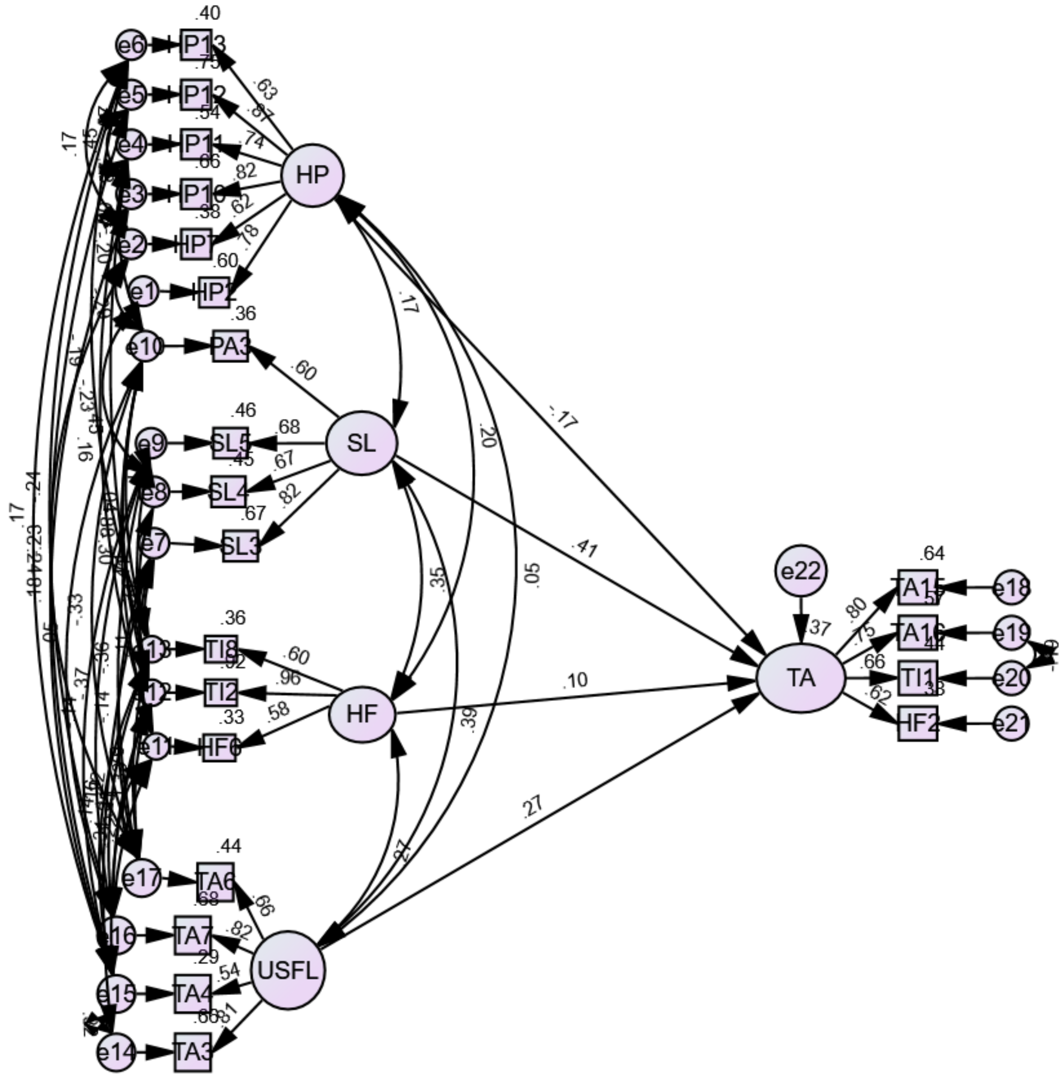


**Table 36 Structural Model Fit Meaures**

| Measure | Estimate | Interpretation |
|---|---|---|
| CMIN | 344.930 | -- |
| DF | 138.000 | -- |
| CMIN/DF | 2.499 | Excellent |
| CFI | 0.931 | Acceptable |
| SRMR | 0.071 | Excellent |
| RMSEA | 0.071 | Acceptable |

The structural model has achieved model fit after setting the indicators free to covary i.e, removing the constraints. The reasons behind this are as follows (Hair et al., 2006; Hair Jr et al., 2017; Rigdon et al., 2017):

1) Non-normal nature of the data.

2) More sample size requirement for CB-SEM.

3) Common Method Bias.

### 8.11 Chapter Conclusion

This chapter analysed the hypotheses generated from the literature review and qualitative input by deploying PLS-SEM and developing a PLS model. The measurement model was finalised from the hypotheses generated from PCA. PCA reduces the dimension of the dataset, keeping the indicators with the highest factor loadings and reducing multicollinearity and cross-loadings. As such, the bias of the indicators is reduced (Hair et al., 1998).

Further, PCA helps identify what is actually measured by the quantitative instrument, rather than relying on the measurement accuracy of the previous hypotheses upon which the instrument is built (Hair et al., 1998). The difference in statistical values between the two models (Multiple Regression and PLS) is due to these factors. The $R^2$ value increased to TA = .31 in the PLS Model from TA = .23 in the previous Multiple

Regression Model. Nevertheless, the significance of the determinants in both the models established through a robust statistical process cannot be neglected. The models are not supplementary but complementary to each other because statistical validity has been established for both models. Hence, both the models can be used concurrently to predict and adopt telehealth adoption in Indian healthcare.

The CFA and CB-SEM structural model was developed afterwards to further reconfirm and generalise the constructs. In the CFA and CB-SEM one additional factor HP was validated. Thus, the models developed through multiple linear regression and PLS-SEM are further validated, and the difference in the results of PLS-SEM and CB-SEM are due to several factors. According to Hair Jr et al. (2017), while the PLS-SEM maximises the explained variance in the DV, CB-SEM estimates parameters of the model minimising the differences between the observed sample covariance matrix (which is calculated beforehand) and the covariance matrix which is estimated after the revised theoretical model has been confirmed. Another reason is that CB-SEM is based on composite model and CB-SEM is based on the common factor model (Hair Jr et al., 2017). Due to the presence of random errors in composite models and the indeterminacy of the common factor model, the different constructs scores can generate equally good fitting models (Grice, 2001; Hair Jr et al., 2017; Rigdon, 2016; Rigdon et al., 2017; Steiger, 1979).

The next chapter will discuss the overall findings of this research on telehealth adoption in Indian healthcare. Drawing on the findings from the literature review, qualitative analysis, quantitative analysis and structural equation modelling, discussion will turn to the relevance of these findings for telehealth adoption in Indian healthcare.

# CHAPTER 9 DISCUSSION

## 9.1 Chapter Overview

The preceding chapters identified and reconfirmed the perceived determinants of telehealth adoption by employing various qualitative and quantitative methods, including structural equation modelling. This chapter will discuss the qualitative and quantitative findings, comprehensively consider the findings, and compare and contrast those findings with relevant literature. Thus, the discussion arising from the overall findings of the research is presented, subsequently answering the research questions and sub-questions.

## 9.2 Introduction

The qualitative analysis (Chapter 5), the quantitative analysis (Chapter 7), and the structural equation modelling (Chapter 8) concluded with models of telehealth adoption in Indian healthcare. While the discussion on qualitative findings will answer the research questions and sub research questions (a and b), it will also complement the quantitative study to answer the research questions and sub-questions (c and d). The discussion on the quantitative findings will also reconfirm and generalise the findings of the qualitative study. In mixed-methods research, the axioms that qualitative research answers 'why' and quantitative research 'what', are integrated to explain what has happened and why it has happened (Caffery et al., 2017; John W Creswell, 2014; Creswell et al., 2011; O'Cathain et al., 2007).

## 9.3 Discussion on Qualitative Findings

The qualitative data analysis has helped to reveal the perceived determinants of telehealth adoption in the Indian healthcare domain. Thus, the qualitative findings of the research have answered the RQ of

> *"What are the perceived determinants of telehealth adoption in the Indian healthcare domain?"*

Further, the qualitative data analysis categorised the determinants into enablers (drivers) of telehealth adoption and identified the barriers to telehealth adoption in the

Indian healthcare context. Thus, the qualitative findings also answered the research sub-questions of:

*a) "What are the drivers or enablers of telehealth adoption in the Indian healthcare domain?"*

*b) "What are the barriers to telehealth adoption in the Indian healthcare domain?"*

The qualitative data analysis identified eleven perceived determinants responsible for influencing telehealth adoption in Indian healthcare. The perceived determinants are Healthcare Practices (HP), Patient Awareness (PA), Usefulness (USFL), Healthcare Facilities (HF), Healthcare Professional Awareness (HCPA), Technology Motivators (TM), Competitiveness (CA), Technology Issues (TI), Organisational Issues (OI), State Leadership (SL) and Communication Issues (CI). While HP, PA, USFL, HF, HCPA, TM and CA had been identified as perceived enablers (drivers) of telehealth adoption, the identified perceived barriers to telehealth adoption are TI, OI, SL and CI. The enablers (drivers) and barriers are discussed in detail below.

### 9.3.1 A) Perceived Enablers (Drivers)

#### 1) Healthcare Practices

Healthcare Practices (HP) were found to be a perceived determinant in this research study on Indian telehealth adoption. The ability to diagnose a patient's condition is a dominant motivator for globally adopting telehealth services (American Medical Association, 2020; Hodgkins et al., 2021). Various studies have highlighted the importance of telehealth in the early diagnosis of medical conditions (Taylor et al., 2015; Thielst, 2010; Weinstein et al., 2014). The findings of this study affirm that, at least as a reason for the first contact or initial consultation, the ability of telehealth for diagnosis (in particular cases) was perceived as an enabler (driver) by Indian HCPs to adopt telehealth. Treatment, monitoring, referral, rehabilitation, expert opinion and counselling have also received favourable responses in previous research for the adoption of telehealth (Ahmed et al., 2010; Anwar et al., 2019; Ashburner et al., 2016; Bee et al., 2016; Bowman et al., 2013; Finkelstein et al., 2011; Ganapathy et al., 2019; Raza et al., 2017). Similar results were reported in the qualitative findings of this research, whereby treatment, monitoring, referral, rehabilitation, expert opinion and counselling were perceived as an enabler (driver) of telehealth by the Indian HCPs.

**2) Patient Awareness**

Patient Awareness (PA) was another vital perceived determinant in this research on telehealth adoption in the Indian healthcare context. According to the qualitative findings, telehealth can promote health education, disease prevention, particularly for non-communicable diseases, and healthy diets. As a result, telehealth is thought to play a role in improving patient wellness and disease self-management, which leads to better health outcomes. The concept of patient empowerment has previously been studied to develop an integrated telehealth system (Clemensen et al., 2011; Donovan et al., 2021; Krausz et al., 2016; Merrell, 2021; Suter et al., 2011). Furthermore, gaining knowledge can benefit patients in the long run (Paget et al., 2010; Standing et al., 2014; Tuot & Boulware, 2017). Additionally, according to the qualitative findings and literature, government policies and procedures (State Leadership in this study) may promote patient awareness and the use of telehealth for improved population health outcomes. The role of state leadership was also evident in the studies conducted by researchers in different countries and cultural contexts (Dinesen et al., 2016; Zailani et al., 2014).

**3) Usefulness**

Usefulness (USFL) was found to be a significant perceived determinant to adopt telehealth in the Indian context. The usefulness and inherent benefits of telehealth in Indian healthcare are clear from the literature (Dasgupta & Deb, 2008; Ganapathy, 2014; Ganapathy, 2015a). The more it became evident that the 'usefulness' of telehealth was vital to society and the healthcare professionals, the more the Indian HCPs found the adoption of telehealth to be helpful (Lanseng & Andreassen, 2007; Parmanto et al., 2016; Sobrepera et al., 2021; Terry & Buntoro, 2021; Wilson & Lankton, 2004). Moreover, the COVID-19 (SARS-CoV-2) global pandemic has motivated health researchers to explore telehealth's usefulness further (An et al., 2021; Bhatia, 2021). The usefulness of telehealth is inextricably linked to technological ease of use in other studies of telehealth adoption (Dünnebeil et al., 2012; Hu et al., 2002). However, the ease of use construct has been criticised by the works of Chau and Hu (2002), Chismar and Wiley-Patton (2003), and Keil, Beranek, and Konsynski (1995). The researchers were of the view that the physicians rely on the usefulness of ICT instead of relying on the ease of using it. The physicians' emphasis is more on the utility, functionality and effective patient outcomes. The results obtained by Lin, Lin, and Roan (2012) show that usefulness has a greater impact than ease of use. The qualitative findings of this study corroborate the authors' findings, mentioned above, regarding the greater impact of usefulness in the Indian telehealth context.

**4) Healthcare Facilities**

The qualitative study findings provide evidence of the perceived determinant of Healthcare Facilities (HF). The concept of accessibility and the presence of minimal healthcare infrastructure in rural and remote parts of India inspired the perceived determinant of Healthcare Facilities. A lack of doctors and healthcare professionals in India's rural and remote areas have long been a problem in providing uniform healthcare services. As a result, healthcare scarcity in rural and remote areas and the distance to the nearest hospital all encourage HCPs to use telehealth (Dasgupta & Deb, 2008; Ganapathy; Ganapathy et al., 2019). However, adopting such policies necessitates standardised policies and remuneration (Doarn et al., 2008; Kristensen, 2020; Lee et al., 2020). Previous research on telehealth adoption opined that it could provide affordable healthcare services to rural and remote areas (Bradford et al., 2016; Duplantie et al., 2007; Moffatt & Eley, 2010; Speyer et al., 2018). The adoption of telehealth also ensures the availability of uniform healthcare facilities (Basu et al., 2021; Rathi, 2017). Significantly, telehealth has facilitated access to healthcare in times of the global pandemic of COVID-19 (SARS-CoV-2), from reducing mental health conditions to minimising disparities in rural healthcare (Dosaj et al., 2021; Hirko et al., 2020; Hoffman, 2020; Koonin et al., 2020; Parisien et al., 2020).

**5) HCP Awareness**

HCP Awareness (HCPA) as a perceived determinant of telehealth adoption was an interesting finding of this research. A key finding of the qualitative analysis is that the HCPs associated with telehealth and applications of mobile technologies in India generally view it in a functional manner rather than in an explicit manner. The telehealth applications and mobile healthcare technologies in use are looked upon as an alternative solution for clinical purposes, such as viewing diagnostic reports or providing initial information to the patients, and many more. This is evident from one of the many interview excerpts as an example

> "*It increases the medical knowledge, informs the patients about their disease, to guide them for appropriate treatment.*" (Interview 4).

The recognition of the idea of explicit and tacit knowledge is not usual among the HCPs. Therefore, telehealth's knowledge-sharing ability, including mobile healthcare technologies, is not fully understood and often underutilised (Chowdhury et al., 2020; Räisänen et al., 2009). Mobile devices and mobile applications along with telehealth are in use in the healthcare domain for a considerable period, especially in developed countries (Trmčić et al., 2016). Efficient management of knowledge can enhance the health outcomes using such technologies (Eysenbach, 2001). Nevertheless, managing knowledge can be a complicated affair to accomplish in healthcare practice (A. Dwivedi et al., 2001). The literature presents no standardised or transparent definitions of knowledge. One of the studies alludes to knowledge, as information retained in the human mind, with some meaning attributed to it (Alavi & Leidner, 2001). Further, some authors defined knowledge as a belief which justifies an increase in organisational efficacy (Kelp, 2016). The forms of knowledge can be codified, as found in systems software, or dynamic conversations may yield such knowledge (Bock et al., 2005; Chen et al., 2012; Nonaka, 1994; Nonaka & Takeuchi, 2007; Sveiby, 1996). Thus, tacit knowledge is the personal knowledge stored in the human mind, but its expression entails complication. On the contrary, explicit knowledge is expressible in codes or written modes (Nonaka & Takeuchi, 2007). Ideas, experiences, difficulties faced and requirements are included in tacit knowledge, whereas ideas in written forms such as reports, articles, and books are examples of explicit knowledge (Panahi et al., 2016). Recent studies are increasingly focusing on converting tacit knowledge to explicit knowledge (Shepherd & Cooper, 2020). The role of information and communications technology (ICT) in converting tacit knowledge to explicit knowledge is ambiguous enough, though recent studies show the potential of its role in sharing knowledge and codifying the same in healthcare domain (Dagenais et al., 2020). ICT in healthcare can be used for sharing information and knowledge, although there are not enough standards (Standing et al., 2014).

**6) Technology Motivators**

Technology Motivators (TM) was an important perceived determinant according to the qualitative findings. The qualitative input of this research highlights several technology motivators such as, robust ICT infrastructure, broadband services and ICT-based health services as an alternative support solution. For example, the following interview excerpt and several others provide motivational input for this research regarding available good connectivity.

> *"Yes we have very good internet facility. Used to have a tech team to maintain and help in online consults."* (Interview 3)

However, research is scarce in the Indian healthcare domain that examines the combined perspectives of HCPs and organisational or government policymakers, which is highlighted in the qualitative findings of this. The qualitative findings also established that the HCPs perceive that technological availability and robustness influences telehealth adoption.

In the literature, many information-technology motivators have been identified. These include the desire for integration, access to real-time data, modernisation and dissatisfaction with older systems, image concerns, decision-making and complexity, process performance and productivity, response time, reduced operating costs, strategic decision-making, management reporting, business flexibility and transparency (Avison & Young, 2007; De Rosis & Seghieri, 2015). Various healthcare professionals, such as physicians, surgeons, dietitians, dentists and physiotherapists, have begun to offer online consultations in urban areas, at least at the initial level. Online consultations have a large reach across India (Brindha, 2013; Sivagurunathan et al., 2015).

**7) Competitiveness**

Competitiveness (CA) is another perceived determinant of telehealth adoption in the Indian healthcare context, according to the qualitative findings of this research. It was found that telehealth adoption saves time, saves money (economical), reduces distance and has a global reach.

> *Advantage is it's quick, it's fast, it can save life, and in emergencies it definitely works."* (Interview 7)

The qualitative findings that telehealth adoption saves time and distance for both the HCPs and patients, and are economical compared to regular healthcare services, corroborate earlier research on Healthcare ICT adoption (Hafeez-Baig & Gururajan, 2010; Janda et al., 2019; Liu Sheng et al., 1998; Loane et al., 1998; Wootton, 2009). Further, the unique findings of this research in the Indian healthcare context is that of the potential of telehealth to serve overseas Indians at least as a point of an initial consultation and for providing information. This finding is essentially factual for the Indians located outside of India whose diet patterns are known to the Indian dietitians very well.

> *"That way it is a very positive thing because the reach is huge and it helps the global Indians to reach out to Indian dietitians."* (Interview 11)

Also, the qualitative findings indicate that telehealth can serve as an essential point of the first contact for promoting health tourism in India, where the super-speciality hospitals provide cheaper and quality-oriented consultations, diagnosis and treatment, including surgical procedures, compared to other developing countries.

> *"Urban, pan-India, abroad as well……Australia, United Kingdom. Also, Indians settled elsewhere……..global outreach."* (Interview 6)

Further, the waiting period for availing state medical facilities in developed countries can compel some overseas persons to access the quick service of India's multi-speciality hospitals. The backlog in state healthcare facilities in developed countries and the rise of medical visas are reflected through the studies of Chinai (2007); Islam (2017); Poongodi (2020). Also, the backlog in times of the global pandemic of COVID-19 (SARS-CoV-2) can be substantiated through the studies of Aggarwal et al. (2020); Carr et al. (2021); Diaper (2021).

**9.3.1 B) Perceived Barriers**

**8) Technology Issues**

An important perceived determinant of telehealth adoption in the Indian healthcare domain is Technology Issues (TI), as revealed by the qualitative findings in this research. Technological issues in India represent a barrier to telehealth adoption, creating hindrances or disruption in seamless connectivity between the users, especially in the rural and remote areas. Further, this study indicates that whereas the urban areas have upgraded and robust ICT infrastructure, essential for telehealth services utilisation, the rural and remote areas possess limited ICT infrastructure with much scope for improvement.

> *"Disruption in connectivity cause loss in doctor's time and patient's time. This is a challenge but over the years it has improved."* (Interview 1)

These findings corroborate with several recent studies on ICT infrastructure in rural India (Bajwa, 2021; Budhedeo, 2016; Gulati, 2009; Sreekumar, 2012; Venkatesh et al., 2020).

Furthermore, the qualitative findings indicate the HCPs' concern regarding data security, confidentiality and lack of ethical standards. Technology security can impede an organisation's adoption of ICT. HCPs are concerned about the safety of the technology and equipment used to provide care to their patients (Hu et al., 2002). A risky technology is one that has the potential to affect the outcome of a patient's care. Despite significant improvements in India's urban ICT infrastructure, there is still room for improvement in broadband speed and increasing rural connectivity, both of which are still lacking (Confederation of Indian Industry & KPMG, 2017).

**9) Organisational Issues**

Another determinant revealed by the qualitative findings was Organisational Issues. This was seen as one of the perceived barriers to adoption as identified by the HCPs in India. The qualitative study further revealed the shortage of HCPs, especially in India's rural and remote areas. Doctors and health care workers are in short supply in rural and remote areas of India, which is a widespread issue (Bhandari & Dutta, 2007; Goel et al., 2019; Sachan, 2013). The qualitative study also indicates that while the short supply of HCPs was once a motivator for healthcare professionals to adopt telehealth, it may act as a barrier due to a lack of proper organisational infrastructure, healthcare professionals' aversion to virtual adoption and lack of a revenue model and salary for providing additional services. One of the reasons why healthcare professionals have been slow to adopt telehealth is because of this. The literature also reveals the collective attitude of healthcare staff as the most significant factor influencing ICT adoption in a telehealth environment (Hu et al., 2002). According to the same study, organisational policies and management are insignificant. The collective attitude of the healthcare workforce towards telehealth can influence an organisation's readiness to adopt ICT. This includes a willingness to share knowledge as well as a willingness to learn from training. The primary goal of a healthcare organisation is to provide services to people who require medical care. Since there prevails a huge disparity in health in India, which results in lack of access or poor-quality healthcare according to Balarajan et al. (2011), arranging alternative service delivery arrangements is among the top priorities of healthcare organisations.

**10) State Leadership**

A critical perceived determinant revealed by the qualitative study is State Leadership (SL), which indicates the nature of the prevailing government standards, policies and procedures. This study revealed limited government guidelines, policies and standards relating to telehealth in India. Further, the qualitative study revealed the perception of Indian HCPs regarding the current policies as impractical. Also, it was found that the role of the government, in promoting the benefits of telehealth, may expedite telehealth adoption, according to the findings of this study. The role of the government in promoting awareness among the population and HCPs was also acknowledged by this research.

Though SL was critical for the Indian healthcare context, not many studies were found in the literature. Government policies and regulations, particularly in developing countries, are critical to the adoption and spread of telemedicine technology (Zailani et al., 2014). Similar to other developing countries, one of the main challenges for Indian healthcare in adopting and implementing telehealth is a lack of funds and adequate ICT infrastructure, which appropriate governmental policies can address. Furthermore, because it can create the legal framework to address issues such as confidentiality, dependability, liability and cross-border authority, once telehealth services are implemented, the government has significant capacity for developing telehealth rules and regulations (Judi et al., 2009).

**11) Communication Issues**

One of the unique contributions of this research is revealing the perceived determinant of Communication Issues (CI). The qualitative findings of this research stressed the disadvantages of telehealth in regard to online communications. Many of the perceptions of the HCPs were regarding the advantage of face-to-consultations as to online communications. Also, from an organisational point of view the HCPs' reluctance to offer telehealth becomes a hindrance in offering such services. Further, there is concern that telehealth services may provide misleading information to the patients, as there may be communication gaps. The opinions of the HCPs reflect the benefits of telehealth only favouring viewing diagnostic reports or scheduling appointments. According to Wootton and Darkins (1997), there is no consensus on whether telehealth improves or harms the therapeutic relationship or traditional medical practise. Bashshur (1995) agreed, noting that it is still unknown whether telemedicine facilitates or inhibits patients' communication of their discomfort, symptoms and socio-emotional state, or whether it facilitates or inhibits doctors' communication of treatment instructions or expressions of empathy and caring. Because of the scarcity of data on the relational aspects of telehealth, many people believe that changes in the nature and content of doctor-patient communication should be a key component of any telehealth evaluation. Interpersonal communication between doctors and patients is also essential for establishing comfort and trust, exchanging information that will be used to make healthcare decisions and negotiating patient and physician decision-making roles. As a result, telehealth may have an impact on the level of patient and doctor participation during a medical encounter, either facilitating or reinforcing Haug and Lavin (1983); Moskop (1981) patient-centred and consumer-oriented patterns, or reinforcing traditional, paternalistic patterns first described by Freidson (1988); Parsons (1951) and later elaborated by Waitzkin (1991).

### 9.3.2 The Qualitative Model

The qualitative part of the research focused on analysing interviews of healthcare professionals to form a perception about the determinants of telehealth adoption in the Indian healthcare domain. The perceived constructs identified in this research are Healthcare Practices (HP), Patient Awareness (PA), Usefulness (USFL), Healthcare Facilities (HF), HCP Awareness (HCPA), Technology Motivators (TM), Competitiveness (CA), Technology Issues (TI), Organisational Issues (OI), State Leadership (SL) and Communication Issues (CI). These perceived determinants were further aligned with published literature. This helped to categorise the perceived determinants into enablers (drivers) of telehealth adoption and identifying the barriers to telehealth adoption. Thus, the qualitative discussion provided an inquiry into the RQ relating to the perceived determinants of telehealth adoption in the Indian healthcare context. The qualitative part of the research also answered the RQ regarding the enabler (drivers) of telehealth adoption and the barriers to telehealth adoption in the Indian healthcare domain.

These perceived constructs helped form the qualitative model used to complement the research undertaken in the quantitative analysis, reconfirm the significant determinants and generalise the qualitative findings. The qualitative model is represented below.

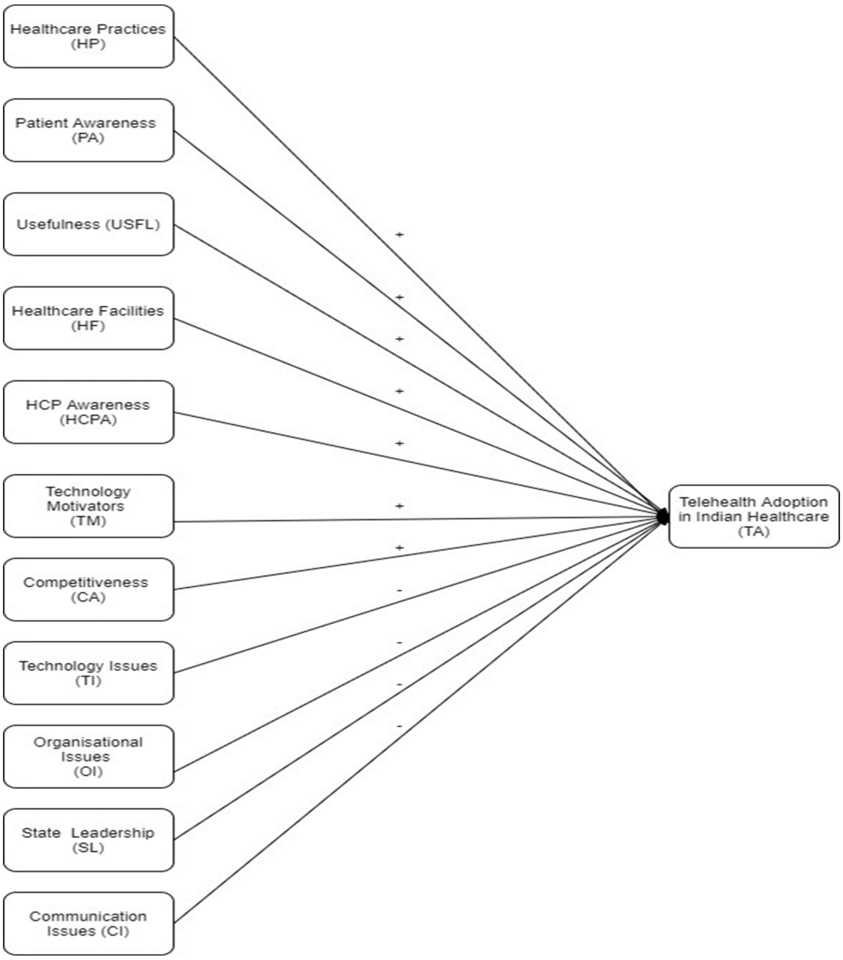



***Figure 87 Qualitative Model***

While the determinants were aligned with published literature, the CI determinant is unique in the Indian context. This is because of lack of awareness and trust, inadequate ICT infrastructure and limited policies and procedures. As revealed from the interview excerpt below, the psychological barrier of missing the physicians' touch can be removed through adequate training of the healthcare workers who stay in constant touch with the patients.

> *"There is another barrier of human touch which is missing. It is a psychological barrier. This barrier can be removed through the health workers. Doctors can't tell everything from far away as such, health workers can shoulder responsibility of gaining the patients' confidence in touch."* (Interview 5)

Subjective analysis of the above interview excerpt, among several other interviews, shows the HCPs’ consideration of replacing normal healthcare practices with telehealth. Though the HCPs acknowledged the role of telehealth as a support solution, the role of the government and healthcare organisations lies in educating patients and raising awareness among the patients and HCPs.

The following section will reconfirm and generalise the findings and answer the research sub-questions regarding the relationship between the determinants, and the perceived final theoretical framework, for telehealth adoption in the Indian healthcare domain.

### 9.4 Discussion on Quantitative Findings

The qualitative discussion justified the perceived drivers (enablers) and barriers to telehealth adoption in the Indian healthcare domain. After the qualitative phase, the hypotheses helped to prepare the quantitative data collection instrument. As a result, the quantitative stage generalised the findings on a larger population. Further, it validated the significant constructs and inquired into the causal relationship of the exogenous constructs to the endogenous construct of telehealth adoption. Thus, the quantitative study provided answers to the research sub-questions

> *c) What is the relationship between the determinants of telehealth adoption in the Indian healthcare domain?"*
>
> and
>
> *d) What is the perceived theoretical framework for telehealth adoption in the Indian healthcare domain?*

The following section presents the discussion on the quantitative and structural equation modelling findings, highlighting the significant determinants and the causal relationship between the constructs to telehealth adoption in the Indian healthcare context.

After the quantitative data collection and subsequent analysis, an exploratory factor analysis (EFA- PCA method) was performed to yield six factors (exogenous variables) and the endogenous variable of Telehealth Adoption (TA). Thus, the ongoing research model derived from the literature review and qualitative input were reduced to six perceived factors out of the proposed hypotheses on 11 factors. The exogenous variables were Healthcare Practices (HP), Healthcare Facilities (HF), Organisational Issues (OI), State Leadership (SL), Technology issues (TI) and Usefulness (USFL). The factor loadings were significant and ranged from .565 to .850, which pointed to good indicator reliability (J W Creswell, 2014; Hair et al., 2006). The Cronbach Alpha (.786 to .902) of the derived factors were of significant values. The overall Cronbach's Alpha of the composites (.843) reflects a good overall score and establishes the internal consistency and the reliability of the constructs (Bujang et al., 2018; Creswell et al., 2011; Hair et al., 1998; Taber, 2018).

A correlation analysis, after the EFA, generated significant correlation values with the DV telehealth adoption. The constructs which gained significant correlations are HF, OI, SL and USFL ($p < .01$). Next, a simple linear regression model first determined the causal effect of the constructs derived from the EFA with HF ($p < .0001$), SL ($p = .000$) and USFL ($p = .000$) gaining statistical significance.

Afterwards, a multiple linear regression model (MR) validated three constructs. Healthcare Facilities (HF), State Leadership (SL) and Usefulness (USFL) were found to be the most significant determinants of telehealth adoption statistically by Indian healthcare professionals. This was established in the first model developed, by deploying the multiple linear regression technique. This primary research on telehealth adoption was conceived from global telehealth literature, qualitative data, and quantitative data from an exploratory point of view. Globally there were many determinants of telehealth adoption in terms of technology, environment, organisation, knowledge, innovation and healthcare-specific factors. These were reflected in the studies of Alami et al. (2017); Buck (2009); Chowdhury et al. (2019); Chowdhury et al. (2020); Ly et al. (2017); Paslakis et al. (2019); Peddle (2007); Rho et al. (2014); Saigi-Rubió et al. (2016); Saigí-Rubió et al. (2014); Zanaboni and Wootton (2012); Zobair et al. (2020). In these studies, some of the constructs acted as drivers, some as barriers. In the Indian healthcare context, HF acted as an enabler (driver) of telehealth for Indian healthcare professionals. Studies by Jean et al. (2015); Rathi (2017); Singh et al. (2016); West and Milio (2004) considered environmental factors, such as demographic changes, resources and economic contexts, affecting telehealth adoption. Thus, according to the literature, HF can be denoted as an external environmental factor enabling telehealth adoption. HF refers to providing basic healthcare access, especially in rural and remote areas, to provide preliminary information to patients, counselling, health awareness development and patient health education. The shortage of doctors in the rural areas of India, coupled with health ignorance and inaccessibility to proper healthcare facilities, have necessitated that healthcare professionals adopt an approach that enables accessibility to primary health information by all in India (Chowdhury et al., 2019; Cilliers & Flowerday, 2013; Tracy et al., 2008). The qualitative findings and literature corroborate the findings of this research. Globally, healthcare facilities have been studied in varied research on telehealth adoption (Doarn et al., 2008; Tracy et al., 2008). The difference between the studies lies in the socio-economic-cultural settings of the countries involved (Chandwani, 2017; Chandwani & De, 2015; Chandwani & Dwivedi, 2015; Zailani et al., 2014).

The construct of USFL is at the forefront of adoption in most countries. The studies of Hu et al. (2002); Hu et al. (1999); Hu et al. (1999); Saigi-Rubió et al. (2016); Sobrepera et al. (2021); Suhr (2006); Terry and Buntoro (2021); Tsai et al. (2019) confirmed the significance of usefulness of telehealth. In this research, similarly, USFL is one of the most determining factors of telehealth adoption in India. Therefore, understanding HCP perceptions of telehealth use in the Indian healthcare context may aid in identifying adoption barriers and concerns. One of the aims of this study was to explore a link between HCP confidence to adopt telehealth and perceived technology usefulness. It was expected from the qualitative and literature review findings that providers would report a significant increase in telehealth use and increased belief in the usefulness of technology, particularly in providing uniform healthcare access to rural and remote communities. Furthermore, it was expected that greater increases in telehealth use would be associated with a higher perception of the usefulness of technology (Terry & Buntoro, 2021).

SL is a barrier to the adoption of telehealth in developing countries (Dasgupta & Deb, 2008; Ganapathy, 2002, 2014; Ganapathy, 2015a). Studies relating to policies on telehealth reveal that policy changes, state legislative professionalism, the partisanship of state legislators, government resources and severity of need are essential factors in understanding and facilitating telehealth adoption by HCPs (Judi et al., 2009; Mary Schmeida et al., 2007; Zailani et al., 2014). Telehealth adoption requires a procedural policy that essentially lays out ways for policy implementation. In general, these policies do not engage patient interest. In this case, the onus lies with the mobilised interest group (which in this case are the Indian HCPs) to undertake responsibilities to adhere to the policies. Although the policy literature does not consider interest groups to be important in the implementation of procedural policies, this result emphasises the importance of considering how these policies will affect those who must carry them out. The qualitative phase of this research highlighted the vision of the development of practical telehealth policies and standard guidelines. The HCPs as an interest group, can act as an enabler or as a deterrent to implementation (Mary Schmeida et al., 2007).

The three predictor multiple regression model, of the exploratory factors HF, USFL and SL, gained statistically significant ANOVA values ($p < .05$) and path relationships $\beta$ values (HF = .11, USFL = .27, and SL = .29), and fits well within the model. The MR model (TA $R^2 = .23$) reflects a low to moderate effect on telehealth adoption by Indian HCPs. The value conforms to similar studies by Shree (2020) in the Indian healthcare context reconfirming the determinants having significant effect with TA.

After establishing the determinants with the multiple linear regression model, the data were subjected to the PLS-SEM algorithm for a high-level evaluation of the projected model. The results of the PLS SEM model exactly matched with the MR model, albeit with difference in values, with the $R^2$ (.31) showing a greater effect of the constructs. The path coefficients $\beta$ values also increased to HF = .24 and USFL = .33, though SL decreased to .23. Nevertheless, the PLS-SEM model confirmed the MR model.

After the PLS-SEM validated the constructs, confirmatory factor analysis (CFA) was conducted to reconfirm the constructs and verify if the causal relationship changed with CB-SEM. The one factor CFA model validated eight constructs - HP, HF, USFL, HCPA, CA, SL, TI and OI - with significant $x^2/df$ values, AVE and Composite Reliability. Single relationship testing yielded significance for six of the constructs which are HP, HF, USFL, TI, HCPA and SL. Later, in the final CFA model, four constructs - HP, HF, USFL and SL - achieved convergent and discriminant validity, and model fit measures. The results varied from the EFA, where TI and OI were also significant.

The causal model of CB-SEM established the validities of HP, HF, USFL and SL. Surprisingly, the difference in the results is that HP gained a significant negative path relationship ($\beta = -.17$). This may be because of the fact that as HCP usage of telehealth increases, as has been the case during the COVID-19 (CoV-SARS-2) pandemic, the adoption factors eventually saturate (Dosaj et al., 2021; Hirko et al., 2020; Koonin et al., 2020; Parisien et al., 2020; Terry & Buntoro, 2021). Further, it may be worth noting that prior to the pandemic, telehealth adoption (used alongside normal healthcare practice) was slow among HCPs (Smith et al., 2020; Wade et al., 2014). The other significant constructs showed SL $\beta = .41$, HF $\beta = .10$ and USFL $\beta = .27$.

The quantitative findings thus reconfirmed and generalised the qualitative findings establishing HP, HF, USFL and SL as the foremost constructs influencing telehealth adoption in the Indian healthcare domain. Thus, by establishing the causal effect the discussion on quantitative findings have answered the research sub-question of:

> *c) What is the relationship between the determinants of telehealth adoption in the Indian healthcare domain?"*

After discussing the significance of the qualitative and quantitative findings, the final theoretical framework is proposed below to answer the research sub-question of:

> *d) What is the perceived theoretical framework for telehealth adoption in the Indian healthcare domain?*

## 9.5 Final Theoretical Framework

ICT adoption in healthcare settings has been a topic of research for decades, and the outcome of such research differs in contexts, technicalities and complexities. As such, different environments in which healthcare systems operate in different countries influences the adoption of ICT. Additionally, different organisational approaches, technological barriers, knowledge barriers, innovation capacities and healthcare-specific needs influence the adoption of ICT in healthcare. Telehealth, as a result, has a similar class of determinants evolving around the technology-organisation-environment frameworks (Depietro et al., 1990), with variations in the determining nature of the constructs.

The Technology-Organisation-Environment Model (TOE) (Depietro et al., 1990) has been tested in organisational settings in a variety of ICT adoption domains, including healthcare. TOE provides a comprehensive framework that produces consistent conclusions or results regarding ICT adoption in healthcare and other domains (Hu et al., 2002). This is supported by the findings of studies led by Ahmadi et al. (2015);

Alaboudi et al. (2016); Brancheau and Wetherbe (1990); Bretschneider (1990); Cooper and Zmud (1990); Fichman (1992), Ghani and Jaber (2015); Lian et al. (2014). The TOE framework effectively represented the various constructs reconfirmed and generalised by SEM (Adamson, 2016; Faber et al., 2017; Tanriverdi & Iacono, 1998; Zailani et al., 2014). Since the goal of the study was to identify the various drivers and barriers to telehealth technology adoption in an organisational setting, the TOE framework adapted from Depietro et al. (1990); Hu et al. (2002), assisted in the modification and development of a new theoretical framework for telehealth technology adoption in the Indian healthcare domain. The various constructs of the TOE framework are: technological factors such as usefulness and ease-of-use of technology; organisational factors such as the collective attitude of healthcare staff, management support, organisational infrastructure and support; and external environmental factors such as government policies influencing demand and supply of telehealth, and limited access to healthcare facilities especially in the rural and remote parts (Zailani et al., 2014).

In this particular research on telehealth adoption in the Indian healthcare domain, the results were similar in terms of the TOE framework with added parameters such as HCP Awareness (knowledge management practices), Competitveness (innovation) and Healthcare Practices (HP). Though the literature review and qualitative findings on HP, HCP Awareness and Competitiveness were reconfirmed by EFA and the one factor congeneric CFA model factor, the constructs, except for HP, gained no statistical significance in the quantitative analysis (Simple Linear Regression and Multiple Linear Regression), PLS-SEM and the final CFA and Structural Model of the CB-SEM. The variation in this framework can be explained through the final results of the structural equation modelling. The final framework includes HP, SL, USFL and HF. The final theoretical framework is presented below.

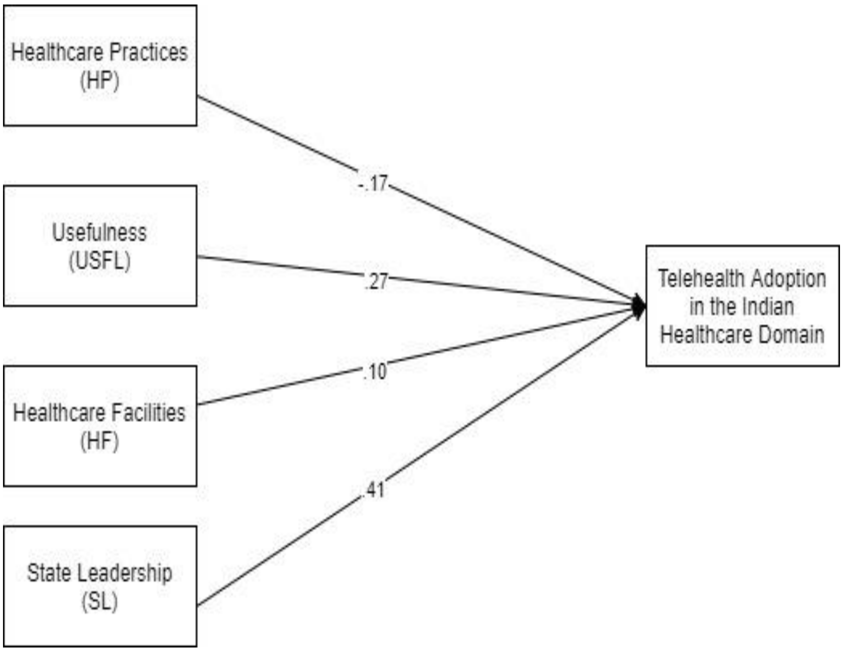



***Figure 88 Final Thoretical Framework***

### 9.6 Chapter Conclusion

This chapter discussed the findings from qualitative, quantitative and structural equation modelling of this research on telehealth adoption in the Indian healthcare domain. The chapter also related the findings to relevant literature in the healthcare domain. After answering the research questions, the next chapter will conclude the thesis by highlighting the implications, limitations, recommendations and future research directions discovered through this research.

# CHAPTER 10 CONCLUSION

## 10.1 Chapter overview

The previous chapter covered a discussion on the findings of the exploratory mixed-methods research on the determinants of telehealth adoption in Indian healthcare. The discussion converged the literature review findings, qualitative findings and quantitative findings. It aligned the findings to literature for confirmation of the pieces of evidence. This chapter will conclude this study by enumerating the implications, contributions, limitations, future research directions and recommendations of the research.

## 10.2 Conclusion

This research on telehealth adoption in Indian healthcare started with a literature review on the global findings around the determinants or factors of telehealth adoption. The literature review provided an insight into the various factors which influence or affect telehealth adoption in different geographical areas and cultural contexts, including India. The factors were initially identified and a preliminary conceptual framework prepared to further guide the research as it progressed. A review of information systems models was also done to find an appropriate theory or framework that could help explore the determinants in the Indian context. The drivers and barriers to telehealth adoption in different countries were also identified. The preliminary conceptual framework acted as a "working hypothesis" to identify the gap for the research to be conducted and to set the research questions. A significant gap, in the lack of a theoretical framework for telehealth adoption, was found. Additionally, there were found to be limited studies on Indian telehealth with low sample size and responses.

The preliminary conceptual framework also helped frame the research questions, prompted the methodology to be adopted, and later, synthesised the factors on which the semi-structured interviews were based. The identified factors in the literature review influencing telehealth adoption globally and in India were technological, organisational, environmental, knowledge, innovation and healthcare-specific factors. The qualitative stage involved data collection from healthcare professionals in India through semi-structured interviews. The interviews were transcribed to generate a rich data set. Multiple qualitative data analysis techniques were employed, such as manual coding and Computer-Assisted Qualitative Data Analysis Software (CAQDAS) coding (Leximancer 4 and NVivo 12 Pro). The final themes of the qualitative analysis were generated by converging the themes derived from the different techniques employed. The perceived drivers and barriers of telehealth adoption in Indian healthcare were thus identified through the qualitative stage. These themes provided the base to develop a survey instrument through which the perceived factors of telehealth adoption, derived from qualitative analysis and literature review, were explored in the Indian healthcare context. The identified enablers (drivers) of telehealth adoption in India were HP, PA, USFL, HF, HCPA, TM and CA. The identified barriers from the qualitative findings were TI, OI, SL and CI. The quantitative stage involved deploying the survey instrument amongst healthcare professionals to collect quantitative data for statistical analysis. After collecting the quantitative data and subsequent data transfer and cleaning process, several quantitative techniques were employed, such as testing the data for normality, homoscedasticity and multi-collinearity. An exploratory factor analysis was conducted to explore the number of factors that the instrument actually measured. Subsequently, correlation analysis and multiple regression models were developed to assess the statistical significance of the constructs. Further, PLS-SEM was deployed to reconfirm the constructs. Additionally, Confirmatory Factor Analysis (CFA) was conducted to validate the constructs and to develop a causal covariance-based structural equation model. The constructs from the first two stages were similar, however, the constructs varied in the CB-SEM model. Three constructs were similar to the Multiple Regression and PLS-SEM models (SL, HF and USFL), but in the CFA and the causal CB-SEM Model, one additional construct (HP) was found to be validated.

This research has identified the enablers and barriers to telehealth adoption in the Indian healthcare domain and has developed predictive models applying high-level statistical techniques. The identified determinants and the final theoretical framework can help prepare policies and procedures for telehealth adoption at the Indian federal and state levels. Governmental and non-governmental healthcare organisations and HCPs can also benefit from the findings of this research.

## 10.3 Implications

The determinants of telehealth adoption in the Indian healthcare domain were comprehensively explored using mixed-methods in this research. Mixed-methods research in healthcare settings increases the robustness of the developed theoretical and predictive models (Bryman, 2006; Creswell et al., 2004; Fetters et al., 2013). The research used qualitative and literature review inputs to complement the quantitative study to reconfirm and generalise the findings. As such, the reliability of the findings increases. Any construct reconfirmed and generalised by quantitative analysis, can be explained through the qualitative findings (Caffery et al., 2017; Driscoll et al., 2007). Therefore, though the quantitative findings are statistically validated constructs having causal effects, the qualitative findings cannot be ignored, even if some constructs were not reconfirmed by quantitative analysis. Also, any unexpected findings of the quantitative stage can be explained through the qualitative findings. As an example, HP emerged as a validated construct in the final causal model though it had a negative path relationship with telehealth adoption. The relationship has been explained in the previous chapter, utilising the qualitative input.

The stakeholders of Indian healthcare (governmental and non-governmental) can use the identified determinants in their policy-level decision making. Providers of telehealth can consult the research to increase their service delivery. The telehealth technology design and research companies can use these determinants to design and re-design new telehealth applications and systems from human-computer interaction and user experience (UX) perspectives. Other implications of this research are enumerated below.

i) Telehealth adoption can potentially benefit the healthcare practices of healthcare professionals.

ii) Telehealth adoption can facilitate knowledge sharing amongst healthcare professionals.

iii) Telehealth adoption can increase patient awareness in terms of self-management of diseases.

iv) Telehealth adoption can facilitate healthcare-related education.

v) Telehealth adoption can be an alternative to address the shortage of healthcare professionals especially in rural and remote areas.

vi) Telehealth adoption can act as a support solution in case of emergencies and natural disasters.

vii) Telehealth adoption can be an important tool in tackling a pandemic situation such as Covid-19 (SARS-COV-2).

### 10.4 Contributions

The theoretical framework can be applied and tested in other domains of healthcare technology adoption in India. Further, the findings of this research and the developed causal effect model could be used in framing policies and procedures for telehealth adoption at governmental and non-governmental healthcare organisations. Also, the theoretical framework developed by deploying high-level statistical techniques can be applied and tested in the healthcare and telehealth domain in other developing countries. Thus, the research findings and the theoretical framework contribute to the theory, knowledge and practice of telehealth adoption which governmental and non-governmental healthcare authorities can utilise in India and other developing and developed countries.

**Theoretical Contributions:** In terms of theory, the research can guide future research on technology adoption, particularly as an application to a hierarchical adoption model. The research could influence future technology adoption research in healthcare as well as in other domains. The identified determinants and the predictive models developed by high-level statistical techniques provide a theoretical base for research in India and the health information systems domain in other countries.

**Knowledge Contributions:** The research identified several gaps from the literature review before conducting this research (Dasgupta & Deb, 2008; Dattakumar, 2012; Durrani & Khoja, 2009; Elder & Clarke, 2007; Ganapathy, 2002, 2014; Ganapathy, 2015a; Ganapathy et al., 2019; Ghia et al., 2013; Kumar & Ahmad, 2015). There were limited studies on Indian telehealth adoption and the determinants, with existing studies being low in population and response (Bhatia, 2021; Ghia et al., 2013; Iyer, 2014). The main aim of the research was to develop a new knowledge base regarding

Indian telehealth technology adoption. The work contains a comprehensive and high-level analysis of the determinants of telehealth adoption in India, which has created a new knowledge base for the health information systems domain.

**Practical Contributions:** The research contributes to telehealth adoption in practice. The qualitative study has closely monitored the leadership, change management and knowledge sharing processes amongst telehealth organisations. Consequently, a practical management philosophy has been generated from understanding the deeper meaning of the determinants through the qualitative study. Further, the quantitative study has reconfirmed and generalised the significant constructs, creating an opportunity for a validated causal effect model and theoretical framework ready for policy-level decision-making, both by Indian governmental and non-governmental healthcare organisations, to integrate telehealth adoption.

**Governmental and Non-Governmental:** The theory, knowledge and practice thus developed from the study would create an opportunity to guide the process of future telehealth adoption in governmental and non-governmental telehealth organisations. Further, the research can influence policy-level decision making in governmental and non-governmental settings, both at state and federal levels. For example, the government can allocate resources and make provisions in the budget for inducing telehealth adoption in the Indian healthcare domain.

**Benefits to Australia:** Australian telehealth is reasonably established, and both private and public-sector healthcare organisations have adopted telehealth successfully on a limited scale (Carati & Margelis, 2013). As such, a scholarly interest might arise in the future, to gain valuable insights regarding telehealth adoption in India and other developing countries, adding substantial value to the existing knowledge base of Australian Scholars with an interest in technology adoption in healthcare, especially in developing countries.

Further, future migrants to Australia, especially healthcare professionals, can benefit from the research to overview telehealth adoption prevailing in India. The migrant healthcare professionals can increase their knowledge base by referring to the determinants and the high-level statistical predictive models developed by this research.

**Benefits to other countries:** The research findings and the predictive models developed by high-level statistical analysis can benefit other developing countries in implementing and adopting telehealth in their countries. The causal effect of the identified determinants can be utilised for telehealth policy-making decisions both at governmental and non-governmental levels. Similarly, the determinants and the causal models can be utilised on a limited scale for research on technology adoption in healthcare environments in developing countries with similar socio-cultural contexts to India. For example, the predictive models can be utilised on a limited scale for research in sub-continental countries healthcare environments. The predictive models can also be utilised on a limited scale for research in other environments and sectors in developing countries.

### 10.5 Limitations

Research conducted in any field of study has inherent limitations. Price and Murnan (2004) define research limitations as "the systematic bias that the researcher did not or could not control and which could inappropriately affect the results." Therefore, there are certain limitations that the researcher could not control in this research on telehealth adoption.

Firstly, India is a populous country with a large landmass covering 28 states and eight union territories (including the National Capital Territory). As such, all the states could not be covered in the research. The qualitative stage covered only five states. The quantitative paper-based and online survey study was conducted around India, including the five states covered by the qualitative study. However, the responses varied, and so the research is concentrated on responses from few states.

Secondly, this research on telehealth adoption solely focussed on the perceptions of HCPs and healthcare administrators. For developing an integrative theoretical framework for telehealth adoption, patient-level and health authority-level research is required.

## 10.6 Future Research Directions

- Future research studies may focus on specialised telehealth adoption, such as home care telehealth adoption and mental health telehealth services adoption, and other specialised telehealth services. In addition, the adoption studies can focus on both HCP-level and patient-level adoption of specialised telehealth services.
- This research was conducted on the perceptions of Indian HCPs. The research findings indicate that telehealth adoption by HCPs can promote patient health awareness, address patient counselling, monitoring and follow-up issues. However, limited evidence is present to highlight the determinants of patient-level telehealth adoption in India. As such, future patient-level adoption studies can be conducted in India.
- Future research on telehealth adoption can extend and generalise the findings to a wider geographical area covering India's states and union territories.

## 10.7 Recommendations

- Future telehealth applications can benefit from the findings of both the qualitative and quantitative sections of this research. Integrating the qualitative and quantitative findings in future telehealth applications can increase the functionality and user experience. For example, telehealth application designers may improve ease of use by eliminating the need for patients to log in.
- Healthcare organisations can support and create an atmosphere to attract a new patient base for the HCPs, motivating them to integrate telehealth into their usual practice.
- Healthcare organisations can provide job satisfaction to the HCPs who uptake telehealth by creating a good work environment.
- This research recommends training healthcare professionals in adopting telehealth and integrating telehealth into their regular healthcare practice.
- Standard guidelines for telehealth adoption and practices are required to be prepared by the health authorities.
- Organisational support from top management is required for the uptake of telehealth by the HCPs.

- Creating robust physical and ICT infrastructure could foster a better healthcare environment with successful health outcomes. Telehealth adoption helps to extend access to specialist HCPs, especially for patients from rural and remote areas.

### 10.8 End of Thesis

The thesis concludes by completing an exploratory sequential mixed-methods research project on telehealth adoption in India. A comprehensive literature review, qualitative and quantitative data analysis and discussion have answered the research questions. In addition, high-level statistical techniques have been deployed to develop predictive models of telehealth adoption in the Indian healthcare domain. Finally, the constructs of Healthcare Practices (HP), State Leadership (SL), Healthcare Facilities (HF) and Usefulness (USFL) have been reconfirmed and validated, having significant causal effects on telehealth adoption in India.

## REFERENCES


Aarons, G. A., Hurlburt, M., & Horwitz, S. M. (2011). Advancing a conceptual model of evidence-based practice implementation in public service sectors. *Administration and Policy in Mental Health and Mental Health Services Research*, *38*(1), 4-23.

Ab Hamid, M., Sami, W., & Sidek, M. M. (2017). Discriminant validity assessment: Use of Fornell & Larcker criterion versus HTMT criterion. Journal of Physics: Conference Series,

Abrahim, S., Mir, B. A., Suhara, H., Mohamed, F. A., & Sato, M. (2019). Structural equation modeling and confirmatory factor analysis of social media use and education. *International Journal of Educational Technology in Higher Education*, *16*(1), 1-25.

Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. (2013). Sampling: Why and how of it. *Indian Journal of Medical Specialties*, *4*(2), 330-333.

Acharya, R. V., & Rai, J. J. (2017). Evaluation of patient and doctor perception toward the use of telemedicine in Apollo Tele Health Services, India. *Journal of Family Medicine and Primary Care*, *5*, 798-803. https://doi.org/https://doi.org/10.4103/2249-4863.201174

Ackerman, M. J., Filart, R., Burgess, L. P., Lee, I., & Poropatich, R. K. (2010). Developing next-generation telehealth tools and technologies: patients, systems, and data perspectives. *Telemedicine and e-Health*, *16*(1), 93-95.

Adamson, G. (2016). The persistent challenge of health informatics. *Information, Communication & Society*, *19*(4), 551-558. https://doi.org/10.1080/1369118X.2015.1118523

Adler, G., Pritchett, L. R., Kauth, M. R., & Nadorff, D. (2014). A pilot project to improve access to telepsychotherapy at rural clinics. *Telemedicine and e-Health*, *20*(1), 83-85.

Adler-Milstein, J., Kvedar, J., & Bates, D. W. (2014). Telehealth Among US Hospitals: Several Factors, Including State Reimbursement And Licensure Policies, Influence Adoption [Article]. *Health Affairs*, *33*(2), 207-215. https://doi.org/10.1377/hlthaff.2013.1054

Adwok, J. (2015). Probability Sampling-A Guideline for Quantitative Health Care Research. *Annals of African Surgery*, *12*(2).

Afthanorhan, W. (2013). A comparison of partial least square structural equation modeling (PLS-SEM) and covariance based structural equation modeling (CB-SEM) for confirmatory factor analysis. *International Journal of Engineering Science and Innovative Technology*, *2*(5), 198-205.

Aggarwal, S., Jain, P., & Jain, A. (2020). COVID-19 and cataract surgery backlog in Medicare beneficiaries. *Journal of cataract and refractive surgery*.

Ahamed, F., Palepu, S., Dubey, M., & Nongkynrih, B. (2017). Scope of mobile health in Indian health care system–the way forward. *Intl J Community Med Public Health*, *4*, 875-881.

Ahmadi, H., Nilashi, M., & Ibrahim, O. (2015). Prioritizing critical factors to successful adoption of total hospital information system. *Journal of Soft Computing and Decision Support Systems*, *2*(4), 6-16.

Ahmed, S. N., Wiebe, S., Mann, C., & Ohinmaa, A. (2010). Telemedicine and epilepsy care — A Canada wide survey. *The Canadian Journal of Neurological Sciences / Le Journal Canadien Des Sciences Neurologiques*, *37*(6), 814-818. https://doi.org/10.1017/S0317167100051490

Aiello, M., Cavaliere, C., D'Albore, A., & Salvatore, M. (2019). The challenges of diagnostic imaging in the era of big data. *Journal of clinical medicine*, *8*(3), 316.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11-39). Springer.

Ajzen, I. (1987). Attitudes, traits, and actions: Dispositional prediction of behavior in personality and social psychology. *Advances in experimental social psychology*, *20,* 1-63.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological bulletin*, *84*(5), 888.

Akhlaq, A., McKinstry, B., Muhammad, K. B., & Sheikh, A. (2016). Barriers and facilitators to health information exchange in low- and middle-income country settings: a systematic review [journal article]. *Health Policy & Planning*, *31*(9), 1310-1325. https://doi.org/10.1093/heapol/czw056

Akossou, A., & Palm, R. (2013). Impact of Data Structure on the Estimators R-square and Adjusted R-square in Linear Regression. *Int. J. Math. Comput*, *20,* 84-93.

Al Athmay, A. (2015). Demographic factors as determinants of e-governance adoption: a field study in the United Arab Emirates (UAE). *Transforming Government: People, Process and Policy*, *9*(2), 159-180.

Alaboudi, A., Atkins, A., Sharp, B., Balkhair, A., Alzahrani, M., & Sunbul, T. (2016). Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia. *Journal of infection and public health*, *9*(6), 725-733.

Alam, M. Z., Hu, W., Kaium, M. A., Hoque, M. R., & Alam, M. M. D. (2020). Understanding the determinants of mHealth apps adoption in Bangladesh: A SEM-Neural network approach. *Technology in Society*, *61*, 101255.

Alami, H., Gagnon, M.-P., Wootton, R., Fortin, J.-P., & Zanaboni, P. (2017). Exploring factors associated with the uneven utilization of telemedicine in Norway: a mixed methods study. *BMC Medical Informatics and Decision Making*, *17*(1), 180.

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS quarterly*, *25*(1), 107-136.

Albarrak, A. I., Mohammed, R., Almarshoud, N., Almujalli, L., Aljaeed, R., Altuwaijiri, S., & Albohairy, T. (2019). Assessment of physician's knowledge, perception and willingness of telemedicine in Riyadh region, Saudi Arabia. *Journal of infection and public health*.

Albers, S. (2010). PLS and success factor studies in marketing. In *Handbook of partial least squares* (pp. 409-425). Springer.

Alin, A. (2010). Multicollinearity. *Wiley Interdisciplinary Reviews: Computational Statistics, 2*(3), 370-374.

Al-Mahdi, I., Gray, K., & Lederman, R. (2015). Online Medical Consultation: A review of literature and practice. Proceedings of the 8th Australasian Workshop on Health Informatics and Knowledge Management,

Alrahbi, D., Khan, M., & Hussain, M. (2019). Exploring the motivators of technology adoption in healthcare. *International Journal of Healthcare Management*, 1-14.

Altman, D. G. (1990). *Practical statistics for medical research*. CRC press.

American Medical Association. (2020). *AMA Digital Health Research: Physicians' Motivations and Requirements for Adopting Diigital Health: Adoption and Attitudinal Shifts from 2016 to 2019*. Retrieved 11 June 2021 from https://www.ama-assn.org/system/files/2020-02/ama-digital-health-study.pdf

Ammenwerth, E., Iller, C., & Mahler, C. (2006). IT-adoption and the interaction of task, technology and individuals: a fit framework and a case study. *BMC Medical Informatics and Decision Making*, *6*(1), 3.

An amendment to Regulation 2.8 governing physician/patient relationships, § 8A1B (2016). http://170.94.37.152/REGS/060.00.16-003F-16840.pdf

An amendment to Regulation 2.8 governing physician/patient relationships, § 8A1B (2016). http://170.94.37.152/REGS/060.00.16-003F-16840.pdf

An, M. H., You, S. C., Park, R. W., & Lee, S. (2021). Using an Extended Technology Acceptance Model to Understand the Factors Influencing Telehealth Utilization After Flattening the COVID-19 Curve in South Korea: Cross-sectional Survey Study. *JMIR medical informatics*, *9*(1), e25435.

Anand, S., & Fan, V. (2016). The health workforce in India.

Ananthakrishnan, N. (2010). Medical education in India: Is it still possible to reverse the downhill trend. *Nat Med J India*, *23*(3), 156-160.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological bulletin*, *103*(3), 411.

Anderson, N. H. (1981). *Foundations of information integration theory* (Vol. 578). Academic Press New York.

Andreadis, I. (2014). Data quality and data cleaning. *Matching Voters with Parties and Candidates. Voting Advice Applications in Comparative Perspective*, 79-91.

Andreassen, H. K., Trondsen, M., Kummervold, P. E., Gammon, D., & Hjortdahl, P. (2006). Patients Who Use E-Mediated Communication With Their Doctor: New Constructions of Trust in the Patient-Doctor Relationship. *Qualitative Health Research*, *16*(2), 238-248. https://doi.org/10.1177/1049732305284667

Anwar, S., & Prasad, R. (2018). Framework for Future Telemedicine Planning and Infrastructure using 5G Technology. *Wireless Personal Communications*, *100*(1), 193-208. https://doi.org/10.1007/s11277-018-5622-8

Anwar, S., Prasad, R., Chowdhary, B. S., & Anjum, M. R. (2019). A Telemedicine Platform for Disaster Management and Emergency Care [Article]. *Wireless Personal Communications*, *106*(1), 191-204. https://doi.org/10.1007/s11277-019-06273-6

Araújo, M. T., Paiva, T., Jesuino, J. C., & Magalhães, M. (2000). General practitioners and neurotelemedicine. *Studies in health technology and informatics, 78,* 45-67. http://europepmc.org/abstract/MED/11151607

Argote, L. (2012). *Organizational learning: Creating, retaining and transferring knowledge*. Springer Science & Business Media.

Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational behavior and human decision processes*, *82*(1), 150-169.

Armitage, P., Berry, G., & Matthews, J. N. S. (2008). *Statistical methods in medical research*. John Wiley & Sons.

Ashburner, J., Vickerstaff, S., Beetge, J., & Copley, J. (2016). Remote versus face-to-face delivery of early intervention programs for children with autism spectrum disorders: Perceptions of rural families and service providers. *Research in Autism Spectrum Disorders*, *23*, 1-14. https://doi.org/10.1016/j.rasd.2015.11.011

Astrachan, C. B., Patel, V. K., & Wanzenried, G. (2014). A comparative study of CB-SEM and PLS-SEM for theory development in family firm research. *Journal of Family Business Strategy, 5*(1), 116-128. https://doi.org/https://doi.org/10.1016/j.jfbs.2013.12.002

Aswathy, K., Rathi, R., & Shankar, E. S. (2019). A Facile Doctor-Validation-Strategy (DVS) for the Registration Part of Medical Query Systems with Python Programming. *International Journal of Applied Engineering Research*, *14*(5), 1098-1101.

Attri, J. P., Khetarpal, R., Chatrath, V., & Kaur, J. (2016). Concerns about usage of smartphones in operating room and critical care scenario [Review Article]. *Saudi Journal of Anesthesia*, *10*(1), 87-94. https://doi.org/10.4103/1658-354X.169483

Avison, D., & Young, T. (2007). Time To Rethink Health Care and ICT [Conceptual Paper]. *Communications of the ACM, 50*(6), 69-74.

Avkiran, N. K. (2018). An in-depth discussion and illustration of partial least squares structural equation modeling in health care. *Health Care Management Science*, *21*(3), 401-408. https://doi.org/10.1007/s10729-017-9393-7

Axel, E. (1997). 11 One developmental line in European Activity Theories. *Mind, culture, and activity: Seminal papers from the laboratory of comparative human cognition*, 128.

Azzolini, C. (2011). A pilot teleconsultation network for retinal diseases in ophthalmology. *Journal of Telemedicine and Telecare*, *17*(1), 20-24. https://doi.org/10.1258/jtt.2010.100305

Bai, V. T., Murali, V., Kim, R., & Srivatsa, S. K. (2007). Teleophthalmology-Based Rural Eye Care in India. *Telemedicine and e-Health*, *13*(3), 313-321. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eoah&AN=12183334&site=ehost-live

Baishya, A. An update on primary health care in rural India.

Bajwa, S. S. (2021). Role of ICT & traditional folk media in rural development in India. *Asian Journal of Research in Marketing*, *10*(2), 1-7. https://doi.org/10.5958/2277-6621.2021.00004.9

Balarajan, Y., Selvaraj, S., & Subramanian, S. V. (2011). Health care and equity in India. *Lancet*, *377(9764)*, 505-515. https://doi.org/10.1016/S0140-6736(10)61894-6

Baltzer, D. J., Gray, M., & Ffitzer, J. (1981). Teleconferencing may be (micro) wave of future. *Contract*, *341*, 247,800.

Barbour, R. S., & Morgan, D. L. (2017). *A new era in focus group research: Challenges, Innovation and Practice*. Springer.

Barrett, P. (2007). Structural equation modelling: Adjudging model fit. *Personality and Individual differences*, *42*(5), 815-824.

Bashshur, R. L. (1995). On the definition and evaluation of telemedicine. *Telemedicine Journal*, *1*(1), 19-30.

Bass, B. M., Avolio, B. J., Jung, D. I., & Berson, Y. (2003). Predicting unit performance by assessing transformational and transactional leadership. *Journal of applied psychology*, *88*(2), 207.

Basu, A., Kuziemsky, C., de Araújo Novaes, M., Kleber, A., Sales, F., Al-Shorbaji, N., Flórez-Arango, J. F., Gogia, S. B., Ho, K., & Hunter, I. (2021). Telehealth and the COVID-19 pandemic: international perspectives and a health systems framework for telehealth implementation to support critical response. *Yearbook of medical informatics*.

Batchelor, S., Waldman, L., Bloom, G., Rasheed, S., Scott, N., Ahmed, T., Khan, N. U. Z., & Sharmin, T. (2015). Understanding Health Information Seeking from an Actor-Centric Perspective. *International Journal of Environmental Research and Public Health*, *12*, 8103-8124. https://doi.org/10.3390/ijerph120708103

Bate, S. P., & Robert, G. (2002). Knowledge management and communities of practice in the private sector: lessons for modernizing the National Health Service in England and Wales. *Public administration*, *80*(4), 643-663.

Bee, P., Lovell, K., Airnes, Z., & Pruszynska, A. (2016). Embedding telephone therapy in statutory mental health services: A qualitative, theory-driven analysis. *BMC Psychiatry*, *16*. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2016-11238-001&site=ehost-live

Benbya, H., & McKelvey, B. (2006). Toward a complexity theory of information systems development. *Information Technology & People*, *19*(1), 12-34.

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, *2*, 8-14.

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, *2*, 8-14.

Benitez, J., Henseler, J., Castillo, A., & Schuberth, F. (2020). How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory IS research. *Information & Management*, *57*(2), 103168. https://doi.org/https://doi.org/10.1016/j.im.2019.05.003

Benschoter, R. A., Wittson, C. L., & Inngham, C. G. (1965). Teaching and consultation by television: I. Closed-circuit collaboration. *Mental Hospitals*, *16*(3), 99-100.

Berenson, M., Levine, D., Szabat, K. A., & Krehbiel, T. C. (2012). *Basic business statistics: Concepts and applications*. Pearson higher education AU.

Berg, B. L. (2001). *Qualitative Research Methods for the Social Sciences* (4 ed.). Allyn and Bacon.

Berger, D. E. (2003). Introduction to multiple regression. *USA: Claremont Graduate University*.

Bergrath, S., Rörtgen, D., Rossaint, R., Beckers, S. K., Fischermann, H., Brokmann, J. C., Czaplik, M., Felzen, M., Schneiders, M.-T., & Skorning, M. (2011). Technical and organisational feasibility of a multifunctional telemedicine system in an emergency medical service — an observational study. *Journal of Telemedicine and Telecare*, *17*(7), 371-377. https://doi.org/10.1258/jtt.2011.110203

Bernard, H. R. (2013). *Social research methods: Qualitative and quantitative approaches*. Sage.

Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches*. Rowman & Littlefield.

Bhadra, M. (2011). Indian women in medicine: an enquiry since 1880. *Indian Anthropologist*, 17-43.

Bhandari, L., & Dutta, S. (2007). Health infrastructure in rural India. *India infrastructure report*, 265-271.

Bhatia, R. (2021). Telehealth and COVID-19: Using technology to accelerate the curve on access and quality healthcare for citizens in India. *Technology in Society*, *64*, 101465.

Bigna, J. J. R., Noubiap, J. J. N., Plottel, C. S., Kouanfack, C., & Koulla-Shiro, S. (2014). Barriers to the implementation of mobile phone reminders in pediatric HIV care: a pre-trial analysis of the Cameroonian MORE CARE study. *BMC health services research*, *14*(1), 1-7.

Blackler, F. (1993). Knowledge and the theory of organizations: Organizations as activity systems and the reframing of management. *Journal of management studies*, *30*(6), 863-884.

Blackler, F. (1995). Knowledge, knowledge work and organizations: An overview and interpretation. *Organization studies*, *16*(6), 1021-1046.

Blackler, F. (2009). Cultural-historical activity theory and organization studies. *Learning and expanding with activity theory*, 19-39.

Blalock, H. M. J. (1979). *Social Statistics* (Revised second ed.). McGraw-Hill.

Blanchet, K. D. (2007). Innovative programs in Telemedicine: University of Miami Telemedicine. *Telemedicine and e-Health*, *13*(6), 627. https://doi.org/10.1089/tmj.2007.9970

Bland, M. (2015). *An introduction to medical statistics*. Oxford University Press (UK).

Blount, Y., & Gloet, M. (2015). *Adoption of ICT Enabled Telehealth Services in the Australian Context: Implications of Technology Use for Telehealth Workers* 48th Hawaii International Conference on System Sciences, Hawaii.

Blumer, H. (1969). *Symbolic Interactionism: Perspective and Method*. University of California Press.

Bock, G.-W., Zmud, R. W., Kim, Y.-G., & Lee, J.-N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS quarterly*, *29*(1), 87-111.

Bodavala, R. (2002). ICT applications in public healthcare system in India: A review. *Administrative Staff College of India Journal of Management*, *31*(1 & 2).

Boker, S., Neale, M., Maes, H., Wilde, M., Spiegel, M., Brick, T., Spies, J., Estabrook, R., Kenny, S., & Bates, T. (2011). OpenMx: an open source extended structural equation modeling framework. *Psychometrika*, *76*(2), 306-317.

Bollen, K. A., & Long, J. S. (1993). *Testing structural equation models* (Vol. 154). Sage.

Bowman, S., Hooker, K., Steggell, C., & Brandt, J. (2013). Perceptions of Communication and Monitoring Technologies Among Older Rural Women: Problem or Panacea? [Article]. *Journal of Housing for the Elderly*, *27*(1/2), 48-60. https://doi.org/10.1080/02763893.2012.754814

Bradford, N. K., Caffery, L. J., & Smith, A. C. (2016). Telehealth services in rural and remote Australia: a systematic review of models of care and factors influencing success and sustainability. *Rural and remote health*, *16*(4), 245.

Brancheau, J. C., & Wetherbe, J. C. (1990). The adoption of spreadsheet software: testing innovation diffusion theory in the context of end-user computing. *Information systems research*, *1*(2), 115-143.

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, *3*(2), 77-101.

Bresnen, M., Edelman, L., Newell, S., Scarbrough, H., & Swan, J. (2003). Social practices and the management of knowledge in project environments. *International journal of project management*, *21*(3), 157-166.

Bretschneider, S. (1990). Management information systems in public and private organizations: An empirical test. *Public Administration Review*, 536-545.

Brick, J. M., & Kalton, G. (1996). Handling missing data in survey research. *Statistical methods in medical research*, *5*(3), 215-238.

Brindha, G. (2013). Emerging trends of telemedicine in India. *Indian Journal of Science and Technology*, *6*(sup 5).

Bronfenbrenner, U. (1992). *Ecological systems theory*. Jessica Kingsley Publishers.

Brown, S. (1987). Drop and collect surveys: a neglected research technique? *Marketing Intelligence & Planning*.

Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford publications.

Brown, T. A., & Moore, M. T. (2012). Confirmatory factor analysis. *Handbook of structural equation modeling*, 361-379.

Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological methods & research*, *21*(2), 230-258.

Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? *Qualitative research*, *6*(1), 97-113.

Bryman, A. (2012). *Social Research Methods*. OUP.

Bryman, A., & Cramer, D. (2005). *Quantitative data analysis with SPSS 12 and 13: A guide for social scientists*. Psychology Press.

Buck, S. (2009). Nine human factors contributing to the user acceptance of telemedicine applications: a cognitive-emotional approach. *Journal of Telemedicine and Telecare*, *15*(2), 55-58.

Budhedeo, D. S. H. (2016). Issues And Challenges in Bringing ICT Enabled Education To Rural India. *International Journal Of Scientific Research And Education*, *4*(1). https://doi.org/10.18535/ijsre/v4i01.01

Budman, S. H., Portnoy, D., & Villapiano, A. J. (2003). How to get technological innovation used in behavioral health care: Build it and they still might not come. *Psychotherapy: Theory, Research, Practice, Training*, *40*(1-2), 45-54. https://doi.org/10.1037/0033-3204.40.1-2.45 (The Technology of Psychotherapy)

Bujang, M. A., Omar, E. D., & Baharum, N. A. (2018). A review on sample size determination for Cronbach's alpha test: a simple guide for researchers. *The Malaysian journal of medical sciences: MJMS*, *25*(6), 85.

Business Standard. (2013). *70% Indians live in rural areas: Census*. Retrieved 1 Nov, 2017 from http://www.business-standard.com/article/economy-policy/70-indians-live-in-rural-areas-census-111071500171_1.html

Byrne, B. M. (2001). Structural equation modeling with AMOS, EQS, and LISREL: Comparative approaches to testing for the factorial validity of a measuring instrument. *International journal of testing*, *1*(1), 55-86.

Byrne, B. M. (2013). *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. routledge.

Cabassut, R., & Ferrando, I. (2015). Conceptions in France about mathematical modelling: Exploratory research with design of semi-structured interviews. CERME 9-Ninth Congress of the European Society for Research in Mathematics Education,

Cady, R. G., & Finkelstein, S. M. (2014). Task–Technology Fit of Video Telehealth for Nurses in an Outpatient Clinic Setting. *Telemedicine Journal and e-health*, *20*(7), 633.

Caffery, L. J., Martin-Khan, M., & Wade, V. (2017). Mixed methods for telehealth research. *Journal of Telemedicine and Telecare, 23*(9), 764-769. https://journals.sagepub.com/doi/pdf/10.1177/1357633X16665684

Cain, M. K., Zhang, Z., & Yuan, K.-H. (2017). Univariate and multivariate skewness and kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behavior research methods, 49*(5), 1716-1735.

Campbell, J. D., Harris, K. D., & Hodge, R. (2001). Introducing telemedicine technology to rural physicians and settings. *The Journal of Family Practice, 50*(5), 419-424. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2001-06554-006&site=ehost-live

Cantor, D. E., Corsi, T. M., & Grimm, C. M. (2006). Safety technology adoption patterns in the US motor carrier industry. *Transportation Journal*, 20-45.

Carati, C., & Margelis, G. (2013, 26-28 Nov. 2012). *Towards a National Strategy for Telehealth in Australia 2013-2018* Global Telehealth 2012, Sydney. aths.org.au

Carr, E. C., & Worth, A. (2001). The use of the telephone interview for research. *NT research*, *6*(1), 511-524.

Carson, D., Gilmore, A., Perry, C., & Gronhaug, K. (2001). *Qualitative marketing research*. Sage.

Cashen, L. H., & Geiger, S. W. (2004). Statistical power and the testing of null hypotheses: A review of contemporary management research and recommendations for future studies. *Organizational Research Methods*, *7*(2), 151-167.

Catan, G., Espanha, R., Mendes, R. V., Toren, O., & Chinitz, D. (2015). Health information technology implementation Impacts and policy considerations: A comparison between Israel and Portugal. *Israel Journal of Health Policy Research*, *4*(1), Article 41. https://doi.org/10.1186/s1358401500409

Cetina, K. K., Schatzki, T. R., & Von Savigny, E. (2005). *The practice turn in contemporary theory*. Routledge.

Chaiklin, H. (2011). Attitudes, behavior, and social practice. *J. Soc. & Soc. Welfare*, *38*, 31.

Chandwani, R. (2017). Doctor-patient interaction in telemedicine: Logic of choice and logic of care perspectives. *Information Systems Frontiers*, *19*(4), 955-968.

Chandwani, R. K., & Dwivedi, Y. K. (2015). Telemedicine in India: current state, challenges and opportunities. *Transforming Government: People, Process and Policy*, *9*(4), 393-400.

Chandwani, R., & De, R. (2015). The institutional dynamics perspective of ICT for health initiatives in India. In A. Chib, J. May, & R. Barrantes (Eds.), *Impact of Information Society Research in the Global South* (pp. 167-185). Springer Open.

Chang, Y.-Z., Ko, C.-Y., Hsiao, C.-J., Chen, R.-J., Yu, C.-W., Cheng, Y.-W., Chang, T.-F., & Chao, C.-M. (2015). Understanding the Determinants of Implementing Telehealth Systems: A Combined model of the theory of Planned Behaviour and the Technology Acceptance Model. *Journal of Applied Sciences*, *15*(2), 277-282.

Chang, Y.-Z., Ko, C.-Y., Hsiao, C.-J., Chen, R.-J., Yu, C.-W., Cheng, Y.-W., Chang, T.-F., & Chao, C.-M. (2015). Understanding the Determinants of Implementing Telehealth Systems: A Combined model of the theory of Planned Behaviour and the Technology Acceptance Model. *Journal of Applied Sciences*, *15*(2), 277-282.

Chapple, A. (1999). The use of telephone interviewing for qualitiative research. *Nurse Researcher (through 2013)*, *6*(3), 85.

Charness, N., Best, R., & Evans, J. (2016). Supportive home health care technology for older adults: Attitudes and implementation. *Gerontechnology*, *15*(4), 233-242. https://doi.org/10.4017/gt.2016.15.4.006.00

Chattopadhyay, S. (2010). A Framework for Studying Perceptions of Rural Healthcare Staff and Basic ICT Support for e-Health Use: An Indian Experience. *TELEMEDICINE and e-HEALTH*, *16*(1), 80-88. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eoah&AN=20632607&site=ehost-live

Chau, P. Y. K., & Hu, P. J.-H. (2002). Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories. *Information & Management*, *39*(4), 297-311. https://doi.org/10.1016/S0378-7206(01)00098-2

Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., & Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models. *Sociological methods & research*, *36*(4), 462-494.

Chen, S.-S., Chuang, Y.-W., & Chen, P.-Y. (2012). Behavioral intention formation in knowledge sharing: Examining the roles of KMS quality, KMS self-efficacy, and organizational climate. *Knowledge-Based Systems*, *31*, 106-118.

Cheng, E. W. (2001). SEM being more effective than multiple regression in parsimonious model testing for management development research. *Journal of management development*.

Cherney, L. R., & Van Vuuren, S. (2012). Telerehabilitation, virtual therapists, and acquired neurologic speech and language disorders. Seminars in speech and language,

Chib, A., van Velthoven, M. H., & Car, J. (2015). mHealth adoption in low-resource environments: A review of the use of mobile healthcare in developing countries. *Journal of Health Communication*, *20*(1), 4-34. https://doi.org/10.1080/10810730.2013.864735

Child, D. (1990). *The essentials of factor analysis*. Cassell Educational.

Chin, W. W. (2010a). Bootstrap cross-validation indices for PLS path model assessment. In *Handbook of partial least squares* (pp. 83-97). Springer.

Chin, W. W. (2010b). How to write up and report PLS analyses. In *Handbook of partial least squares* (pp. 655-690). Springer.

Chin, W. W., & Newsted, P. R. (1999). Structural equation modeling analysis with small samples using partial least squares. *Statistical strategies for small sample research*, *1*(1), 307-341.

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information systems research*, *14*(2), 189-217.

Chinai, R. (2007). Medical visas mark growth of Indian medical tourism. *Bulletin of the World Health Organization*, *85*(3), 164-165. https://doi.org/10.2471/blt.07.010307

Chismar, W. G., & Wiley-Patton, S. (2003). Does the extended technology acceptance model apply to physicians. Proceedings of the 36th Annual Hawaii International Conference on System Sciences 2003,

Cho, S., Mathiassen, L., & Gallivan, M. (2009). Crossing the diffusion chasm: from invention to penetration of a telehealth innovation. *Information Technology & People*, *22*(4), 351-366. https://doi.org/doi:10.1108/09593840911002450

Cho, S., Mathiassen, L., & Robey, D. (2007). Dialectics of Resilience: A Multi–Level Analysis of a Telehealth Innovation. *Journal of Information Technology*, *22*(1), 24-35. https://doi.org/10.1057/palgrave.jit.2000088

Choudhury, N. R. (2016). Framework for development of Information Technology Infrastructure for Health (ITIH) care in India – a critical study. *Qualitative and Quantitative Methods in Libraries (QQML)*, *5*, 787-796.

Chowdhury, A., Hafeez-Baig, A., Gururajan, R., & Chakraborty, S. (2019). Conceptual framework for telehealth adoption in Indian healthcare. 24th Annual Conference of the Asia Pacific Decision Sciences Institute: Full papers,

Chowdhury, A., Hafeez-Baig, A., Gururajan, R., & Sharif, M. A. (2020). The Adoption of Mobile Technologies in Healthcare: The Perceptions of Healthcare Professionals Regarding Knowledge Management Practices in Developing Countries. In C. Stephanidis, G. Salvendy, J. Wei, S. Yamamoto, H. Mori, G. Meiselwitz, F. F.-H. Nah, & K. Siau (Eds.), *HCI International 2020 – Late Breaking Papers: Interaction, Knowledge and Social Media, 22nd HCI International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Lecture Notes in Computer Science* (1 ed., Vol. 12427, pp. 68-76). Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-030-60152-2_5

Chung, J. W. Y., Chung, L. M. Y., Kwok, N. W. L., & Wong, T. K. S. (2008). Evaluation of services of the integrative health clinic in Hong Kong. *Journal of Clinical Nursing (Wiley-Blackwell)*, *17*(19), 2550-2557. https://doi.org/10.1111/j.1365-2702.2008.02305.x

Cilliers, L., & Flowerday, S. V. (2013). Health information systems to improve health care: A telemedicine case study. *SA Journal of Information Management*, *15*(1), 5. https://doi.org/10.4102/sajim.v15i1.541

Cimperman, M., Brenčič, M. M., & Trkman, P. (2016). Analyzing older users' home telehealth services acceptance behavior—applying an Extended UTAUT model. *International journal of medical informatics*, *90*, 22-31.

Clemensen, J., Rasmussen, J., Denning, A., & Craggs, M. (2011). Patient empowerment and new citizen roles through telehealth technologies. Proceedings of conference eTELEMED,

CMS. (2016a). *Medicaid program; face-to-face requirements for home health services; policy changes and clarifications related to home health*. Retrieved 21 Feb 2018 from https://s3.amazonaws.com/public-inspection.federalregister.gov/2016-01585.pdf

CMS. (2016b). *Telemedicine (n.d.)*. Centers for Medicare & Medicaid Services. Retrieved 21 Feb 2018 from https://www.medicaid.gov/medicaid/benefits/telemed/index.html

Cohen, D., & Crabtree, B. (2006). *Qualitative research guidelines project*. http://www.qualres.org/HomeSemi-3629.html

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic press.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). *Applied multiple regression/correlation analysis for the behavioral sciences*. Routledge.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative science quarterly*, 128-152.

Collis, J., & Hussey, R. (2014). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students* (4 ed.). Palgrave Macmillan.

Conde, J. G., De, S., Hall, R. W., Johansen, E., Meglan, D., & Peng, G. C. (2010). Telehealth innovations in health education and training. *Telemedicine and e-Health*, *16*(1), 103-106.

Confederation of Indian Industry, & KPMG. (2017). *Building ICT Infrastructure - Connecting the unconnected*.

Cooper, R. B., & Zmud, R. W. (1990). Information technology implementation research: a technological diffusion approach. *Management science*, *36*(2), 123-139.

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment, research, and evaluation*, *10*(1), 7.

Courtney, K. L., Demiris, G., Rantz, M., & Skubic, M. (2008). Needing smart home technologies: the perspectives of older adults in continuing care retirement communities. *Informatics in Primary Care*, *16*(3), 195-201. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=105605701&site=ehost-live

Cousins, P. D. (2002). A conceptual model for managing long-term inter-organisational relationships. *European Journal of Purchasing & Supply Management*, *8*(2), 71-82.

Craig, J., & Patterson, V. (2005). Introduction to the practice of telemedicine. *Journal of Telemedicine and Telecare*, *11*(1), 3-9.

Cramer, D. (2003). *Advanced quantitative data analysis*. McGraw-Hill Education (UK).

Creswell, J. W. (2014). *A concise introduction to mixed methods research*. SAGE publications.

Creswell, J. W. (2014). *A concise introduction to mixed methods research*. SAGE publications.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.

Creswell, J. W., Fetters, M. D., & Ivankova, N. V. (2004). Designing a mixed methods study in primary care. *The Annals of Family Medicine*, *2*(1), 7-12.

Creswell, J. W., Fetters, M. D., & Ivankova, N. V. (2004). Designing a mixed methods study in primary care. *The Annals of Family Medicine*, *2*(1), 7-12.

Creswell, J. W., Klassen, A. C., Plano Clark, V. L., & Smith, K. C. (2011). Best practices for mixed methods research in the health sciences. *Bethesda (Maryland): National Institutes of Health*, *2013*, 541-545.

Creswell, J. W., Klassen, A. C., Plano Clark, V. L., & Smith, K. C. (2011). Best practices for mixed methods research in the health sciences. *Bethesda (Maryland): National Institutes of Health*, *2013*, 541-545.

Crotty, M., & Crotty, M. F. (1998). *The foundations of social research: Meaning and perspective in the research process*. Sage.

Cunningham, C. T., Quan, H., Hemmelgarn, B., Noseworthy, T., Beck, C. A., Dixon, E., Samuel, S., Ghali, W. A., Sykes, L. L., & Jetté, N. (2015). Exploring physician specialist response rates to web-based surveys. *BMC Medical Research Methodology*, *15*(1), 32.

Dagenais, C., Dupont, D., Brière, F. N., Mena, D., Yale-Soulière, G., & Mc Sween-Cadieux, E. (2020). Codifying explicit and tacit practitioner knowledge in community social pediatrics organizations: Evaluation of the first step of a knowledge transfer strategy. *Evaluation and Program Planning*, *79*, 101778.

Damanpour, F., & Schneider, M. (2006). Phases of the adoption of innovation in organizations: effects of environment, organization and top managers 1. *British journal of Management*, *17*(3), 215-236.

Darkins, A., Kendall, S., Edmonson, E., Young, M., & Stressel, P. (2015). Reduced cost and mortality using home telehealth to promote self-management of complex chronic conditions: a retrospective matched cohort study of 4,999 veteran patients. *Telemedicine and e-Health*, *21*(1), 70-76.

Dasgupta, A., & Deb, S. (2008). Telemedicine: A new horizon in public health in india. *Indian Journal of Community Medicine*, *33*(1), 3-8.

Dattakumar, A. (2012). *Adoption of Telemedicine in India: Perceptions of Decision Makers and Clinicians* [Standard, Monash University]. Melbourne.

Davidson, E. J., & Chismar, W. G. (2007). The interaction of institutionally triggered and technology-triggered social structure change: An investigation of computerized physician order entry. *MIS Quarterly*, 739-758.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319-340.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*(3), 475-487. https://doi.org/https://doi.org/10.1006/imms.1993.1022

De Rosis, S., & Seghieri, C. (2015). Basic ICT adoption and use by general practitioners: an analysis of primary care systems in 31 European countries. *BMC Medical Informatics and Decision Making*, *15*(70). https://doi.org/10.1186/s12911-015-0185-z

Dearnley, C. (2005). A reflection on the use of semi-structured interviews. *Nurse researcher, 13*(1).

DeJonckheere, M., & Vaughn, L. M. (2019). Semistructured interviewing in primary care research: a balance of relationship and rigour. *Family Medicine and Community Health*, *7*(2).

Dempsey, L., Dowling, M., Larkin, P., & Murphy, K. (2016). Sensitive interviewing in qualitative research. *Research in nursing & health*, *39*(6), 480-490.

Denzin, N. K. (1986). Postmodern social theory. *Sociological theory*, *4*(2), 194-204.

Denzin, N. K., & Lincoln, Y. S. (2008). Introduction: The discipline and practice of qualitative research.

Deogaonkar, M. (2004). Socio-economic inequality and its effect on healthcare delivery in India: Inequality and healthcare. *Electronic Journal of Sociology*, *8*(1).

Depietro, R., Wiarda, E., & Fleischer, M. (1990). The Context for Change: Organization, Technology and Environment. In L. G. Tornatzky & M. Fleischer (Eds.), *The processes of technological innovation* (pp. 151-175). Lexington Books.

Deshpande, R. (1983). “Paradigms lost”: On theory and method in research in marketing. *Journal of marketing*, *47*(4), 101-110.

Deswal, B. S., & Singhal, V. K. (2016). Problems of medical education in India. *Int J Community Med Public Health*, *3*(7), 1905-1909.

Deterding, N. M., & Waters, M. C. (2021). Flexible coding of in-depth interviews: A twenty-first-century approach. *Sociological methods & research*, *50*(2), 708-739.

DeVellis, R. F. (2016). *Scale development: Theory and applications* (Vol. 26). Sage publications.

Dewey, J. (1931). The development of American pragmatism. In J. Dewey (Ed.), *Philosophy and Civilization*. Minton, Balch & Co.

Dewey, J. (1938). *Logic: The Theory of Inquiry*. Henry Holt.

Diaper, C. (2021). NHS needs more capacity to tackle surgery backlog. *Bmj*, *372*.

Dick, H. P. (2006). What to do with "I don't know:" Elicitation in ethnographic & survey interviews. *Qualitative Sociology*, *29*(1), 87-102.

Dillon, A., & Morris, M. G. (1996). User acceptance of new information technology: theories and models. In *Annual review of information science and technology*. Medford, NJ: Information Today.

Dinesen, B., Nonnecke, B., Lindeman, D., Toft, E., Kidholm, K., Jethwani, K., Young, H. M., Spindler, H., Oestergaard, C. U., & Southard, J. A. (2016). Personalized telehealth in the future: a global research agenda. *Journal of Medical Internet Research*, *18*(3), e53.

Doarn, C. R., Pruitt, S., Jacobs, J., Harris, Y., Bott, D. M., Riley, W., Lamer, C., & Oliver, A. L. (2014). Federal efforts to define and advance telehealth—a work in progress. *TELEMEDICINE and e-HEALTH*, *20*(5), 409-418.

Doarn, C. R., Yellowlees, P., Jeffries, D. A., Lordan, D., Davis, S., Hammack, G., McClosky-Armstrong, T., & Kvedar, J. (2008). Societal Drivers in the Applications of Telehealth [TELEHEALTH WHITE PAPERS: A ROADMAP FOR THE FUTURE Societal Impacts]. *TELEMEDICINE and e-HEALTH*, 998 - 1002. https://doi.org/DOI: 10.1089/tmj.2008.0111

Doarn, C. R., Zacharias, S., Keck, C. S., Tabangin, M., DeAlarcon, A., & Kelchner, L. (2019). Design and Implementation of an Interactive Website for Pediatric Voice Therapy—The Concept of In-Between Care: A Telehealth Model. *Telemedicine and e-Health*, *25*(5), 415-422.

Dodder, R., & Dare, R. (2000). Complex adaptive systems and complexity theory: inter-related knowledge domains. ESD. 83: Research Seminar in Engineering Systems, Dodel, M. (2015). An Analytical Framework to Incorporate ICT as an Independent Variable In A. Chib, J. May, & R. Barrantes (Eds.), *Impact of Information Society Research in the Global South* (pp. 125-144). Springer Open.

Dodgson, M., Gann, D., & Salter, A. (2006). The role of technology in the shift towards open innovation: the case of Procter & Gamble. *R&D Management*, *36*(3), 333-346.

Donovan, L. M., Mog, A. C., Blanchard, K. N., Magid, K. H., Syed, A. S., Kelley, L. R., Palen, B. N., Parsons, E. C., McCall, C. C., & Thompson, W. (2021). Patient experiences with telehealth in sleep medicine: a qualitative evaluation. *Journal of Clinical Sleep Medicine*, jcsm. 9266.

Doody, O., & Noonan, M. (2013). Preparing and conducting interviews to collect data. *Nurse researcher, 20*(5).

Dosaj, A., Thiyagarajan, D., Ter Haar, C., Cheng, J., George, J., Wheatley, C., & Ramanathan, A. (2021). Rapid implementation of telehealth services during the COVID-19 pandemic. *Telemedicine and e-Health*, *27*(2), 116-120.

Draper, N. R., & Smith, H. (1998). *Applied regression analysis* (Vol. 326). John Wiley & Sons.

Driscoll, D. L., Appiah-Yeboah, A., Salib, P., & Rupert, D. J. (2007). Merging qualitative and quantitative data in mixed methods research: How to and why not.

Dünnebeil, S., Sunyaev, A., Blohm, I., Leimeister, J. M., & Krcmar, H. (2012). Determinants of physicians' technology acceptance for e-health in ambulatory care. *International Journal of Medical Informatics*, *81*(11), 746-760. https://doi.org/https://doi.org/10.1016/j.ijmedinf.2012.02.002

Duplantie, J., Gagnon, M.-P., Fortin, J.-P., & Landry, R. (2007). Telehealth and the recruitment and retention of physicians in rural and remote regions: a Delphi study. *Can J Rural Med*, *12*(1), 30-36.

Durrani, H., & Khoja, S. (2009). A systematic review of the use of telehealth in Asian countries. *Journal of Telemedicine and Telecare*, *15*(4), 175-181. https://doi.org/10.1258/jtt.2009.080605

Dwivedi, A., Bali, R. K., James, A. E., & Naguib, R. N. G. (2001, 25-28 Oct. 2001). Telehealth systems: considering knowledge management and ICT issues. 2001 Conference Proceedings of the 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society,

Dwivedi, A., Bali, R., James, A., & Naguib, R. (2001). Telehealth systems: considering knowledge management and ICT issues. 2001 Conference Proceedings of the 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society,

Dwivedi, A., Bali, R., James, A., Naguib, R., & Johnston, D. (2002). Merger of knowledge management and information technology in healthcare: Opportunities and challenges. IEEE CCECE2002. Canadian Conference on Electrical and Computer Engineering. Conference Proceedings (Cat. No. 02CH37373),

Dwivedi, Y. K., Choudrie, J., & Brinkman, W. P. (2006). Development of a survey instrument to examine consumer adoption of broadband. *Industrial Management & Data Systems*.

Dyk, L. v. (2014). A review of Telehealth Service Implementation Frameworks [Systematic Review]. *International Journal of Environmental Research and Public Health*, *11*, 1279-1298. https://doi.org/10.3390/ijerph110201279

Elder, L., & Clarke, M. (2007). Past, present and future: experiences and lessons from telehealth projects. *Open Med*, *1*(3), 166-170.

Ellimoottil, C., An, L., Moyer, M., Sossong, S., & Hollander, J. E. (2018). Challenges and opportunities faced by large health systems implementing telehealth. *Health Affairs*, *37*(12), 1955-1959.

Elliott, A. C., Hynan, L. S., Reisch, J. S., & Smith, J. P. (2006). Preparing data for analysis using Microsoft Excel. *Journal of investigative medicine, 54*(6), 334-341.

El-Mahalli, A. A., El-Khafif, S. H., & Al-Qahtani, M. F. (2012). Successes and Challenges in the Implementation and Application of Telemedicine in the Eastern Province of Saudi Arabia. *Perspectives in Health Information Management*, 1-27. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=104388548&site=ehost-live

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of advanced nursing*, *62*(1), 107-115.

Emory, C. W., & Cooper, D. R. (1991). Business Research Methods. Boston: Richard D. Irwin. *Inc*.

Engeström, Y. (1999). Activity theory and individual and social transformation. *Perspectives on activity theory*, *19*(38), 19-30.

Engeström, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualization. *Journal of education and work, 14*(1), 133-156.

Engeström, Y. (2006). Activity theory and expansive design. *Theories and practice of interaction design*, 3-23.

Engeström, Y., Engeström, R., & Vähäaho, T. (1999). *When the center does not hold: The importance of knotworking* (Vol. 381).

Epple, D., Argote, L., & Devadas, R. (1991). Organizational learning curves: A method for investigating intra-plant transfer of knowledge acquired through learning by doing. *Organization science*, *2*(1), 58-70.

Etikan, I., & Bala, K. (2017). Sampling and sampling methods. *Biometrics & Biostatistics International Journal*, *5*(6), 00149.

Eysenbach, G. (2001). What is e-health? [Editorial]. *J Med Internet Res*, *3*(2), e20. https://doi.org/10.2196/jmir.3.2.e20

Faber, S., Van Geenhulzen, M., & de Reuver, M. (2017). eHealth adoption factors in medical hospitals: A focus on the Netherlands. *International Journal of Medical Informatics*, *100*, 77-89. https://doi.org/10.1016/j.ijmedinf.2017.01.009

Farnham, J. W. (2006). Disaster and emergency communications prior to computers / Internet: A review. *Critical Care*, *10*, 207. https://doi.org/doi:10.1186/cc3944

Farrar, D. E., & Glauber, R. R. (1967). Multicollinearity in regression analysis: the problem revisited. *The Review of Economic and Statistics*, 92-107.

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—principles and practices. *Health Services Research*, *48*(6pt2), 2134-2156.

Fichman, R. G. (1992). Information technology diffusion: a review of empirical research. ICIS,

Field, A. (2017). *Discovering statistics using IBM SPSS statistics: North American edition*. sage.

Fink, A. (2003). *How to manage, analyze, and interpret survey data*. Sage.

Finkelstein, S. M., Speedie, S. M., Zhou, X., Potthoff, S., & Ratner, E. R. (2011). Perception, satisfaction and utilization of the VALUE home telehealth service. *Journal of Telemedicine and Telecare*, *17*(6), 288-292. https://doi.org/10.1258/jtt.2011.100712

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*.

Fishbein, M., & Ajzen, I. (1976). Misconceptions about the Fishbein model: Reflections on a study by Songer-Nocks. *Journal of Experimental Social Psychology*, *12*(6), 579-584.

Fixsen, D. L., Naoom, S. F., Blase, K. A., Friedman, R. M., Wallace, F., Burns, B., Carter, W., Paulson, R., Schoenwald, S., & Barwick, M. (2005). Implementation research: A synthesis of the literature.

Fleuren, M., Wiefferink, K., & Paulussen, T. (2004). Determinants of innovation within health care organizations: literature review and Delphi study. *International journal for quality in health care*, *16*(2), 107-123.

Flick, U. (2015). *Introducing Research Methodology: A Beginner's Guide to Doing a Research Project*. SAGE.

Frambach, R. T., & Schillewaert, N. (2002). Organizational innovation adoption: A multi-level framework of determinants and opportunities for future research. *Journal of business research*, *55*(2), 163-176.

Franke, G., & Sarstedt, M. (2019). Heuristics versus statistics in discriminant validity testing: a comparison of four procedures. *Internet Research*.

Freidson, E. (1988). *Profession of medicine: A study of the sociology of applied knowledge*. University of Chicago Press.

Gabriel, C. (1990). The validity of qualitative market research. *Journal of the Market Research Society*.

Gagnon, M. P., Lamothe, L., Fortin, J. P., Cloutier, A., Godin, G., Gagné, C., & Reinharz, D. (2005). Telehealth adoption in hospitals:an organisational perspective. *Journal of Health Organization and Management*, *19*(1), 32-56. https://doi.org/doi:10.1108/14777260510592121

Gagnon, M.-P., Godin, G., Gagné, C., Fortin, J.-P., Lamothe, L., Reinharz, D., & Cloutier, A. (2003). An adaptation of the theory of interpersonal behaviour to the study of telemedicine adoption by physicians. *International Journal of Medical Informatics*, *71*(2), 103-115. https://doi.org/10.1016/S1386-5056(03)00094-7

Gallivan, M. J. (2001). Organizational adoption and assimilation of complex technological innovations: development and application of a new framework. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, *32*(3), 51-85.

Ganapathy, K. (2002). Telemedicine and Neurosciences in Developing Countries. *Surg Neurol*, *58*, 388-394.

Ganapathy, K. (2014). Telehealth in India: The Apollo contribution and an overview. *Apollo Medicine*, *11*(3), 201-207. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eoah&AN=33476577&site=ehost-live

Ganapathy, K. (2015a). Distribution of neurologists and neurosurgeons in India and its relevance to the adoption of telemedicine. *Neurology India*, *63*(2), 142.

Ganapathy, K. (2015b). Distribution of neurologists and neurosurgeons in India and its relevance to the adoption of telemedicine. *Neurology India*, *63*(2), 142-154.

Ganapathy, K., Alagappan, D., Rajakumar, H., Dhanapal, B., Rama Subbu, G., Nukala, L., Premanand, S., Veerla, K. M., Kumar, S., & Thaploo, V. (2019). Tele-Emergency Services in the Himalayas. *Telemedicine and e-Health*, *25*(5), 380-390.

Garbett, R., & Mccormack, B. (2001). The experience of practice development: an exploratory telephone interview study. *Journal of Clinical Nursing*, *10*(1), 94-102.

Garland, A. F., Bickman, L., & Chorpita, B. F. (2010). Change what? Identifying quality improvement targets by investigating usual mental health care. *Administration and Policy in Mental Health and Mental Health Services Research*, *37*(1-2), 15-26.

Gaskell, G. (2000). Individual and group interviewing. *Qualitative researching with text, image and sound*, 38-56.

Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research policy*, *33*(6-7), 897-920.

Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information systems*, *4*(1), 7.

Ghani, M. K. A., & Jaber, M. M. (2015). Willingness to adopt telemedicine in major Iraqi hospitals: a pilot study. *International journal of telemedicine and applications*, *2015*, 6.

Ghia, C. J., Ved, J. K., & Jha, R. K. (2013). Benefits of Telemedicine and Barriers to its Effective Implementation in Rural India: A Multicentric E-Survey.

Gichoya, D. (2005). Factors affecting the successful implementation of ICT projects in government. *the Electronic Journal of e-government*, *3*(4), 175-184.

Gil-Garcia, J. R. (2008). Using partial least squares in digital government research. In *Handbook of research on public information technology* (pp. 239-253). IGI Global.

Gillham, B. (2005). *Research Interviewing: The range of techniques: A practical guide*. McGraw-Hill Education (UK).

Gillham, B. (2005). *Research Interviewing: The range of techniques: A practical guide*. McGraw-Hill Education (UK).

Gilmour, Campbell, Loane, Esmail, Griffiths, Roland, Parry, Corbett, Eedy, Gore, Mathews, Steel, & Wootton. (1998). Comparison of teleconsultations and face-to-face consultations: preliminary results of a United Kingdom multicentre teledermatology study [Article]. *British Journal of Dermatology*, *139*(1). https://doi.org/10.1046/j.1365-2133.1998.02318.x

Glaser, B., & Strauss, A. (1967). The discovery of grounded theory. *London: Weidenfeld and Nicholson*, *24*(25), 288-304.

Goel, S., Angeli, F., Dhirar, N., Sangwan, G., Thakur, K., & Ruwaard, D. (2019). Factors affecting medical students’ interests in working in rural areas in North India—A qualitative inquiry. *PLoS ONE*, *14*(1), e0210251.

Goldkuhl, G. (2012). Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems, 21*(2), 135-146.

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly*, 213-236.

Grant, A. (2011). Fear, confusion and participation: Incapacity Benefit claimants and (compulsory) work focused interviews. *Research, Policy and Planning, 28*(3), 161-171.

Gray, P. S., Williamson, J. B., Karp, D. A., & Dalphin, J. R. (2007). *The research imagination: An introduction to qualitative and quantitative methods*. Cambridge University Press.

Greenhalgh, T., & Stones, R. (2010). Theorising big IT programmes in healthcare: strong structuration theory meets actor-network theory. *Social science & medicine, 70*(9), 1285-1294.

Greenhalgh, T., Potts, H. W., Wong, G., Bark, P., & Swinglehurst, D. (2009). Tensions and paradoxes in electronic patient record research: a systematic literature review using the meta-narrative method. *The Milbank Quarterly, 87*(4), 729-788.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: systematic review and recommendations. *The Milbank Quarterly, 82*(4), 581-629.

Grice, J. W. (2001). Computing and evaluating factor scores. *Psychological methods, 6*(4), 430.

Groeneveld, R. A., & Meeden, G. (1984). Measuring skewness and kurtosis. *Journal of the Royal Statistical Society: Series D (The Statistician), 33*(4), 391-399.

Gschwendtner, A., Netzer, T., Mairinger, B., & Mairinger, T. (1997). What do students think about telemedicine? *Journal of Telemedicine and Telecare, 3*(3), 169-171.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research*, *2*(163-194), 105.

Gulati, A. G. (2009). Broadband Services for Rural India: Connectivity and Content. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1419425

Gupta, S. G. (2013). Tips for telephone and electronic medical consultation. *The Indian Journal of Pediatrics*, *80*(11), 944-948.

Gururajan, R., & Hafeez-Baig, A. (2014). An empirical study to determine factors that motivate and limit the implementation of ICT in healthcare environments. *BMC Medical Informatics and Decision Making*, *14*(1), 1-8. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eoah&AN=35512425&site=ehost-live

Habing, B. (2003). Exploratory factor analysis. *University of South Carolina-October*, *15*, 2003.

Hadi, A. S., & Ling, R. F. (1998). Some cautionary notes on the use of principal components regression. *The American Statistician*, *52*(1), 15-19.

Hafeez-Baig, A., & Gururajan, R. (2010). An Exploratory Study to Understand the Drivers and Inhibitors for the Successful Adoption of Wireless Technology in Australian Healthcare Systems. In W. Pease, M. Cooper, & R. Gururajan (Eds.), *Biomedical Knowledge Management: Infrastructures and Processes for E-Health Systems*. IGI Global.

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.

Hair Jr, J. F., Matthews, L. M., Matthews, R. L., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: updated guidelines on which method to use. *International Journal of Multivariate Data Analysis*, *1*(2), 107-123.

Hair Jr, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European business review*.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (1998). *Multivariate data analysis* (5 ed.). Prentice hall Upper Saddle River, NJ.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, *19*(2), 139-152.

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the academy of marketing science*, *40*(3), 414-433.

Hammer, M. (1990). Reengineering work: don't automate, obliterate. *Harvard business review*, *68*(4), 104-112.

Hanafizadeh, M. R., Saghaei, A., & Hanafizadeh, P. (2009). An index for cross-country analysis of ICT infrastructure and access. *Telecommunications Policy*, *33*(7), 385-405.

Handayani, P. W., Hidayanto, A. N., Pinem, A. A., Hapsari, I. C., Sandhyaduhita , P. I., & Budi, I. (2017). Acceptance Model of a Hospital information System. *International Journal of Medical Informatics*, *99*, 11-28.

Hanney, S. R., Gonzalez-Block, M. A., Buxton, M. J., & Kogan, M. (2003). The utilisation of health research in policy-making: concepts, examples and methods of assessment. *Health research policy and systems*, *1*(1), 1-28.

Harel, O. (2009). The estimation of R 2 and adjusted R 2 in incomplete data sets using multiple imputation. *Journal of Applied Statistics*, *36*(10), 1109-1118.

Harrell, M. C., & Bradley, M. A. (2009). *Data collection methods. Semi-structured interviews and focus groups*.

Harrington, D. (2009). *Confirmatory factor analysis*. Oxford university press.

Harrison, S., Moran, M., & Wood, B. (2002). Policy emergence and policy convergence: the case of 'scientific-bureaucratic medicine'in the United States and United Kingdom. *The British Journal of Politics and International Relations*, *4*(1), 1-24.

Harvey-Jordan, S., & Long, S. (2001). The process and the pitfalls of semi-structured interviews. *Community Practitioner*, *74*(6), 219.

Haug, M. R., & Lavin, B. (1983). Consumerism in medicine: Challenging physician authority.

Hayduk, L., Cummings, G., Boadu, K., Pazderka-Robinson, H., & Boulianne, S. (2007). Testing! testing! one, two, three–Testing the theory in structural equation models! *Personality and Individual differences*, *42*(5), 841-850.

Haynes, S. N., Richard, D., & Kubany, E. S. (1995). Content validity in psychological assessment: A functional approach to concepts and methods. *Psychological assessment*, *7*(3), 238.

Healy, M., & Perry, C. (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative market research: An international journal*.

Helitzer, D., Heath, D., Maltrud, K., Sullivan, E., & Alverson, D. (2003). Assessing or predicting adoption of telehealth using the diffusion of innovations theory: a practical example from a rural program in New Mexico. *Telemedicine Journal and e-health*, *9*(2), 179-187.

Henderson, C., Knapp, M., Fernández, J.-L., Beecham, J., Hirani, S. P., Cartwright, M., Rixon, L., Beynon, M., Rogers, A., & Bower, P. (2013). Cost effectiveness of telehealth for patients with long term conditions (Whole Systems Demonstrator telehealth questionnaire study): nested economic evaluation in a pragmatic, cluster randomised controlled trial. *Bmj*, *346*.

Henderson, H. V., & Velleman, P. F. (1981). Building multiple regression models interactively. *Biometrics*, 391-411.

Hendy, J., Chrysanthaki, T., Barlow, J., Knapp, M., Rogers, A., Sanders, C., Bower, P., Bowen, R., Fitzpatrick, R., & Bardsley, M. (2012). An organisational analysis of the implementation of telecare and telehealth: the whole systems demonstrator. *BMC health services research*, *12*(1), 1-10.

Henry, G. (1990). Sample selection approaches. *Practical sampling*, 17-32.

Henseler, J. (2020). *Composite-based structural equation modeling: analyzing latent and emergent variables*. Guilford Publications.

Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., Ketchen Jr, D. J., Hair, J. F., Hult, G. T. M., & Calantone, R. J. (2014). Common beliefs and reality about PLS: Comments on Rönkkö and Evermann (2013). *Organizational Research Methods*, *17*(2), 182-209.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, *43*(1), 115-135.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In *New challenges to international marketing*. Emerald Group Publishing Limited.

Hirko, K. A., Kerver, J. M., Ford, S., Szafranski, C., Beckett, J., Kitchen, C., & Wendling, A. L. (2020). Telehealth in response to the COVID-19 pandemic: Implications for rural health disparities. *Journal of the American Medical Informatics Association*, *27*(11), 1816-1818.

Hodgkins, M., Barron, M., Jevaji, S., & Lloyd, S. (2021). Physician requirements for adoption of telehealth following the SARS-CoV-2 pandemic. *npj Digital Medicine*, *4*(1), 19. https://doi.org/10.1038/s41746-021-00390-y

Hoffman, D. A. (2020). Increasing access to care: telehealth during COVID-19. *Journal of Law and the Biosciences*, *7*(1), lsaa043.

Hohwü, L., Lyshol, H., Gissler, M., Jonsson, S. H., Petzold, M., & Obel, C. (2013). Web-Based Versus Traditional Paper Questionnaires: A Mixed-Mode Survey With a Nordic Perspective [Original Paper]. *J Med Internet Res*, *15*(8), e173. https://doi.org/10.2196/jmir.2595

Holden, M. T., & Lynch, P. (2004). Choosing the appropriate methodology: Understanding research philosophy. *The marketing review*, *4*(4), 397-409.

Holden, R. J., & Karsh, B.-T. (2010). The Technology Acceptance Model: Its past and its future in health care. *Journal of Biomedical Informatics*, *43*(1), 159-172. https://doi.org/https://doi.org/10.1016/j.jbi.2009.07.002

Holt, A. (2010). Using the telephone for narrative interviewing: a research note. *Qualitative research*, *10*(1), 113-121.

Holweg, M. (2007). The genealogy of lean production. *Journal of operations management*, *25*(2), 420-437.

Hooper, D., Coughlan, J., & Mullen, M. (2008). Evaluating model fit: a synthesis of the structural equation modelling literature. 7th European Conference on research methodology for business and management studies,

Hsiao, C. H., & Yang, C. (2011). The intellectual development of the technology acceptance model: A co-citation analysis. *International Journal of Information Management*, *31*(2), 128-136.

Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277-1288.

https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1746-1561.2007.00214.x

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, *6*(1), 1-55.

Hu, P. J., Chau, P. Y. K., Liu Sheng, O. R., & Kar Yan, T. (1999). Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology [Article]. *Journal of Management Information Systems*, *16*(2), 91-112. https://doi.org/10.1080/07421222.1999.11518247

Hu, P., Chau, P. Y. K., & Liu Sheng, O. R. (2002). Adoption of telemedicine technology by health care organizations: An exploratory study. *Journal of Organizational Computing and Electronic Commerce*, *12*(3), 197-221.

Hu, P., Chau, P., Sheng, O., & Tam, K. (1999). Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management Information Systems, 16*(2), 91-112.

Hu, P., Sheng, O., Chau, P. Y., Tam, K., & Fung, H. (1999). Investigating physician acceptance of telemedicine technology: A survey study in Hong Kong. Proceedings of the Hawaii International Conference on System Sciences,

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic management journal*, *20*(2), 195-204.

Hunt, S. D. (1991). Positivism and paradigm dominance in consumer research: toward critical pluralism and rapprochement. *Journal of consumer research*, *18*(1), 32-44.

Hunter, J. (2015). An Intervention to Improve the Comfort And Satisfaction of Nurses in the Telephone Triage of Child Maltreatment Calls [Article]. *Pediatric Nursing*, *41*(6), 296-300. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=111668962&site=ehost-live

Hutchins, E. (1993). Learning to navigate. *Understanding practice: Perspectives on activity and context*, 35-63.

Hutchins, E. (1993). Learning to navigate. *Understanding practice: Perspectives on activity and context*, 35-63.

Islam, M. N. (2017). New Consumption: Rise of Health Tourism. *Chinese and Indian Medicine Today*, 141-164. https://doi.org/10.1007/978-981-10-3962-1_6

Iyer, M. (2014). Telemedicine Adoption in India: The new Drivers. *Health and Medicine*.

Jaeger, R. G., & Halliday, T. R. (1998). On confirmatory versus exploratory research. *Herpetologica*, S64-S66.

Jameson, J. P., Farmer, M. S., Head, K. J., Fortney, J., & Teal, C. R. (2011). VA Community Mental Health Service Providers' Utilization of and Attitudes Toward Telemental Health Care: The Gatekeeper's Perspective [Article]. *Journal of Rural Health*, *27*(4), 425-432. https://doi.org/10.1111/j.1748-0361.2011.00364.x

Janda, M., Horsham, C., Koh, U., Gillespie, N., Vagenas, D., Loescher, L. J., Curiel-Lewandrowski, C., Hofmann-Wellenhof, R., & Peter Soyer, H. (2019). Evaluating healthcare practitioners' views on store-and-forward teledermoscopy services for the diagnosis of skin cancer. *Digital health*, *5*, 2055207619828225.

Jarvis-Selinger, S., Chan, E., Payne, R., Plohman, K., & Ho, K. (2008). Clinical telehealth across the disciplines: lessons learned. *Telemedicine and e-Health*, *14*(7), 720-725.

Jean, C., Jankovic, M., Stal-Le Cardinal, J., & Bocquet, J.-C. (2015). Predictive modelling of telehealth system deployment. *Journal of Simulation*, *9*(2), 182-194.

Jeon, J. (2015). The strengths and limitations of the statistical modeling of complex social phenomenon: Focusing on SEM, path analysis, or multiple regression models. *International Journal of Economics and Management Engineering*, *9*(5), 1634-1642.

Jinka, S., & Venugopal, P. (2015). PERCEPTION OF DOCTORS ON THE ACCEPTANCE AND USE OF TELEMEDICINE [Article]. *Global Management Review*, *10*(1), 84-99. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=113664255&site=ehost-live

Joanes, D. N., & Gill, C. A. (1998). Comparing measures of sample skewness and kurtosis. *Journal of the Royal Statistical Society: Series D (The Statistician)*, *47*(1), 183-189.

Johansson, A., Esbjörnsson, M., Nordqvist, P., Wiinberg, S., Andersson, R., Ivarsson, B., & Möller, S. (2019). Technical feasibility and ambulance nurses' view of a digital telemedicine system in pre-hospital stroke care – A pilot study. *International Emergency Nursing*, *44*, 35-40. https://doi.org/10.1016/j.ienj.2019.03.008

Jolliffe, I. T. (1986). Principal components in regression analysis. In *Principal component analysis* (pp. 129-155). Springer.

Jones, J., & Hidiroglou, M. (2013). Capturing, coding, and cleaning survey data. *Designing and conducting business surveys*, 459-504.

Judi, H., Razak, A., Sha'Ari, N., & Mohamed, H. (2009). Feasibility and critical success factors in implementing telemedicine. *Information Technology Journal*, *8*(3), 326-332.

Kahn, J. M., Cicero, B. D., Wallace, D. J., & Iwashyna, T. J. (2014). Adoption of intensive care unit telemedicine in the United States. *Critical care medicine*, *42*(2), 362.

Kane, A. A. (2010). Unlocking knowledge transfer potential: Knowledge demonstrability and superordinate social identity. *Organization Science*, *21*(3), 643-660.

Karavasilis, I., Zafiropoulos, K., & Vrana, V. (2010). Extending TAM to understand E-governance adoption by teachers in Greece. World Summit on Knowledge Society,

Katzenstein, J., Yrle, A. C., Chrispin, B., Hartman, S., & Lundberg, O. (2012). Telemedicine: an innovative technique in healthcare delivery. *Academy of Health Care Management Journal*, *8*(1-2), 49.

Kavanaugh, K., & Ayres, L. (1998). "Not as bad as it could have been": Assessing and mitigating harm during research interviews on sensitive topics. *Research in nursing & health*, *21*(1), 91-97.

Keil, M., Beranek, P. M., & Konsynski, B. R. (1995). Usefulness and ease of use: field study evidence regarding task considerations. *Decision Support Systems*, *13*(1), 75-91.

Keith, T. Z. (2014). *Multiple regression and beyond: An introduction to multiple regression and structural equation modeling*. Routledge.

Kelp, C. (2016). Justified belief: Knowledge first-style. *Philosophy and Phenomenological Research*, *93*(1), 79-100.

Khoja, S., Scott, R., Husyin, N., Durrani, H., Arif, M., Faqiri, F., Hedayat, E., & Yousufzai, W. (2016). Impact of simple conventional and Telehealth solutions on improving mental health in Afghanistan. *Journal of Telemedicine and Telecare*, *22*(8), 495-498. https://doi.org/10.1177/1357633X16674631

Kierkegaard, P. (2015). Interoperability after deployment: Persistent challenges and regional strategies in Denmark. *International Journal for Quality in Health Care*, *27*(2), 147-153.

Kifle, M., Mbarika, V., & Tan, J. (2007). Telemedicine Transfer in Sub-Saharan Africa: Investigating Infrastructure and  Culture. 9th International Conference on Social Implications of Computers in Developing Countries, São Paulo, Brazil.

Kifle, M., Payton, F. C., Mbarika, V., & Meso, P. (2010). Transfer and adoption of advanced information technology solutions in resource-poor environments: The case of telemedicine systems adoption in ethiopia. *TELEMEDICINE and e-HEALTH*, *16*(3), 327-343. https://doi.org/10.1089/tmj.2009.0008

Kijsanayotin, B., Pannarunothai, S., & Speedie, S. M. (2009). Factors influencing health information technology adoption in Thailand's community health centers: Applying the UTAUT model. *International Journal of Medical Informatics*, *78*(6), 404-416. https://doi.org/https://doi.org/10.1016/j.ijmedinf.2008.12.005

Kim, N. (2015). Tests based on skewness and kurtosis for multivariate normality. *Communications for Statistical Applications and Methods*, *22*(4), 361-375.

Kim, T.-H., & White, H. (2004). On more robust estimation of skewness and kurtosis. *Finance Research Letters*, *1*(1), 56-73.

Kimberly, J. R., & Evanisko, M. J. (1981). Organizational innovation: The influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. *Academy of management journal*, *24*(4), 689-713.

King, G., Richards, H., & Godden, D. (2007). Adoption of telemedicine in Scottish remote and rural general practices: A qualitative study. *Journal of Telemedicine and Telecare*, *13*(8), 382-386. https://doi.org/10.1258/135763307783064430

Kline, R. (2013). Exploratory and confirmatory factor analysis. *Applied quantitative analysis in the social sciences*, 171-207.

Kline, R. B. (1998). Software Review: Software Programs for Structural Equation Modeling: Amos, EQS, and LISREL. *Journal of Psychoeducational Assessment*, *16*(4), 343-364. https://doi.org/10.1177/073428299801600407

Kline, R. B. (2013). Assessing statistical aspects of test fairness with structural equation modelling. *Educational Research and Evaluation*, *19*(2-3), 204-222.

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford publications.

Kock, N. (2015). A note on how to conduct a factor-based PLS-SEM analysis. *International Journal of e-Collaboration (IJeC)*, *11*(3), 1-9.

Kondracki, N. L., Wellman, N. S., & Amundson, D. R. (2002). Content analysis: Review of methods and their applications in nutrition education. *Journal of nutrition education and behavior*, *34*(4), 224-230.

Kontos, E., Blake, K. D., Chou, W.-Y. S., & Prestin, A. (2014). Predictors of eHealth usage: insights on the digital divide from the Health Information National Trends Survey 2012. *Journal of Medical Internet Research*, *16*(7), e3117.

Kontos, P. C., & Poland, B. D. (2009). Mapping new theoretical and methodological terrain for knowledge translation: contributions from critical realism and the arts. *Implementation Science*, *4*(1), 1-10.

Koonin, L. M., Hoots, B., Tsang, C. A., Leroy, Z., Farris, K., Jolly, B., Antall, P., McCabe, B., Zelis, C. B., & Tong, I. (2020). Trends in the use of telehealth during the emergence of the COVID-19 pandemic—United States, January–March 2020. *Morbidity and Mortality Weekly Report*, *69*(43), 1595.

Kootstra, G. (2004). Project on exploratory Factor Analysis applied to foreign language learning. Accessed via: http://www. let. rug. nl/~ nerbonne/teach/remastats-meth-seminar/Factor-Analysis-Kootstra-04. PDF,

Kootstra, G. J. (2004). Exploratory factor analysis. *University of Groningen*.

Koran, J. (2020). Indicators per factor in confirmatory factor analysis: More is not always better. *Structural equation modeling: a multidisciplinary journal*, *27*(5), 765-772.

Krauss, S. E. (2005). Research paradigms and meaning making: A primer. *The qualitative report*, *10*(4), 758-770.

Krausz, M., Ward, J., & Ramsey, D. (2016). From telehealth to an interactive virtual clinic. In *e-Mental Health* (pp. 289-310). Springer.

Kreps, G. L., & Neuhauser, L. (2010). New directions in eHealth communication: Opportunities and challenges. *Patient Education and Counseling*, *78*(3), 329-336. https://doi.org/10.1016/j.pec.2010.01.013

Krishnan, S., Haas, D., Franklin, M. J., & Wu, E. (2016). Towards reliable interactive data cleaning: A user survey and recommendations. Proceedings of the Workshop on Human-In-the-Loop Data Analytics,

Kristensen, M. (2020). Comprehensive Review of Telehealth Law and Literature: Implications for Future Policy and Patients.

Kruse, C. S., Karem, P., Shifflett, K., Vegi, L., Ravi, K., & Brooks, M. (2018). Evaluating barriers to adopting Telemedicine worldwide: A systematic review. *Journal of Telemedicine and Telecare*, *24*(1), 4-12.

Kumar, A., & Ahmad, S. (2015). A Review study on utilization of Telemedicine and e-Health services in Public Health. *Asian Pacific Journal of Health Sciences*, *2*(1), 60-68.

Kumar, A., Mehta, P. L., & Prasad, R. (2014). Place Time Capacity-A novel concept for defining challenges in 5G networks and beyond in India. 2014 IEEE Global Conference on Wireless Computing & Networking (GCWCN),

Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). *Applied linear statistical models* (Vol. 5). McGraw-Hill Irwin New York.

Kuutti, K. (1996). Activity theory as a potential framework for human-computer interaction research. *Context and consciousness: Activity theory and human-computer interaction*, *1744*.

Kvale, S. (1996). The 1,000-page question. *Qualitative inquiry*, *2*(3), 275-284.

Lal, K. (2017). Investigating ICT infrastructure to develop an information society in India [Conceptual Paper]. *Universal Access in the Information Society (UAIS)*, *16*, 517-528. https://doi.org/10.1007/s10209-016-0472-1

Langbecker, D., Caffery, L. J., Gillespie, N., & Smith, A. C. (2017). Using survey methods in telehealth research: A practical guide. *Journal of Telemedicine and Telecare*, *23*(9), 770-779.

Lanseng, E. J., & Andreassen, T. W. (2007). Electronic healthcare: a study of people's readiness and attitude toward performing self-diagnosis. *International Journal of Service Industry Management*.

Lave, C. A., & March, J. G. (1993). *An introduction to models in the social sciences*. University Press of America.

Lee, D., Helal, S., & Johnson, B. D. (2010). An action-based behavior model for persuasive telehealth. International Conference on Smart Homes and Health Telematics, Lee, L. Y.-S. (2016). Hospitality industry web-based self-service technology adoption model: A cross-cultural perspective. *Journal of Hospitality & Tourism Research*, *40*(2), 162-197.

Lee, N. T., Karsten, J., & Roberts, J. (2020). Removing regulatory barriers to telehealth before and after COVID-19. *Brookings Institution*. https://www.brookings.edu/wp-content/uploads/2020/05/Removing-barriers-to-telehealth-before-and-after-COVID-19_PDF.pdf

Legard, R., Keegan, J., & Ward, K. (2003). In-depth interviews. *Qualitative research practice: A guide for social science students and researchers*, *6*(1), 138-169.

Légaré, É., Vincent, C., Lehoux, P., Anderson, D., Kairy, D., Gagnon, M.-P., & Jennett, P. (2010). Telehealth readiness assessment tools. *Journal of Telemedicine and Telecare, 16*(3), 107-109. https://doi.org/10.1258/jtt.2009.009004

LeRouge, C., & Garfield, M. J. (2013). Crossing the telemedicine chasm: have the US barriers to widespread adoption of telemedicine been significantly reduced? *International journal of environmental research and public health*, *10*(12), 6472-6484.

Levine, M., Richardson, J. E., Granieri, E., & Reid, M. C. (2014). Novel telemedicine technologies in geriatric chronic non-cancer pain: primary care providers' perspectives. *Pain medicine*, *15*(2), 206-213.

Leys, C., Klein, O., Dominicy, Y., & Ley, C. (2018). Detecting multivariate outliers: Use a robust variant of the Mahalanobis distance. *Journal of Experimental Social Psychology*, *74*, 150-156. https://doi.org/https://doi.org/10.1016/j.jesp.2017.09.011

Lian, J.-W., Yen, D. C., & Wang, Y.-T. (2014). An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management*, *34*(1), 28-36.

Lin, C., Lin, I. C., & Roan, J. (2012). Barriers to Physicians' Adoption of Healthcare Information Technology: An Empirical Study on Multiple Hospitals. *Journal* *of Medical Systems*, *36*(3), 1965-1977. https://doi.org/10.1007/s10916-011-9656-7

Lin, C.-C. C., Dievler, A., Robbins, C., Sripipatana, A., Quinn, M., & Nair, S. (2018). Telehealth in health centers: key adoption factors, barriers, and opportunities. *Health Affairs*, *37*(12), 1967-1974.

Lincoln, Y. S., & Denzin, N. K. (2003). *Turning points in qualitative research: Tying knots in a handkerchief* (Vol. 2). Rowman Altamira.

Liu Sheng, O. R., Jen-Hwa Hu, P., Wei, C.-P., Higa, K., & Au, G. (1998). Adoption and diffusion of telemedicine technology in health care organizations: a comparative case study in Hong Kong. *Journal of Organizational Computing and Electronic Commerce, 8*(4), 247-275.

Liu, X. S. (2013). *Statistical power analysis for the social and behavioral sciences: Basic and advanced techniques*. Routledge.

Lluch, M. (2011). Healthcare professionals' organisational barriers to health information technologies—A literature review. *International Journal of Medical Informatics, 80*(12), 849-862. https://doi.org/https://doi.org/10.1016/j.ijmedinf.2011.09.005

Loane, M. A., Bloomer, S. E., Corbett, R., Eedy, D. J., Gore, H. E., Mathews, C., Steele, K., & Wooton, R. (1998). Patient satisfaction with real-time teledermatology in Northern Ireland. *Journal of Telemedicine and Telecare, 4*(1), 36-40.

Loane, M., & Wootton, R. (2001). A review of telehealth. *Medical Principles and Practice, 10*(4), 163-170.

Loane, M., Bloomer, S., Corbett, R., Eedy, D., Hicks, N., Lotery, H., Mathews, C., Paisley, J., Steele, K., & Wootton, R. (2000). A comparison of real-time and store-and-forward teledermatology: a cost–benefit study. *British Journal of Dermatology*, *143*(6), 1241-1247.

Longhurst, R. (2003). Semi-structured interviews and focus groups. *Key methods in geography*, *3*(2), 143-156.

Looman, W. S., Antolick, M., Cady, R. G., Lunos, S. A., Garwick, A. E., & Finkelstein, S. M. (2015). Effects of a telehealth care coordination intervention on perceptions of health care by caregivers of children with medical complexity: A randomized controlled trial. *Journal of Pediatric Health Care*, *29*(4), 352-363. https://doi.org/10.1016/j.pedhc.2015.01.007

Low, J. (2013). Unstructured and semi-structured interviews in health research. *Researching health: Qualitative, quantitative and mixed methods*, *2*, 87-105.

Luo, L., & Wildemuth, B. M. (2009). Semistructured interviews. *Applications of social research methods to questions in information and library science*, *232*.

Ly, B. A., Labonté, R., Bourgeault, I. L., & Niang, M. N. (2017). The individual and contextual determinants of the use of telemedicine: A descriptive study of the perceptions of Senegal's physicians and telemedicine projects managers. *PLoS ONE*, *12*(7), e0181070. https://doi.org/10.1371/journal.pone.0181070

MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011). Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS quarterly*, 293-334.

Mackert, M., & Whitten, P. (2007). Successful Adoption of a School-Based Telemedicine System. *Journal of School Health*, *77*(6), 327-330. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=25535536&site=ehost-live

Mahapatra, A. K., Mishra, S. K., Kapoor, L., & Singh, I. P. (2009a). Critical issues in medical education and the implications for telemedicine technology. *TELEMEDICINE and e-HEALTH*, *15*(6), 592-596.

Mahapatra, A. K., Mishra, S. K., Kapoor, L., & Singh, I. P. (2009b). Critical issues in medical education and the implications for telemedicine technology.(SPECIAL SECTION: TELEMEDICINE IN INDIA).

*Telemedicine and e-Health*, *15*(6), 592. https://doi.org/10.1089/tmj.2009.0057

Mahapatra, A. K., Mishra, S. K., Kapoor, L., & Singh, I. P. (2009). Critical issues in medical education and the implications for telemedicine technology. *TELEMEDICINE and e-HEALTH*, *15*(6), 592-596.

Maier, R., & Hadrich, T. (2011). Knowledge management systems. In *Encyclopedia of Knowledge Management, Second Edition* (pp. 779-790). IGI Global.

Mairinger, T., Gable, C., Derwan, P., Mikuz, G., & Ferrer-Roca, O. (1996). What do physicians think of telemedicine? A survey in different European regions. *Journal of Telemedicine and Telecare*, *2*(1), 50-56.

Mansfield, E. R., & Helms, B. P. (1982). Detecting multicollinearity. *The American Statistician*, *36*(3a), 158-160.

Marcelo, A., Ganesh, J., Mohan, J., Kadam, D., Ratta, B., Kulatunga, G., John, S., Chandra, A., Primadi , O., Mohamed, A. A. S., Khan, M. A. H., Azad, A. A., & Marcelo, P. (2015). Governance and Management of National Telehealth Programs in Asia. *Global Telehealth 2015: Integrating Technology and Information for Better Healthcare*, *209*, 95.

Marcoulides, G. A., Chin, W. W., & Saunders, C. (2009). A critical look at partial least squares modeling. *MIS quarterly*, *33*(1), 171-175.

Mardia, K. V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika*, *57*(3), 519-530.

Marmot, M., Friel, S., Bell, R., Houweling, T. A. J., & Taylor, S. (2008). Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet*, *372*, 1661-1669.

Mars, M. (2012). Telepsychiatry in Africa-A way forward? *African Journal of Psychiatry*, *15*(4), 215-217. https://doi.org/10.4314/ajpsy.v15i4.27

Marsh, H. W., Hau, K.-T., Balla, J. R., & Grayson, D. (1998). Is more ever too much? The number of indicators per factor in confirmatory factor analysis. *Multivariate behavioral research*, *33*(2), 181-220.

Marshall, P., Kelder, J.-A., & Perry, A. (2005). *Social constructionism with a twist of pragmatism: a suitable cocktail for information systems research* 16th Australasian Conference on Information Systems, Sydney.

Massy, W. F. (1965). Principal components regression in exploratory statistical research. *Journal of the American Statistical Association*, *60*(309), 234-256.

Mathur, P., Srivastava, S., Lalchandani, A., & Mehta, J. L. (2017). Evolving Role of Telemedicine in Health Care Delivery in India [Review Article]. *Primary Healthcare*, *7*, 260. https://doi.org/10.4172/2167-1079.1000260

May, C. R., Finch, T. L., Cornford, J., Exley, C., Gately, C., Kirk, S., Jenkings, K. N., Osbourne, J., Robinson, A. L., & Rogers, A. (2011). Integrating telecare for chronic disease management in the community: what needs to be done? *BMC health services research*, *11*(1), 1-11.

May, C. R., Mair, F., Finch, T., MacFarlane, A., Dowrick, C., Treweek, S., Rapley, T., Ballini, L., Ong, B. N., & Rogers, A. (2009). Development of a theory of implementation and integration: Normalization Process Theory. *Implementation Science*, *4*(1), 29.

May, C., & Finch, T. (2009). Implementing, embedding, and integrating practices: an outline of normalization process theory. *Sociology*, *43*(3), 535-554.

Mbarika, V. W. A. (2004). Is Telemedicine the Panacea for Sub-Saharan Africa's Medical Nightmare? [Article]. *Communications of the ACM*, *47*(7), 21-24. https://doi.org/10.1145/1005817.1005838

McElroy, M. W. (2000). Integrating complexity theory, knowledge management and organizational learning. *Journal of knowledge management*, *4*(3), 195-203.

McHugh, C., Krinsky, R., & Sharma, R. (2018). Innovations in Emergency Nursing: Transforming Emergency Care Through a Novel Nurse-Driven ED

Telehealth Express Care Service. *JEN: Journal of Emergency Nursing*, *44*(5), 472-477. https://doi.org/10.1016/j.jen.2018.03.001

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia medica*, *23*(2), 143-149.

McIntosh, M. J., & Morse, J. M. (2015). Situating and constructing diversity in semi-structured interviews. *Global qualitative nursing research*, *2*, 2333393615597674.

Mead, G. H. (1934). *Mind, Self and Society*. University of Chicago Press.

Mead, G. H. (1938). *Philosophy of the Act*. University of Chicago Press.

Meade, A. W., & Craig, S. B. (2012). Identifying careless responses in survey data. *Psychological methods*, *17*(3), 437.

Meher, S. K., & Kant, S. (2014). Awareness and attitudes of geriatric patients towards telemedicine in India. *Gerontechnology*, *13*(2), 262.

Meher, S. K., Tyagi, R. S., & Chaudhry, T. (2009). Awareness and attitudes to telemedicine among doctors and patients in India.

Melissant, H. C., Verdonck-de Leeuwa, I. M., Lissenberg-Witte, B. I., Konings, I. R., Pim, C., & Van Uden-Kraan, C. F. (2018). 'Oncokompas', a web-based self-management application to support patient activation and optimal supportive care: a feasibility study among breast cancer survivors [Article]. *Acta Oncologica*, *57*(7), 924-934. https://doi.org/10.1080/0284186X.2018.1438654

Mendel, P., Meredith, L. S., Schoenbaum, M., Sherbourne, C. D., & Wells, K. B. (2008). Interventions in organizational and community context: a framework for building evidence on dissemination and implementation in health services research. *Administration and Policy in Mental Health and Mental Health Services Research*, *35*(1-2), 21-37.

Mendenhall, W., Sincich, T., & Boudreau, N. S. (1996). *A second course in statistics: regression analysis* (Vol. 5). Prentice Hall Upper Saddle River, NJ.

Merrell, R. C. (2021). Telehealth Patient Portal: Opportunities and Reality. In *Telemedicine, Telehealth and Telepresence* (pp. 189-195). Springer.

Miles, J. (2014). R squared, adjusted R squared. *Wiley StatsRef: Statistics Reference Online*.

Miles, M. B., Huberman, M. A., & Saldaña, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3 ed.). Sage Publications, Inc.

Miller, W. R. (1996). Motivational interviewing: research, practice, and puzzles. *Addictive behaviors*, *21*(6), 835-842.

Mishra, S. K., Singh, I. P., & Chand, R. D. (2012). Current Status of Telemedicine Network in India and Future Perspective. Asia-Pacific Advanced Network,

Moffatt, J. J., & Eley, D. S. (2010). The reported benefits of telehealth for rural Australians. *Australian Health Review, 34*(3), 276-281.

Mohammadzadeh, N., Safdari, R., & Rahimi, A. (2013). Cancer care management through a mobile phone health approach: key considerations. *Asian Pacific Journal of Cancer Prevention*, *14*(9), 4961-4964.

Mohr, D. C., Burns, M. N., Schueller, S. M., Clarke, G., & Klinkman, M. (2013). Behavioral intervention technologies: evidence review and recommendations for future research in mental health. *General hospital psychiatry, 35*(4), 332-338.

Molfenter, T., Boyle, M., Holloway, D., & Zwick, J. (2015). Trends in telemedicine use in addiction treatment. *Addiction science & clinical practice, 10*(1), 1-9.

Monecke, A., & Leisch, F. (2012). semPLS: structural equation modeling using partial least squares.

Montgomery, D. C., Peck, E. A., & Vining, G. G. (2012). *Introduction to linear regression analysis* (Vol. 821). John Wiley & Sons.

Monthuy-Blanc, J., Bouchard, S., Maïano, C., & Séguin, M. (2013). Factors influencing mental health providers' intention to use telepsychotherapy in

First Nations communities. *Transcultural Psychiatry*, *50*(2), 323-343. https://doi.org/10.1177/1363461513487665

Morgan, D. L. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative health research*, *8*(3), 362-376.

Morgan, G. A., & Harmon, R. J. (2001). Data Collection Techniques. *Journal of the American Academy of Child and Adolescent Psychiatry*, *40*(8), 973-976.

Morgan, G. A., & Harmon, R. J. (2001). Data Collection Techniques. *Journal of the American Academy of Child and Adolescent Psychiatry*, *40*(8), 973-976.

Morrison, D., & Mair, F. S. (2011). Telehealth in practice: using Normalisation Process Theory to bridge the translational gap. *Primary care respiratory journal: journal of the General Practice Airways Group*, *20*(4), 351.

Mukherjee, P. S., Das, D. K., & Goswami, A. (2017). Ethnicity and cultural context influencing hepatitis awareness in multi-linguistic societies: Policy insights from a study across ethnolinguistic communities in India. APHA 2017 Annual Meeting & Expo (Nov. 4-Nov. 8),

Mukherjee, R. (2019). Jio sparks Disruption 2.0: infrastructural imaginaries and platform ecosystems in ‘Digital India’. *Media, Culture & Society*, *41*(2), 175-195.

Murairwa, S. (2015). Voluntary sampling design. *International Journal of Advanced Research in Management and Social Sciences*, *4*(2), 185-200.

Murphy Jr., R. L. H., & Bird, K. T. (1974). Telediagnosis: A New Community Health Resource Observations on the Feasibility of Telediagnosis Based on 1000 Patient Transactions. *American Journal of Public Health*, *64*(2), 113-119.

Murray, E., Treweek, S., Pope, C., MacFarlane, A., Ballini, L., Dowrick, C., Finch, T., Kennedy, A., Mair, F., O'Donnell, C., Ong, B. N., Rapley, T., Rogers, A., & May, C. (2010). Normalisation process theory: a framework for developing, evaluating and implementing complex interventions [journal article]. *BMC Medicine, 8*(1), 63. https://doi.org/10.1186/1741-7015-8-63

Nallala, S., Swain, S., Das, S., Kasam, S. K., & Pati, S. (2015). Why medical students do not like to join rural health service? An exploratory study in India. *Journal of family & community medicine*, *22*(2), 111.

Nardi, B. A. (1996). *Context and consciousness: activity theory and human-computer interaction*. mit Press.

Nessa, A., Al Ameen, M., Ullah, S., & Kwak, K. (2010). Applicability of Telemedicine in Bangladesh: Current Status and Future Prospects [Article]. *International Arab Journal of Information Technology (IAJIT), 7*(2), 138-145. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=aps&AN=51190291&site=ehost-live

Nicolini, D. (2006). The work to make telemedicine work: A social and articulative view. *Social Science & Medicine*, *62*(11), 2754-2767.

Nicolini, D., Gherardi, S., & Yanow, D. (2003). *Knowing in organizations: A practice-based approach*. ME Sharpe.

Nicolini, D., Powell, J., Conville, P., & Martinez-Solano, L. (2008). Managing knowledge in the healthcare sector. A review. *International Journal of Management Reviews, 10*(3), 245-263.

Noir, C., & Walsham, G. (2007). The great legitimizer: ICT as myth and ceremony in the Indian healthcare sector. *Information Technology & People*, *20*(4), 313-333.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization science*, *5*(1), 14-37.

Nonaka, I., & Takeuchi, H. (2007). The knowledge-creating company. *Harvard business review*, *85*(7/8), 162.

Novick, G. (2008). Is there a bias against telephone interviews in qualitative research? *Research in nursing & health*, *31*(4), 391-398.

Nundy, S., Mishra, A., Hogan, P., Lee, S. M., Solomon, M. C., & Peek, M. E. (2014). How do mobile phone diabetes programs drive behavior change?: Evidence from a mixed methods observational cohort study. *The Diabetes Educator*, *40*(6), 806-819. https://doi.org/10.1177/0145721714551992

Nutley, S. M., Nutley, S., Walter, I., & Davies, H. T. (2007). *Using evidence: How research can inform public services*. Policy press.

O'Cathain, A., Murphy, E., & Nicholl, J. (2007). Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. *BMC health services research*, *7*(1), 1-11.

Oldenburg, B., & Glanz, K. (2008). Diffusion of innovations. *Health behavior and health education: Theory, research, and practice*, *4*, 313-333.

Onconet. (2017). *Objectives*. Retrieved 23 October from http://onconet.nic.in/

Opdenakker, R. (2006). Advantages and disadvantages of four interview techniques in qualitative research. Forum qualitative sozialforschung/forum: Qualitative social research,

Paget, T., Jones, C., Davies, M., Evered, C., & Lewis, C. (2010). Using home telehealth to empower patients to monitor and manage long term conditions. *Nursing times*, *106*(45), 17-19.

Pak, H. S., Brown-Connolly, N. E., Bloch, C., Clarke, M., Clyburn, C., Doarn, C. R., Llewellyn, C., Merrell, R. C., Montgomery, K., & Rasche, J. (2008). Global forum on telemedicine: Connecting the world through partnerships. *TELEMEDICINE and e-HEALTH*, *14*(4), 389-395.

Pal, S. K., Pandey, G. S., Kesari, A., Choudhuri, G., & Mittal, B. (2002). Telemedicine: E-Health and Hospital of the Future. *Journal of Scientific & Industrial Research*, *61*, 414-422.

Panahi, S., Watson, J., & Partridge, H. (2016). Information encountering on social media and tacit knowledge sharing. *Journal of Information Science*, *42*(4), 539-550.

Panda, A., & Gupta, R. K. (2004). Mapping cultural diversity within India: A meta-analysis of some recent studies. *Global Business Review*, *5*(1), 27-49.

Pangarakis, S. J., Harrington, K., Lindquist, R., Peden-McAlpine, C., & Finkelstein, S. (2008). Electronic feedback messages for home spirometry lung transplant recipients. *Heart & Lung*, *37*(4), 299-307. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=105804327&site=ehost-live

Panzano, P. C., & Roth, D. (2006). The decision to adopt evidence-based and other innovative mental health practices: Risky business? *Psychiatric Services*, *57*(8), 1153-1161.

Parisien, R. L., Shin, M., Constant, M., Saltzman, B. M., Li, X., Levine, W. N., & Trofa, D. P. (2020). Telehealth utilization in response to the novel coronavirus (COVID-19) pandemic in orthopaedic surgery. *The Journal of the American Academy of Orthopaedic Surgeons*.

Park, H. S., Dailey, R., & Lemus, D. (2002). The use of exploratory factor analysis and principal components analysis in communication research. *Human Communication Research*, *28*(4), 562-577.

Parkhe, A. (1993). “Messy” research, methodological predispositions, and theory development in international joint ventures. *Academy of Management review*, *18*(2), 227-268.

Parmanto, B., Lewis Jr, A. N., Graham, K. M., & Bertolet, M. H. (2016). Development of the telehealth usability questionnaire (TUQ). *International Journal of Telerehabilitation*, *8*(1), 3.

Parsons, T. (1951). Illness and the role of the physician: a sociological perspective. *American Journal of orthopsychiatry*, *21*(3), 452.

Paslakis, G., Fischer-Jacobs, J., Pape, L., Schiffer, M., Gertges, R., Tegtbur, U., Zimmermann, T., Nöhre, M., & de Zwaan, M. (2019). Assessment of Use and Preferences Regarding Internet-Based Health Care Delivery: Cross-Sectional Questionnaire Study [Original Paper]. *J Med Internet Res*, *21*(5), e12416. https://doi.org/10.2196/12416

Paul, D. L., Pearlson, K. E., & McDaniel, R. R. (1999). Assessing technological barriers to telemedicine: Technology-management implications. *IEEE Transactions on Engineering Management*, *46*(3), 279-288.

Peddle, K. (2007). Telehealth in context: Socio-technical barriers to telehealth use in labrador, canada. *Computer Supported Cooperative Work (CSCW)*, *16*(6), 595-614.

penny.bee@manchester.ac.uk

Perednia, D. A., & Allen, A. (1995). Telemedicine technology and clinical applications. *Journal of the American Medical Association*, *273*(6), 483-488.

Perry, C. (1998). Processes of a case study methodology for postgraduate research in marketing. *European journal of marketing*.

Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: models, dimensions, measures, and interrelationships. *European journal of information systems*, *17*(3), 236-263.

Petter, S., Straub, D., & Rai, A. (2007). Specifying formative constructs in information systems research. *MIS quarterly*, 623-656.

Piper, D., Iedema, R., & Bower, K. (2014). Rural patients' experiences of the open disclosure of adverse events. *The Australian Journal of Rural Health*, *22*(4), 197-203. https://doi.org/10.1111/ajr.12124

Plaete, J., Verloigne, M., Crombez, G., & De Bourdeaudhuij, I. (2014). What do general practitioners think about an online tailored self-regulation programme for primary prevention. *European Health Psychologist*, *16*(S), 889-889.

Plsek, P. E., & Greenhalgh, T. (2001). The challenge of complexity in health care. *Bmj*, *323*(7313), 625-628.

Poongodi, P. (2020). HEALTH TOURISM – AN EMERGING SERVICE PACKAGE IN INDIA. *INDIAN JOURNAL OF APPLIED RESEARCH*, 1-3. https://doi.org/10.36106/ijar/8210603

Pope, C., Halford, S., Turnbull, J., Prichard, J., Calestani, M., & May, C. (2013). Using computer decision support systems in NHS emergency and urgent care: ethnographic study using normalisation process theory. *BMC health services research*, *13*(1), 111.

Prasad, D. D., Ray, S., Majumdar, A. K., Mukherjee, J., Majumdar, B., Paul, S., & Verma, A. (2010). Real time medical image consultation system through Internet. *Journal of Healthcare Engineering*, *1*(1), 141-154.

Preacher, K. J. (2001). Calculation for the Chi-square test. *An Interactive Calculation Tool for Chi-Square Tests of Goodness of Fit and Independence. Ohio State University. Available online at: http://quantrm2. psy. ohio-state. edu/kris/chisq/chisq. htm*.

Price, J. H., & Murnan, J. (2004). Research limitations and the necessity of reporting them. *American Journal of Health Education*, *35*(2), 66.

Proctor, E. K., Landsverk, J., Aarons, G., Chambers, D., Glisson, C., & Mittman, B. (2009). Implementation research in mental health services: an emerging science with conceptual, methodological, and training challenges. *Administration and Policy in Mental Health and Mental Health Services Research*, *36*(1), 24-34.

Purohit, B., & Bandyopadhyay, T. (2014). Beyond job security and money: driving factors of motivation for government doctors in India. *Human resources for health*, *12*(1), 1-13.

Radhakrishnan, K., Bo, X., & Jacelon, C. S. (2016). Unsustainable HomeTelehealth: A Texas Qualitative Study [Article]. *Gerontologist*, *56*(5), 830-840. https://doi.org/10.1093/geront/gnv050

Radhakrishnan, S., Duvvuru, A., & Kamarthi, S. (2015). Health Care in US: A Combined Simulation Methodology to Assess the Effectiveness of Home-Monitoring Programmes. *VIKALPA The Journal for Decision Makers*, *40*(3), 269-276. https://doi.org/https://doi.org/10.1177/0256090915598597

Ragasa, C. (2012). *Gender and institutional dimensions of agricultural technology adoption: a review of literature and synthesis of 35 case studies*.

Räisänen, T., Oinas-Kukkonen, H., Leiviskä, K., Seppänen, M., & Kallio, M. (2009). Managing mobile healthcare knowledge: Physicians' perceptions on knowledge creation and reuse. In *Mobile health solutions for biomedical applications* (pp. 111-127). IGI Global.

Ranganathan, C., & Balaji, S. (2020). Key Factors Affecting the Adoption of Telemedicine by Ambulatory Clinics: Insights from a Statewide Survey. *Telemedicine and e-Health*, *26*(2), 218-225. https://doi.org/10.1089/tmj.2018.0114

Rani, V., Hafeez-Baig, A., & Gururajan, R. (2019). Understanding factors influencing adoption of mobile devices in telehealth: a quantitative study. 24th Annual Conference of the Asia Pacific Decision Sciences Institute: Full papers,

Rao, K. D., Bhatnagar, A., & Berman, P. (2012). So many, yet few: human resources for health in India. *Human resources for health*, *10*(1), 19.

Rao, S., Perry, C., & Hine, D. (2007). Convergent interviewing: a starting methodology for an enterprise research program. *Innovative methodologies in enterprise research*, 86-100.

Rathi, A. (2017). Inequalities in financing of healthcare in India. *Trends in Immunotherapy*, *1*(1), 50-51. https://doi.org/10.24294/ti.vlil.44

Raza, M., Le, M. H., Aslam, N., Le, C. H., Le, N. T., & Le, T. L. (2017). Telehealth technology: Potentials, challenges and research directions for developing countries. International Conference on the Development of Biomedical Engineering in Vietnam, Rho, M. J., young Choi, I., & Lee, J. (2014). Predictive factors of telemedicine service acceptance and behavioral intention of physicians. *International Journal of Medical Informatics*, *83*(8), 559-571.

Rietveld, T., & Van Hout, R. (1993). Statistical techniques for the study of language behaviour. *Berlijn: Mouton de Gruyter*.

Rigdon, E. E. (2016). Choosing PLS path modeling as analytical method in European management research: A realist perspective. *European Management Journal*, *34*(6), 598-605.

Rigdon, E. E., Sarstedt, M., & Ringle, C. M. (2017). On comparing results from CB-SEM and PLS-SEM: Five perspectives and five recommendations. *Marketing: ZFP–Journal of Research and Management*, *39*(3), 4-16.

Ringle, C. M., Sarstedt, M., & Straub, D. W. (2012). Editor's comments: a critical look at the use of PLS-SEM in" MIS Quarterly". *MIS quarterly*, iii-xiv.

Ringle, C. M., Wende, S., & Becker, J.-M. (2015). *"SmartPLS 3."*. In SmartPLS GmbH, http://www.smartpls.com.

Ringnér, M. (2008). What is principal component analysis? *Nature biotechnology*, *26*(3), 303-304.

Robben, S. H., Perry, M., Huisjes, M., van Nieuwenhuijzen, L., Schers, H. J., van Weel, C., Rikkert, M. G. O., van Achterberg, T., Heinen, M. M., & Melis, R. J. (2012). Implementation of an innovative web-based conference table for community-dwelling frail older people, their informal caregivers and professionals: a process evaluation. *BMC health services research*, *12*(1), 1-12.

Robson, C. (2002). *Real world research: A resource for social scientists and practitioner-researchers*. Wiley-Blackwell.

Rogers, E. M. (1995). *Diffussion of Innovations*. Free Press.

Rogers, E. M. (1995). *Diffussion of Innovations*. Free Press.

Ronda, M. C., Dijkhorst-Oei, L.-T., & Rutten, G. E. (2014). Reasons and barriers for using a patient portal: survey among patients with diabetes mellitus. *Journal of Medical Internet Research*, *16*(11), e263.

Rönkkö, M., & Evermann, J. (2013). A critical examination of common beliefs about partial least squares path modeling. *Organizational Research Methods*, *16*(3), 425-448.

Rose, K., & Webb, C. (1998). Analyzing data: Maintaining rigor in a qualitative study. *Qualitative health research*, *8*(4), 556-562.

Ross, J., Stevenson, F., Lau, R., & Murray, E. (2015). Exploring the challenges of implementing e-health: a protocol for an update of a systematic review of reviews. *BMJ open*, *5*(4), e006773.

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of statistical software*, *48*(2), 1-36.

Ruane, J. M. (2005). *Essentials of research methods*. Blackwell Pub.

Rubin, H. J., & Rubin, I. S. (2011). *Qualitative interviewing: The art of hearing data*. sage.

Sachan, D. (2013). India looks to a new course to fix rural doctor shortage. *The Lancet*, *382*(9899), e10.

Saigi-Rubió, F., Jiménez-Zarco, A., & Torrent-Sellens, J. (2016). Determinants of the intention to use telemedicine: evidence from primary care physicians. *International journal of technology assessment in health care*, *32*(1-2), 29-36.

Saigí-Rubió, F., Torrent-Sellens, J., & Jiménez-Zarco, A. (2014). Drivers of telemedicine use: comparative evidence from samples of Spanish, Colombian and Bolivian physicians. *Implementation Science*, *9*(1), 128. https://doi.org/10.1186/s13012-014-0128-6

Sallis, J. F., Owen, N., & Fisher, E. (2015). Ecological models of health behavior. *Health behavior: Theory, research, and practice*, *5*, 43-64.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research Methods for Business Students* (7 ed.). Pearson Education Limited.

Schmeida, M., McNeal, R., & Mossberger, K. (2007). Policy determinants affect telehealth implementation. *Telemedicine and e-Health*, *13*(2), 100-107.

Schmeida, M., McNeal, R., & Mossberger, K. (2007). Policy determinants affect telehealth implementation. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*, *13*(2).

Schmeida, M., McNeal, R., & Mossberger, K. (2007). Policy determinants affect telehealth implementation. *TELEMEDICINE and e-HEALTH*, *13*(2), 100-107.

Scholl, J., Syed-Abdul, S., & Ahmed, L. A. (2011). A case study of an EMR system at a large hospital in India: challenges and strategies for successful adoption. *Journal of biomedical informatics*, *44*(6), 958-967.

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of educational research*, *99*(6), 323-338.

Schroeder, M. A., Lander, J., & Levine-Silverman, S. (1990). Diagnosing and dealing with multicollinearity. *Western journal of nursing research*, *12*(2), 175-187.

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling*. psychology press.

Scott, R. E., & Mars, M. (2015). Telehealth in the developing world: current status and future prospects. *Smart Homecare Technology and TeleHealth*, *3*, 25. https://doi.org/10.2147/SHTT.S75184

Scott, W. R. (1990). Innovation in medical care organizations: A synthetic review. *Medical care review*, *47*(2), 165-192.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach*. John Wiley & Sons.

Selwyn, N. (2002). Defining the ‘digital divide’: Developing a theoretical understanding of inequalities in the information age.

Selwyn, N. (2004). Reconsidering political and popular understandings of the digital divide. *New Media & Society*, *6*(3), 341-362.

Selwyn, N., & Facer, K. (2007). Beyond the digital divide.

Shah, S. K., & Corley, K. G. (2006). Building better theory by bridging the quantitative–qualitative divide. *Journal of management studies*, *43*(8), 1821-1835.

Sharifi, M., Dryden, E. M., Horan, C. M., Price, S., Marshall, R., Hacker, K., Finkelstein, J. A., & Taveras, E. M. (2013). Leveraging text messaging and mobile technology to support pediatric obesity-related behavior change: A qualitative study using parent focus groups and interviews. *Journal of Medical Internet Research*, *15*(12), 60-70. https://doi.org/10.2196/jmir.2780

Sharma, S. K. (2021). Realities, scope, challenges, and facilitators for implementation of nurse practitioner's role in India: A review. *International journal of nursing sciences*.

Shepherd, A., & Cooper, J. (2020). KNOWLEDGE MANAGEMENT FOR VIRTUAL TEAMS. *Issues in Information Systems*, *21*(1), 62-68.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The Theory of Reasoned Action: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research [Article]. *Journal of Consumer Research*, *15*(3), 325-343. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=4657529&site=ehost-live

Shields, P. M., & Rangarajan, N. (2013). *A playbook for research methods: Integrating conceptual frameworks and project management*. New Forums Press.

Shin, D.-H., Lee, S., & Hwang, Y. (2017). How do credibility and utility play in the user experience of health informatics services? *Computers in Human Behavior*, *67*, 292-302.

Shoemaker, P. J., Tankard Jr, J. W., & Lasorsa, D. L. (2003). *How to build social science theories*. Sage publications.

Shree, K. (2020). Public Awareness Towards Telehealth Services. *Journal of Contemporary Issues in Business and Government*, *26*(2), 775-781.

Shukla, A., Wang, W., Gao, G. G., & Agarwal, R. (2019). Catch Me If You Can—Detecting Fraudulent Online Reviews of Doctors Using Deep Learning. *Ritu, Catch Me If You Can—Detecting Fraudulent Online Reviews of Doctors Using Deep Learning (January 14, 2019)*.

Shuy, R. W. (2003). TELEPHONE INTERVIEWING. *Inside interviewing: New lenses, new concerns*, 175.

Silverman, D. (2004). In D. Silverman (Ed.), *Qualitative Research: Theory, Method and Practice* (2 ed.). Sage Publications Ltd.

Singh, A., Roy, A., & Goyal, P. (2016). Telemedicine and telehealth-The Indian scenario. *Journal of Integrated Health Sciences, 4*(1), 3.

Singh, I. P., Kapoor, L., Daman, R., & Mishra, S. K. (2008). Comparative study of connectivity in telemedicine. *TELEMEDICINE and e-HEALTH*, *14*(8), 846-850.

Singh, K. (2005). Biotelemetry: could technological developments assist healthcare in rural India. *Rural and Remote Health, 5*(2), 234. www.rrh.org.au/journal/article/234

Singh, R., Mathiassen, L., Stachura, M. E., & Astapova, E. V. (2010). Sustainable Rural Telehealth Innovation: A Public Health Case Study. *Health Services Research*, *45*(4), 985-1004. https://doi.org/10.1111/j.1475-6773.2010.01116.x

Sinha, J. B., Sinha, R., Bhupatkar, A., Sukumaran, A., Gupta, P., Gupta, R., Panda, A., Singh, S., Singh-Sengupta, S., & Srinnas, E. (2004). Facets of societal and organisational cultures and managers' work related thoughts and feelings. *Psychology and Developing Societies*, *16*(1), 1-25.

Sivagurunathan, C., Umadevi, R., Rama, R., & Gopalakrishnan, S. (2015). Adolescent health: present status and its related programmes in India. Are we in the right direction? *Journal of clinical and diagnostic research: JCDR*, *9*(3), LE01.

Smith, A. C., Thomas, E., Snoswell, C. L., Haydon, H., Mehrotra, A., Clemensen, J., & Caffery, L. J. (2020). Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). *Journal of Telemedicine and Telecare*, *26*(5), 309-313.

Sobo, E. J., Bowman, C., & Gifford, A. L. (2008). Behind the scenes in health care improvement: the complex structures and emergent strategies of implementation science. *Social science & medicine*, *67*(10), 1530-1540.

Sobrepera, M. J., Lee, V. G., Garg, S., Mendonca, R., & Johnson, M. J. (2021). Perceived Usefulness of a Social Robot Augmented Telehealth Platform by Therapists in the United States. *IEEE Robotics and Automation Letters*, *6*(2), 2946-2953.

Solanki, A., & Kashyap, S. (2014). Medical education in India: Current challenges and the way forward. *Medical Teacher*, *36*(12), 1027-1031.

Sood, R., & Adkoli, B. (2000). Medical education in India–problems and prospects. *J Indian Acad Clin Med*, *1*(3), 210-212.

Sood, S. P., Negash, S., Mbarika, V. W., Kifle, M., & Prakash, N. (2007). Differences in public and private sector adoption of telemedicine: Indian case study for sectoral adoption. *Studies in health technology and informatics*, *130*, 257.

Soper, B., & Hanney, S. R. (2007). Lessons from the evaluation of the UK's NHS R&D Implementation Methods Programme. *Implementation Science*, *2*(1), 1-13.

Sosik, J. J., Kahai, S. S., & Piovoso, M. J. (2009). Silver bullet or voodoo statistics? A primer for using the partial least squares data analytic technique in group and organization research. *Group & Organization Management*, *34*(1), 5-36.

Sotiriadou, P., Brouwers, J., & Le, T.-A. (2014). Choosing a qualitative data analysis tool: A comparison of NVivo and Leximancer. *Annals of Leisure Research*, *17*(2), 218-234.

Speyer, R., Denman, D., Wilkes-Gillan, S., Chen, Y.-W., Bogaardt, H., Kim, J.-H., Heckathorn, D.-E., & Cordier, R. (2018). Effects of telehealth by allied health professionals and nurses in rural and remote areas: a systematic review and meta-analysis. *Journal of rehabilitation medicine*, *50*(3), 225-235.

Sreekumar, T. T. (2012). ICT and Development: Critical Issues. In *ICTs and Development in India* (pp. 151-174). Anthem Press. https://doi.org/10.7135/upo9781843313830.007

Standing, C., Gururajan, R., Standing, S., & Cripps, H. (2014). Making the most of virtual expertise in telemedicine and telehealth environment. *Journal of organizational computing and electronic commerce*, *24*(2-3), 138-156.

Standing, C., Standing, S., Gururajan, R., Fulford, R., & Gengatharen, D. (2018). Coming to terms with knowledge management in telehealth. *Systems Research and Behavioral Science*, *35*(1), 102-113.

Standing, C., Volpe, I., Standing, S., & Gururajan, R. (2011). *Making the Most of Virtual Expertise in Telemedicine and Telehealth Environments* IEEE Ninth International Conference on Dependable, Autonomic and Secure Computing,

Stebbins, R. A. (2001). *Exploratory research in the social sciences* (Vol. 48). Sage.

Stebbins, R. A. (2001). *Exploratory research in the social sciences* (Vol. 48). Sage.

Steiger, J. H. (1979). Factor indeterminacy in the 1930's and the 1970's some interesting parallels. *Psychometrika*, *44*(2), 157-167.

Stephens, N. (2007). Collecting data from elites and ultra elites: telephone and face-to-face interviews with macroeconomists. *Qualitative research*, *7*(2), 203-216.

Stevens, J. P. (2012). *Applied multivariate statistics for the social sciences*. Routledge.

Stevenson, D., Hutchins, M., & Smith, J. (2010). Human-centered evaluation for broadband tertiary outpatient telehealth: a case study. *Intl. Journal of Human–Computer Interaction*, *26*(5), 506-536.

Straub, D., Boudreau, M.-C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information systems*, *13*(1), 24.

Sturges, J. E., & Hanrahan, K. J. (2004). Comparing telephone and face-to-face qualitative interviewing: a research note. *Qualitative research*, *4*(1), 107-118.

Sturmberg, J. P., & Martin, C. (2013). *Handbook of systems and complexity in health*. Springer Science & Business Media.

Sugarhood, P., Wherton, J., Procter, R., Hinder, S., & Greenhalgh, T. (2014). Technology as system innovation: a key informant interview study of the application of the diffusion of innovation model to telecare. *Disability and Rehabilitation: Assistive Technology*, *9*(1), 79-87.

Suh, N. P., & Ralph, E. (2005). *Complexity: theory and applications*. Oxford University Press on Demand.

Suhr, D. D. (2006). *Exploratory or confirmatory factor analysis?* https://support.sas.com/resources/papers/proceedings/proceedings/sugi31/200-31.pdf

Supe, A., & Burdick, W. P. (2006). Challenges and issues in medical education in India. *Academic Medicine*, *81*(12), 1076-1080.

Suter, P., Suter, W. N., & Johnston, D. (2011). Theory-based telehealth and patient empowerment. *Population health management*, *14*(2), 87-92.

Sveiby, K.-E. (1996). Transfer of knowledge and the information processing professions. *European Management Journal*, *14*(4), 379-388.

Sweet, L. (2002). Telephone interviewing: is it compatible with interpretive phenomenological research? *Contemporary Nurse*, *12*(1), 58-63.

Syed-Abdul, S., Scholl, J., Jian, W.-S., & Li, Y.-C. (2011). Challenges and opportunities for the adoption of telemedicine in India. *Journal of Telemedicine and Telecare*, *17*(6), 336-337.

Szulanski, G. (1996). Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic management journal*, *17*(S2), 27-43.

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational behavior and human decision processes*, *82*(1), 9-27.

Szulanski, G., Winter, S., & Cappetta, R. (2000). Knowledge transfer within the firm: A replication perspective on stickiness. *Philadelphia, The Wharton School*, *37*.

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics* (Vol. 5). Pearson Boston, MA.

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*(6), 1273-1296.

Tanriverdi, H., & Iacono, C. S. (1998). Knowledge Barriers to Diffusion of Telemedicine. Proceedings of the International Conference on Information systems,

Tausig, J. E., & Freeman, E. W. (1988). The next best thing to being there: Conducting the clinical research interview by telephone. *American Journal of Orthopsychiatry*, *58*(3), 418-427.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education, 2*, 53.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education, 2*, 53.

Tavakol, M., Mohagheghi, M. A., & Dennick, R. (2008). Assessing the skills of surgical residents using simulation. *Journal of surgical education, 65*(2), 77.

Taylor, J., Coates, E., Brewster, L., Mountain, G., Wessels, B., & Hawley, M. S. (2015). Examining the use of telehealth in community nursing: identifying the factors affecting frontline staff acceptance and telehealth adoption. *Journal of advanced nursing, 71*(2), 326-337.

Telemedicine Society of India. (2017). *About TSI* Retrieved 28 March 2019 from http://www.tsi.org.in/about.html

Telemedindia. (2011a). *Telemedicine: All About Indian Telemedicine, About Telemedicine*. Retrieved 28 March 2019 from http://telemedindia.org/home.html

Telemedindia. (2011b). *Telemedicine: All About Indian Telemedicine, Barriers in Telemedicine Practice*. Retrieved 28 March 2019 from http://telemedindia.org/over.html

Temme, D., Kreis, H., & Hildebrandt, L. (2006). *PLS path modeling: A software review*.

Terry, D. L., & Buntoro, S. P. (2021). Perceived Usefulness of Telehealth Among Rural Medical Providers: Barriers to Use and Associations with Provider Confidence. *Journal of Technology in Behavioral Science*, 1-5.

Thakkar, J. J. (2020). Applications of structural equation modelling with AMOS 21, IBM SPSS. In *Structural Equation Modelling* (pp. 35-89). Springer.

Thielst, C. B. (2010). At the crossroads: NRTRC white paper examines trends driving the convergence of telehealth, EHRs and HIE. *World Hosp Health Serv, 46*(4), 17-23.

Torre-Díez, I. d. l., López-Coronado, M., Vaca, C., Aguado, J. S., & Castro, C. d. (2015). Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: a systematic review. *TELEMEDICINE and e-HEALTH, 21*(2), 81-85.

Tracy, J., Rheuban, K., Waters, R. J., DeVany, M., & Whitten, P. (2008). Critical steps to scaling telehealth for national reform. *Telemedicine and e-Health, 14*(9), 990-994.

Treiman, D. J. (2014). *Quantitative data analysis: Doing social research to test ideas*. John Wiley & Sons.

Trist, E. (1981). The evolution of socio-technical systems. *Occasional paper, 2*, 1981.

Trmčić, B. R., Labus, A., Bogdanović, Z., Babić, D., & Dacić-Pilčević, A. (2016). Usability of m-Health Services: A Health Professional's Perspective. *Management*, *80*, 45-80. https://doi.org/10. 7595/management.fon.2016.0022

Tsai, J.-M., Cheng, M.-J., Tsai, H.-H., Hung, S.-W., & Chen, Y.-L. (2019). Acceptance and resistance of telehealth: The perspective of dual-factor concepts in technology adoption. *International Journal of Information Management*, *49*, 34-44. https://doi.org/https://doi.org/10.1016/j.ijinfomgt.2019.03.003

Tuot, D. S., & Boulware, L. E. (2017). Telehealth applications to enhance CKD knowledge and awareness among patients and providers. *Advances in chronic kidney disease, 24*(1), 39-45.

Urbach, N., & Ahlemann, F. (2010). Structural equation modeling in information systems research using partial least squares. *Journal of Information technology theory and application, 11*(2), 5-40.

Urquhart, C. (2012). *Grounded Theory for Qualitative Research: A Practical Guide*. SAGE.

Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & health sciences*, *15*(3), 398-405.

Valenzuela, D., & Shrivastava, P. (2002). Interview as a method for qualitative research. *Southern Cross University and the Southern Cross Institute of Action Research (SCIAR)*.

Van den Broeck, J., Cunningham, S. A., Eeckels, R., & Herbst, K. (2005). Data cleaning: detecting, diagnosing, and editing data abnormalities. *PLoS Med*, *2*(10), e267.

van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2011). Internet Skills Performance Tests: Are People Ready for eHealth? *J Med Internet Res*, *13*(2), e35. https://doi.org/10.2196/jmir.1581

Van Jaarsveld, G. M. (2020). The effects of COVID-19 among the elderly population: a case for closing the digital divide. *Frontiers in psychiatry*, *11*.

Vatcheva, K. P., Lee, M., McCormick, J. B., & Rahbar, M. H. (2016). Multicollinearity in regression analyses conducted in epidemiologic studies. *Epidemiology (Sunnyvale, Calif.)*, *6*(2).

Vehovar, V., Toepoel, V., & Steinmetz, S. (2016). Non-probability sampling. *The Sage handbook of survey methods*, 329-345.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425-478. https://doi.org/10.2307/30036540

Venkatesh, V., Sykes, T. A., & Zhang, X. (2020). ICT for Development in Rural India: A Longitudinal Study of Women's Health Outcomes. *MIS quarterly*, *44*(2), 605-629. https://doi.org/10.25300/misq/2020/12342

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, *36*(1), 157-178.

Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: a synthesis and the road ahead. *Journal of the Association for Information Systems*, *17*(5), 328-376.

Voorhees, C. M., Brady, M. K., Calantone, R., & Ramirez, E. (2016). Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies. *Journal of the academy of marketing science*, *44*(1), 119-134.

Wade, V. A., Eliott, J. A., & Hiller, J. E. (2014). Clinician acceptance is the key factor for sustainable telehealth services. *Qualitative Health Research*, *24*(5), 682-694.

Wade, V., Gray, L., & Carati, C. (2017). Theoretical frameworks in telemedicine research [Methods and Methodology]. *Journal of Telemedicine and Telecare*, *23*(1), 181-187. https://doi.org/10.1177/1357633X15626650

Waitzkin, H. (1991). *The politics of medical encounters: How patients and doctors deal with social problems*. Yale University Press.

Walker, H. M. (1940). Degrees of freedom. *Journal of Educational Psychology*, *31*(4), 253.

Walker, J., & Whetton, S. (2002). The diffusion of innovation: factors influencing the uptake of telehealth. *Journal of Telemedicine and Telecare*, *8*(3_suppl), 73-75.

Wallwiener, M., Wallwiener, C. W., Kansy, J. K., Seeger, H., & Rajab, T. K. (2009). Impact of electronic messaging on the patient-physician interaction. *Journal of Telemedicine and Telecare*, *15*(5), 243-250. https://doi.org/10.1258/jtt.2009.090111

Walshe, K., & Rundall, T. G. (2001). Evidence-based management: from theory to practice in health care. *The Milbank Quarterly*, *79*(3), 429-457.

Wang, Y.-M., Wang, Y.-S., & Yang, Y.-F. (2010). Understanding the determinants of RFID adoption in the manufacturing industry. *Technological Forecasting and Social Change*, *77*(5), 803-815.

Ward, V., House, A., & Hamer, S. (2009). Knowledge brokering: the missing link in the evidence to action chain? *Evidence & policy: a journal of research, debate and practice*, *5*(3), 267-279.

Warshaw, E. M., Hillman, Y. J., Greer, N. L., Hagel, E. M., Macdonald, R., Rutks, I. R., & Wilt, T. J. (2011). Teledermatology for diagnosis and management of skin conditions: A systematic review. *Journal of the American Academy of Dermatology*, *64*(4), 759-772.e721. https://doi.org/10.1016/j.jaad.2010.08.026

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS quarterly*, xiii-xxiii.

Weinstein, R. S., Lopez, A. M., Joseph, B. A., Erps, K. A., Holcomb, M., Barker, G. P., & Krupinski, E. A. (2014). Telemedicine, telehealth, and mobile health applications that work: opportunities and barriers. *The American journal of medicine*, *127*(3), 183-187.

Weisberg, S. (2005). *Applied linear regression* (Vol. 528). John Wiley & Sons.

Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Harvard business press.

West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with nonnormal variables: Problems and remedies.

West, V., & Milio, N. (2004). Organizational and Environmental Factors Affecting the Utilization of Telemedicine in Rural Home Healthcare. *Home Health Care Services Quarterly*, *23*(4), 49-67. https://doi.org/10.1300/J027v23n04_04

Whiting, L. S. (2008). Semi-structured interviews: Guidance for novice researchers. *Nursing standard*, *22*(23).

Whitten, P., Johannessen, L. K., Soerensen, T., Gammon, D., & Mackert, M. (2007). A systematic review of research methodology in telemedicine studies. *Journal of Telemedicine and Telecare*, *13*(5), 230-235.

WICHE Publications. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED371926&site=ehost-live

Wilson, E. V., & Lankton, N. K. (2004). Modeling patients' acceptance of provider-delivered e-health. *Journal of the American Medical Informatics Association*, *11*(4), 241-248.

Wilson, I. (2010). Qualitative research in medical education.

Wisdom, J. P., Chor, K. H. B., Hoagwood, K. E., & Horwitz, S. M. (2014). Innovation Adoption: A Review of Theories and Constructs. *Administration and policy in mental health*, *41*(4), 480-502. https://doi.org/10.1007/s10488-013-0486-4

Witherspoon, J. P., Johnstone, S. M., & Wasem, C. J. (1993). *Rural Telehealth: Telemedicine, Distance Education and Informatics for Rural Health Care: a Report of the Office of Rural Health Policy, Health Resources and Services Administration*

Wold, S., Esbensen, K., & Geladi, P. (1987). Principal component analysis. *Chemometrics and intelligent laboratory systems*, *2*(1-3), 37-52.

Wong, K. K.-K. (2011). Book Review: Handbook of Partial Least Squares: Concepts, Methods and Applications. *International Journal of Business Science and Applied Management*, *6*(2), 52-54.

Wootton, R. (2009). *Telehealth in the developing world*. International Development Research Centre.

Wootton, R., & Darkins, A. (1997). Telemedicine and the doctor-patient relationship. *Journal of the Royal College of Physicians of London*, *31*(6), 598.

Wright, D., Gutwirth, S., Friedewald, M., Vildjiounaite, E., & Punie, Y. (2008). *Safeguards in a world of ambient intelligence* (Vol. 1). Springer Science & Business Media.

Wu, I.-L., Li, J.-Y., & Fu, C.-Y. (2011). The adoption of mobile healthcare by hospital's professionals: An integrative perspective. *Decision Support Systems*, *51*(3), 587-596. https://doi.org/https://doi.org/10.1016/j.dss.2011.03.003

Wyatt, J., & Liu, J. (2002). Basic concepts in medical informatics. *Journal of Epidemiology & Community Health*, *56*(11), 808-812.

Wynd, C. A., Schmidt, B., & Schaefer, M. A. (2003). Two quantitative approaches for estimating content validity. *Western journal of nursing research*, *25*(5), 508-518.

Yan, Z., Guo, X. x. g. c., & Vogel, D. R. (2016). Understanding Dynamic Collaboration in Teleconsultation [Article]. *Information Technology for Development, 22*(1), 152-167. https://doi.org/10.1080/02681102.2013.854730

Yarbrough, A. K., & Smith, T. B. (2007). Technology Acceptance among Physicians: A New Take on TAM. *Medical Care Research and Review, 64*(6), 650-672. http://ezproxy.usq.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eoah&AN=13237502&site=ehost-live

Yin, R. K. (2009). *Case study research: Design and methods* (Vol. 5). sage.

Zailani, S., Gilani, M. S., Nikbin, D., & Iranmanesh, M. (2014). Determinants of Telemedicine Acceptance in Selected Public Hospitals in Malaysia: Clinical Perspective. *Journal of Medical Systems*, *38*(9), 1-12. https://doi.org/10.1007/s10916-014-0111-4

Zanaboni, P., & Wootton, R. (2012). Adoption of telemedicine: from pilot stage to routine delivery. *BMC Medical Informatics and Decision Making*, *12*(1), 1. https://doi.org/10.1186/1472-6947-12-1

Zayapragassarazan, Z., & Kumar, S. (2016). Awareness, knowledge, attitude and skills of telemedicine among health professional faculty working in teaching hospitals. *Journal of clinical and diagnostic research: JCDR*, *10*(3), JC01.

Zelmer, J., Ronchi, E., Hyppönen, H., Lupiáñez-Villanueva, F., Codagnone, C., Nøhr, C., Huebner, U., Fazzalari, A., & Adler-Milstein, J. (2017). International health IT benchmarking: learning from cross-country comparisons. *Journal of the American Medical Informatics Association*, *24*(2), 371-379. https://doi.org/10.1093/jamia/ocw111

Zhang, X., Han, X., Dang, Y., Meng, F., Guo, X., & Lin, J. (2017). User acceptance of mobile health services from users' perspectives: The role of self-efficacy and response-efficacy in technology acceptance [journal article]. *Informatics for Health & Social Care*, *42*(2), 194-206. https://doi.org/10.1080/17538157.2016.1200053

Zhang, Z., & Yuan, K.-H. (2018). *Practical statistical power analysis using Webpower and R*. Isdsa Press.

Zhou, L., Thieret, R., Watzlaf, V., DeAlmeida, D., & Parmanto, B. (2019). A Telehealth Privacy and Security Self-Assessment Questionnaire for Telehealth Providers: Development and Validation. *International Journal of Telerehabilitation*, *11*(1), 3-14.

Zibran, M. F. (2007). Chi-squared test of independence. *Department of Computer Science, University of Calgary, Alberta, Canada*, 1-7.

Zikmund, W. G. (2003). *Business Research Methods* (7 ed.). Thomson South-Western.

Zikmund, W. G. (2003). *Business Research Methods* (7 ed.). Thomson South-Western.

Zmud, R. W. (1982). Diffusion of modern software practices: influence of centralization and formalization. *Management science*, *28*(12), 1421-1431.

Zobair, K. M., Sanzogni, L., & Sandhu, K. (2020). Telemedicine Healthcare Service Adoption Barriers in Rural Bangladesh. *Australasian Journal of Information Systems*, *24*.

Zodpey, S., Sharma, A., Zahiruddin, Q. S., Gaidhane, A., & Shrikhande, S. (2018). Allopathic doctors in India: estimates, norms and projections. Journal of Health Management, 20(2), 151-163.

Zorn, T. E., Roper, J., Broadfoot, K., & Kay Weaver, C. (2006). Focus groups as sites of influential interaction: Building communicative self-efficacy and effecting attitudinal change in discussing controversial topics. *Journal of Applied Communication Research*, *34*(2), 115-140.

# APPENDICES

## APPENDIX 1 ETHICS APPROVAL LETTER

**Avijit Chowdhury**

| | |
|---|---|
| **From:** | human.ethics@usq.edu.au |
| **Sent:** | Friday, 22 November 2019 9:32 AM |
| **To:** | Avijit Chowdhury |
| **Cc:** | Abdul Hafeez-Baig |
| **Subject:** | [RIMS] USQ HRE Amendment - H18REA086 (v3) - Expedited review outcome - Approved |

Dear Avijit

The revisions outlined in your HRE Amendment have been deemed by the USQ Human Research Ethics Expedited Review process to meet the requirements of the National Statement on Ethical Conduct in Human Research (2007). Your project is now granted full ethical approval as follows.

USQ HREC ID: H18REA086 (v3)
Project title: Determinants of Telehealth Technology Adoption in the Indian Healthcare Domain: An Exploratory Study
Approval date: 22/11/2019
Expiry date: 11/06/2021
Project status: Approved with conditions.

The standard conditions of this approval are:

(a) conduct the project strictly in accordance with the proposal submitted and ethics approval, including any amendments made to the proposal required by the USQ HREC, or affiliated University ethical review processes;

(b) advise the USQ HREC (via human.ethics@usq.edu.au) immediately of any complaint or other issue in relation to the conduct of this project which may warrant review of the ethical approval of the project;

(c) make submission for ethical review and approval of any amendments or revision to the approved project prior to implementing any changes;

(d) complete and submit a milestone (progress) report as requested, and at least for every year of approval; and

(e) complete and submit a milestone (final) report when the project does not commence within the first 12 months of approval, is abandoned at any stage, or is completed (whichever is sooner).

Additional conditions of this approval are:

(a) Nil.

1

Failure to comply with the conditions of approval or the requirements of the National Statement on Ethical Conduct in Human Research (2007) may result in withdrawal of ethical approval for this project.

If you have any questions or concerns, please contact an Ethics Officer.

Kind regards

Human Research Ethics

University of Southern Queensland
Toowoomba – Queensland – 4350 – Australia
Phone: (07) 4631 2690
Email: human.ethics@usq.edu.au

# APPENDIX 2 SAMPLE INVITATION LETTER FOR INTERVIEW PARTCIPANTS

Dear …,

I hope you are well.

I am currently pursuing a doctoral research on the usage of Telehealth in the Indian healthcare domain from the University of Southern Queensland, Toowoomba, Australia. … being a leading contributor to the healthcare sector in India, especially providing healthcare services to the needy and poorer sections of the society, your organisation's input will be invaluable for the research. It is a well-known fact that your organisation has a long history of providing affordable healthcare to the Indian society. As a part of the research I need to conduct few interviews with persons involved in Telehealth services at any level (providing remote / distant healthcare services) such as Doctors, Nurses, Healthcare Professionals, ICT professionals, Para-Medical Staff or Healthcare Managers / Supervisors / Workers.

The research aims to be valuable for the Indian society in the following ways:

- The main aim of this research is to develop a framework for the effective use of telehealth in the Indian healthcare domain.
- The framework can be utilised for policy making decisions and telehealth implementation by the healthcare organisations as well as by the regulatory bodies and government.
- Telehealth has the potential to remove the barriers of inaccessibility to normal healthcare services especially by the rural and remote communities.
- Further, other members of the society can benefit from telehealth in terms of getting affordable healthcare services.

It is expected that the research will contribute further to extend the viability of telehealth in your organisation and in the Indian healthcare domain.

The research would maintain anonymity and would keep the interviewees non-identifiable as per the regulations of the Indian Laws and Australian Laws. Full ethical approval for this research has been granted by the University of Southern Queensland's Research Ethics Committee. Further, your organisation can go through any publications arising from the research before it is published.

My supervisory team is led by experienced academic researchers in the field of health information systems and have international recognition in this field. The doctoral supervisors are Dr. Abdul Hafeez-Baig (Abdul.Hafeez-Baig@usq.edu.au), Senior Lecturer and Professor Raj Gururajan (Raj.Gururajan@usq.edu.au).

For any clarifications and further communication the undersigned and the doctoral supervisors can be contacted any time.

I hope my request would be kindly considered.

Thanking you.

Yours Faithfully

Avijit Chowdhury (Avijit.Chowdhury@usq.edu.au)

# APPENDIX 3 SAMPLE INVITATION LETTER FOR SURVEY PARTCIPANTS

Dear Participant,

I am Avijit Chowdhury, a PhD student at the University of Southern Queensland (USQ), Toowoomba, Australia. You are invited as a select participant for your views on telehealth/online services usage by healthcare professionals in India. As you are aware, communication technologies have improved much over the last decade globally, the applications of such technologies have a profound influence in providing healthcare services and in your working environment. If you can spare some time to share your opinion on the usage of telehealth/online services/mobile technologies in healthcare, it may pave future pathway regarding its usage and applicability in Indian healthcare. Your participation will remain non-identifiable and remains confidential. Further, you may withdraw from the participation without citing any reason whatsoever. Appropriate ethics approval has been granted for this survey from USQ. Returning the completed survey will imply your tacit consent in participating in this survey. You may also feel free to contact the researchers for any clarifications or any information associated with this research study.

It is anticipated this research study will enhance the healthcare system in India by developing a framework for the effective use of telehealth in the Indian healthcare domain. Further, members of society can benefit from telehealth in terms of getting affordable healthcare services. It is expected that the research will contribute further to extend the viability of telehealth in your organisation and in the Indian healthcare domain.

Your views and opinion are very important and I hope you will participate in this survey. Your help is invaluable for the success of this research and can make a difference. Thank you for your valuable support and time.

# APPENDIX 4 PARTCIPANT INFORMATION SHEET FOR HCP INTERVIEWS CONDUCTED IN INDIA

University of Southern Queensland

## Participant Information for USQ Research Project Interview

### Project Details

| | |
|---|---|
| Title of Project: | Determinants of Telehealth Adoption in the Indian Healthcare Domain: An Exploratory Study |
| Human Research Ethics Approval Number: | H18REA086 v3 |

### Research Team Contact Details


**Principal Investigator Details**

Mr Avijit Chowdhury
Email: Avijit.Chowdhury@usq.edu.au
Telephone: +61 7 4631 2352
Mobile: +61 4 47021698

**Supervisor Details**

Dr Abdul Hafeez-Baig
Email: Abdul.Hafeez-Baig@usq.edu.au
Telephone: +61 7 4631 1461
Mobile:

Prof Raj Gururajan
Email: Raj.Gururajan@usq.edu.au
Telephone: +61 7 3470 4539
Mobile:


### Description

This project is being undertaken as part of a PhD.

The purpose of this project is to understand the determinants of telehealth technology adoption in the Indian healthcare domain.

The research team requests your assistance because you meet the study criteria and can provide valuable data, which is significant for this research. This research aims to establish and confirm the determinants of ICT adoption in Indian telehealth environment, as there is a considerable knowledge gap regarding the determinants. Furthermore, this research has the aim to create a theoretical framework for ICT adoption in the Indian telehealth environment, which might have the potential for utilization in organizational policy level decision making.

### Participation

Your participation will involve contributing your opinions and ideas in an interview that will take approximately 1 hour of your time.

The interview will take place at a time and venue that is convenient to you within your workplace.

OR

The interview will be undertaken by teleconference at a date and time that is convenient to you within your workplace.

Questions will include your opinion regarding the determinants of telehealth adoption in India. The interview would be semi-structured and open ended.

The interview will be audio recorded.

Your participation in this project is entirely voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. You may also request that any data collected about you be destroyed. If you do wish to withdraw from this project or withdraw data collected about you, please contact the Research Team (contact details at the top of this form).

Your decision whether you take part, do not take part, or to take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland.

**Expected Benefits**

It is expected that this project will not directly benefit you. However, it may benefit the Indian healthcare domain. It will help in understanding the driving forces behind the uptake of ICT in Indian telehealth environment. Furthermore, the theoretical framework created from this research might be useful for organizational policy level decision making regarding telehealth within the Indian healthcare domain.

**Risks**

There are minimal risks associated with your participation in this project. The only risk is imposition of time. However, you have the right to withdraw at any time without any consequences.

**Privacy and Confidentiality**

All comments and responses will be treated confidentially unless required by law.

Any data collected as a part of this project will be stored securely as per University of Southern Queensland's Research Data Management policy.

If you would like to have access to a copy of the transcript of the interview please contact the research team. Details can be found in the **"Research Team Contact Details"** section at the top of Page No. 1 of this document.

If you would like to have access to a summary of the research results please contact the research team. Details can be found in the **"Research Team Contact Details"** section at the top of Page No. 1 of this document.

**Consent to Participate**

We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate in this project. Please return your signed consent form to a member of the Research Team prior to participating in your interview.

**Questions or Further Information about the Project**

Please refer to the Research Team Contact Details at the top of the form to have any questions answered or to request further information about this project.

## Concerns or Complaints Regarding the Conduct of the Project

If you have any concerns or complaints about the ethical conduct of the project you may contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au. The Ethics Coordinator is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.

**Thank you for taking the time to help with this research project. Please keep this sheet for your information.**

# APPENDIX 5 PARTICIPANT INFORMATION SHEET FOR SURVEY

University of Southern Queensland

UNIVERSITY OF SOUTHERN QUEENSLAND AUSTRALIA

## Participant Information for USQ Research Project Online Survey

### Project Details

| | |
|---|---|
| Title of Project: | Determinants of Telehealth Adoption in the Indian Healthcare Domain: An Exploratory Study |
| Human Research Ethics Approval Number: | H18REA086 v3 |

### Research Team Contact Details


**Principal Investigator Details**

Mr Avijit Chowdhury
Email: Avijit.Chowdhury@usq.edu.au
Telephone: (07) 4631 2352
Mobile: 0447021698

**Supervisor Details**

Dr Abdul Hafeez-Baig
Email: Abdul.Hafeez-Baig@usq.edu.au
Telephone: (07) 4631 1461
Mobile:

Prof Raj Gururajan
Email: Raj.Gururajan@usq.edu.au
Telephone: (07) 3470 4539
Mobile:


### Description

This project is being undertaken as part of a PhD.

The purpose of this project is to understand the determinants of telehealth technology adoption in the Indian healthcare domain.

The research team requests your assistance because you meet the study criteria and can provide valuable data, which is significant for this research. This research aims to establish and confirm the determinants of ICT adoption in Indian telehealth environment, as there is a considerable knowledge gap regarding the determinants. Furthermore, this research has the aim to create a theoretical framework for ICT adoption in the Indian telehealth environment, which might have the potential for utilization in organizational policy level decision making.

### Participation

Your participation will involve completion of a questionnaire that will take approximately 20 minutes of your time.

Questions will include your opinion regarding the determinants of telehealth adoption in India. The questionnaire would be structured closed ended and would be based on a Likert scale with ratings ranging from Strongly Disagree to Strongly Agree.

## Expected Benefits

It is expected that this project will not directly benefit you. However, it may benefit the Indian healthcare domain. It will help in understanding the driving forces behind the uptake of ICT in Indian telehealth environment. Furthermore, the theoretical framework created from this research might be useful for organizational policy level decision making regarding telehealth within the Indian healthcare domain.

## Risks

There are minimal risks associated with your participation in this project. The only risk is imposition of time.

## Privacy and Confidentiality

All comments and responses will be treated confidentially unless required by law.

Any data collected as a part of this project will be stored securely as per University of Southern Queensland's Research Data Management policy.

If you would like to have access to a summary of the research results please contact the research team. Details can be found in the **"Research Team Contact Details"** section at the top of Page No. 1 of this document.

## Consent to Participate

Prior approval has been taken from the appropriate authority of the organization to conduct the survey.

A return of the completed questionnaire would be taken as an implied consent to participate.

## Questions or Further Information about the Project

Please refer to the Research Team Contact Details at the top of the form to have any questions answered or to request further information about this project.

## Concerns or Complaints Regarding the Conduct of the Project

If you have any concerns or complaints about the ethical conduct of the project you may contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au. The Ethics Coordinator is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.

**Thank you for taking the time to help with this research project. Please keep this sheet for your information.**

# APPENDIX 6 CONSENT FORM FOR INTERVIEWS

University of Southern Queensland

UNIVERSITY OF SOUTHERN QUEENSLAND AUSTRALIA

**Consent Form for USQ Research Project Interview**

**Project Details**

| | |
|---|---|
| Title of Project: | Determinants of Telehealth Adoption in the Indian Healthcare Domain: An Exploratory Study |
| Human Research Ethics Approval Number: | H18REA086 v3 |

**Research Team Contact Details**

**Principal Investigator Details**

Mr Avijit Chowdhury
Email: Avijit.Chowdhury@usq.edu.au
Telephone: +61 7 4631 2352
Mobile: +61 4 47021698

**Other Investigator/Supervisor Details**

Dr Abdul Hafeez-Baig
Email: Abdul.Hafeez-Baig@usq.edu.au
Telephone: +61 7 4631 1461
Mobile:

Prof Raj Gururajan
Email: Raj.Gururajan@usq.edu.au
Telephone: +61 7 3470 4539
Mobile:

**Statement of Consent**

**By signing below, you are indicating that you:**

- Have read and understood the information document regarding this project.
- Have had any questions answered to your satisfaction.
- Understand that if you have any additional questions you can contact the research team.
- Understand that the interview will be audio recorded.
- Understand that you are free to withdraw at any time, without comment or penalty.
- Understand that you can contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au if you do have any concern or complaint about the ethical conduct of this project.
- Are over 18 years of age.
- Agree to participate in the project.

| | |
|---|---|
| Participant Name | |
| Participant Signature | |
| Date | |

**Please return this sheet to a Research Team member prior to undertaking the interview.**

Page **1** of **1**

# APPENDIX 7 SAMPLE SURVEY FORM BEFORE PRE-TEST

University of Southern Queensland

**Exploring the determinants of telehealth adoption by HCPs in India**

**Survey Form**

## Screening Questions

Please circle or specify the relevant answer.

1) Age Bracket (in years): (a) (20-29) (b) (30-39) (c) (40-49) (d) (≥50)

2) Gender: (a) Male (b) Female

3) Educational Qualifications: (a) UG (b) PG

4) Occupation: (a) Doctor (b) Paramedics (c) Healthcare Admin (d) Healthcare Technical Support (e) Other (Please Specify)

5) Employment: (a) Public (b) Private

6) Experience (in years): (a) (0-9) (b) (10-19) (c) (20-29) (d) (≥30)

## Survey Questionnaire

Please rate the following information on a scale of 1 to 5, with 1 being "Strongly Disagree" and 5 being "Strongly Agree".

SD= Strongly Disagree, D= Disagree, N= Neutral, A= Agree, SA= Strongly Agree

HCP= Healthcare Professional

Using online consultations/email/social media apps for viewing reports or to disseminate preliminary information to the patients are considered as part of telehealth for this research.

| Sl. No. | Items | Scale | | | | |
|---|---|---|---|---|---|---|
| | | **SD** | **D** | **N** | **A** | **SA** |
| 1. | Telehealth/online consultations can be beneficial to know the patient profile | **1** | **2** | **3** | **4** | **5** |
| 2. | Telehealth/online consultations can be beneficial to provide preliminary information to the patients | **1** | **2** | **3** | **4** | **5** |
| 3. | Telehealth/online consultations can be beneficial to provide a preliminary plan for the patient | **1** | **2** | **3** | **4** | **5** |
| 4. | Telehealth/online consultations can be beneficial to view reports online | **1** | **2** | **3** | **4** | **5** |
| 5. | Telehealth/online consultations can be beneficial for early detection of patient conditions | **1** | **2** | **3** | **4** | **5** |

1

| | | | | | | |
|---|---|---|---|---|---|---|
| 6. | Telehealth/online consultations can be beneficial for early detection of non-communicable diseases | **1** | **2** | **3** | **4** | **5** |
| 7. | Telehealth/online consultations can be beneficial to prevent non-communicable diseases | **1** | **2** | **3** | **4** | **5** |
| 8. | For the patients requiring long-term care, telehealth/online consultations can facilitate referral services in rural/remote areas | **1** | **2** | **3** | **4** | **5** |
| 9. | For emergency condition of the patients, telehealth/online consultations can facilitate the referral services | **1** | **2** | **3** | **4** | **5** |
| 10. | Telehealth/online consultations can be beneficial to provide information regarding prevention of diseases | **1** | **2** | **3** | **4** | **5** |
| 11. | Telehealth/online consultations can facilitate early treatment for the patient by using examining cameras | **1** | **2** | **3** | **4** | **5** |
| 12. | Telehealth/online consultations can facilitate to verify the condition of the patient by using examining cameras | **1** | **2** | **3** | **4** | **5** |
| 13. | Telehealth/online consultations can facilitate to prescribe diagnostic reports for the patients | **1** | **2** | **3** | **4** | **5** |
| 14. | Telehealth/online consultations can facilitate prescribing medicines to the patients | **1** | **2** | **3** | **4** | **5** |
| 15. | For follow-up patients, telehealth/online consultations can facilitate the scheduling of appointments | **1** | **2** | **3** | **4** | **5** |
| 16. | For monitoring of the patients, telehealth/online consultations can be convenient | **1** | **2** | **3** | **4** | **5** |
| 17. | Telehealth/online consultations can be beneficial for post-treatment counselling | **1** | **2** | **3** | **4** | **5** |
| 18. | Telehealth/online consultations can be beneficial for providing post-treatment rehabilitation services | **1** | **2** | **3** | **4** | **5** |
| 19. | Telehealth/online consultations can be beneficial to promote patient health education | **1** | **2** | **3** | **4** | **5** |
| 20. | Telehealth/online consultations can be beneficial to promote prevention of diseases | **1** | **2** | **3** | **4** | **5** |
| 21. | Telehealth/online consultations can be beneficial to promote healthy diets | **1** | **2** | **3** | **4** | **5** |
| 22. | Telehealth/online consultations can be beneficial to promote healthy lifestyle | **1** | **2** | **3** | **4** | **5** |
| 23. | Telehealth/online consultations promotes self-management of diseases | **1** | **2** | **3** | **4** | **5** |
| 24. | Telehealth/online consultations can be beneficial to promote improved health outcomes | **1** | **2** | **3** | **4** | **5** |
| 25. | Telehealth/online consultations can be beneficial to promote improved patient wellness | **1** | **2** | **3** | **4** | **5** |
| 26. | Telehealth/online consultations helps to improve the care I give to my patients | **1** | **2** | **3** | **4** | **5** |
| 27. | Telehealth/online consultations increases effectiveness of healthcare delivery | **1** | **2** | **3** | **4** | **5** |
| 28. | Using telehealth/online consultations would make it easier to do my job | **1** | **2** | **3** | **4** | **5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 29. | Using telehealth/online consultations would increase my job efficiency | **1** | **2** | **3** | **4** | **5** |
| 30. | Telehealth/online consultations increases productivity in healthcare delivery | **1** | **2** | **3** | **4** | **5** |
| 31. | Telehealth/online consultations may facilitate improvement in the area of my job | **1** | **2** | **3** | **4** | **5** |
| 32. | Telehealth/online consultations helps healthcare monitoring easier | **1** | **2** | **3** | **4** | **5** |
| 33. | Telehealth/online consultations facilitates improved health outcomes for the patients | **1** | **2** | **3** | **4** | **5** |
| 34. | Viewing medical reports is easy using telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 35. | Analysing medical reports is easy using telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 36. | I understand the nuances of technologies involved in providing telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 37. | My interaction with telehealth/online consultations applications is clear and understandable | **1** | **2** | **3** | **4** | **5** |
| 38. | My interaction with online telehealth/online consultations platforms is clear and understandable | **1** | **2** | **3** | **4** | **5** |
| 39. | Learning to provide telehealth/online consultations services would be easy for me | **1** | **2** | **3** | **4** | **5** |
| 40. | I am not in favour of telehealth/online consultations as I feel face-to-face interaction is a better way of communication | **1** | **2** | **3** | **4** | **5** |
| 41. | Telehealth/online consultations is complex in providing care | **1** | **2** | **3** | **4** | **5** |
| 42. | I am in favour of telehealth/online consultations as it provides additional care to my patients | **1** | **2** | **3** | **4** | **5** |
| 43. | Telehealth/online consultations is an integrated technology in providing healthcare services | **1** | **2** | **3** | **4** | **5** |
| 44. | I will use telehealth/online consultations if my organisation implements telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 45. | I will increase providing telehealth/online consultations services in future | **1** | **2** | **3** | **4** | **5** |
| 46. | I will recommend others to provide telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 47. | I will use telehealth/online consultations because the significance and prevalence of the problems to be addressed, and the information needed are available on a timely basis. | **1** | **2** | **3** | **4** | **5** |
| 48. | I will use telehealth/online consultations because these services in my organisation are fully integrated in providing patient care | **1** | **2** | **3** | **4** | **5** |
| 49. | I had seen someone else using telehealth/online consultations before trying it myself | **1** | **2** | **3** | **4** | **5** |
| 50. | I could call someone for help if I got stuck using telehealth/online consultations applications | **1** | **2** | **3** | **4** | **5** |
| 51. | Someone else helped me get started on providing telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 52. | Someone showed me how to provide telehealth/online consultations services first | **1** | **2** | **3** | **4** | **5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 53. | Telehealth/online consultations can be beneficial for the rural and remote areas | **1** | **2** | **3** | **4** | **5** |
| 54. | Telehealth/online consultations can be beneficial for the economically backward regions | **1** | **2** | **3** | **4** | **5** |
| 55. | The disease profile in rural and remote areas can be a motivator to engage in providing telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 56. | Telehealth/online consultations can be beneficial in promoting nutrition and hygiene in the rural and remote areas | **1** | **2** | **3** | **4** | **5** |
| 57. | Telehealth/online consultations can be beneficial in providing emergency services in the rural and remote areas | **1** | **2** | **3** | **4** | **5** |
| 58. | The lack of advanced healthcare facilities in rural and remote areas can be a significant motivator to use telehealth/online consultations by the HCPs | **1** | **2** | **3** | **4** | **5** |
| 59. | The distance to the nearest hospital can be a driving factor to engage in providing telehealth/online consultations services for the rural and remote areas | **1** | **2** | **3** | **4** | **5** |
| 60. | Telehealth/online consultations can lessen the cost of healthcare services | **1** | **2** | **3** | **4** | **5** |
| 61. | Telehealth/online consultations can be beneficial to provide affordable healthcare services to the rural and remote areas | **1** | **2** | **3** | **4** | **5** |
| 62. | Telehealth/online consultations can be beneficial to provide accessible healthcare to the rural and remote areas | **1** | **2** | **3** | **4** | **5** |
| 63. | Telehealth/online consultations helps easy access to information | **1** | **2** | **3** | **4** | **5** |
| 64. | There is enough support for the health workers training in telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 65. | There is enough support for the health professionals training in telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 66. | Medical education can be improved through telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 67. | Doctor to doctor collaboration is more important in telehealth/online consultations than the involvement of patients | **1** | **2** | **3** | **4** | **5** |
| 68. | Expert opinion/second opinion can be solicited easily through use of telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 69. | The healthcare professionals are willing to share their knowledge / expertise to other healthcare professionals | **1** | **2** | **3** | **4** | **5** |
| 70. | I am willing to participate in training to gain knowledge about telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 71. | I am familiar with providing telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 72. | I actually provide telehealth/online consultations services as a part of my normal practice | **1** | **2** | **3** | **4** | **5** |
| 73. | I am familiar with the telehealth/online consultations applications | **1** | **2** | **3** | **4** | **5** |
| 74. | I regularly attend webinars/conferences regarding telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 75. | I am familiar with telehealth/online consultations services in developed or other countries | **1** | **2** | **3** | **4** | **5** |
| 76. | Overall I am satisfied with the broadband services used for telehealth/online consultations especially in the urban areas | **1** | **2** | **3** | **4** | **5** |
| 77. | The ICT infrastructure is robust in urban areas which can motivate to use telehealth/online consultations by the HCPs | **1** | **2** | **3** | **4** | **5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 78. | There are a number of telehealth/online consultations platforms to choose from | **1** | **2** | **3** | **4** | **5** |
| 79. | There are a number of telehealth/online consultations applications to choose from | **1** | **2** | **3** | **4** | **5** |
| 80. | Telehealth/online consultations has the potential to be the alternative solution to support the normal healthcare services | **1** | **2** | **3** | **4** | **5** |
| 81. | Telehealth/online consultations can be used to provide services to the patients who are immovable or with disabilities or specially abled | **1** | **2** | **3** | **4** | **5** |
| 82. | Telehealth/online consultations can be the alternative solution to provide healthcare support services in the rural and remote areas | **1** | **2** | **3** | **4** | **5** |
| 83. | Telehealth/online consultations can be the alternative solution to provide healthcare support services during natural emergencies | **1** | **2** | **3** | **4** | **5** |
| 84. | Providing telehealth/online consultations is time saving for the healthcare professionals | **1** | **2** | **3** | **4** | **5** |
| 85. | Providing telehealth/online consultations is time saving for the patients | **1** | **2** | **3** | **4** | **5** |
| 86. | There are acute shortage of doctors in the rural and remote areas which can be a motivator to start telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 87. | Telehealth/online consultations can cater to the overseas Indians | **1** | **2** | **3** | **4** | **5** |
| 88. | Telehealth/online consultations can provide information about treatment in India to persons residing in different countries | **1** | **2** | **3** | **4** | **5** |
| 89. | Telehealth/online consultations proves to be economical both for the HCPs and the patients | **1** | **2** | **3** | **4** | **5** |
| 90. | Telehealth/online consultations saves travelling distances both for the HCPs and the patients | **1** | **2** | **3** | **4** | **5** |
| 91. | Telehealth/online consultations can be a useful tool to provide allied healthcare services | **1** | **2** | **3** | **4** | **5** |
| 92. | I am using telehealth/online consultations for a considerable period of time | **1** | **2** | **3** | **4** | **5** |
| 93. | I consider myself as a forerunner in Indian telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 94. | Telehealth/online consultations is going to be an essential part of healthcare services in the near future | **1** | **2** | **3** | **4** | **5** |
| 95. | Telehealth/online consultations applications provide me a better understanding of the patient profile | **1** | **2** | **3** | **4** | **5** |
| 96. | I do not consider telehealth/online consultations as a requirement in healthcare practice | **1** | **2** | **3** | **4** | **5** |
| 97. | Telehealth/online consultations is safe to use | **1** | **2** | **3** | **4** | **5** |
| 98. | Telehealth/online consultations adoption depends on appropriate usage | **1** | **2** | **3** | **4** | **5** |
| 99. | Telehealth/online consultations is compatible with the healthcare practices | **1** | **2** | **3** | **4** | **5** |
| 100. | Reliable ICT infrastructure is important for telehealth/online consultations usage | **1** | **2** | **3** | **4** | **5** |
| 101. | Robust ICT infrastructure (e.g. Broadband speed, mobile towers) can be a motivator for telehealth/online consultations usage | **1** | **2** | **3** | **4** | **5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 102. | Uninterrupted video link makes it comfortable to use telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 103. | Rural areas/remote areas need improved broadband services to provide telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 104. | Enough technical support is required to provide telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 105. | Inconvenience of using technology hinders telehealth/online consultations usage | **1** | **2** | **3** | **4** | **5** |
| 106. | Telehealth/online consultations platforms should be technologically upgraded for better online services | **1** | **2** | **3** | **4** | **5** |
| 107. | Telehealth/online consultations usage can increase if the online platforms are easy to use | **1** | **2** | **3** | **4** | **5** |
| 108. | Information security plays a major role in telehealth/online consultations usage | **1** | **2** | **3** | **4** | **5** |
| 109. | Confidentiality of information is necessary to start using telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 110. | Hacking of health data hinders telehealth/online consultations usage | **1** | **2** | **3** | **4** | **5** |
| 111. | Lack of ethical standards hinder telehealth/online consultations usage | **1** | **2** | **3** | **4** | **5** |
| 112. | Validation of doctors credential is essential to provide telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 113. | There is a risk for the patient to get ill advices from unverified quacks posing as HCP in online platforms | **1** | **2** | **3** | **4** | **5** |
| 114. | The staff is willing to collaborate with each other to provide telehealth/online consultation services | **1** | **2** | **3** | **4** | **5** |
| 115. | Shortage of healthcare professionals is a barrier in providing normal healthcare services in rural/remote areas | **1** | **2** | **3** | **4** | **5** |
| 116. | Shortage of health workers is a barrier in providing normal healthcare services in rural/remote areas | **1** | **2** | **3** | **4** | **5** |
| 117. | There is organisational support to readily provide healthcare delivery through use of ICT | **1** | **2** | **3** | **4** | **5** |
| 118. | The organisational ICT infrastructure is sufficient to provide telehealth/online consultations servicedelivery | **1** | **2** | **3** | **4** | **5** |
| 119. | Additional remuneration is required to provide telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 120. | Adequate staff training facilities are provided for training in telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 121. | Organisation top management is encouraging enough to use telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 122. | Organisation provides enough support to acquire new skills in telehealth/online consultations/technology | **1** | **2** | **3** | **4** | **5** |
| 123. | There is a requirement for organisational policy for telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 124. | Standardised guidelines are required for providing telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 125. | There is a requirement for a practical government policy on telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 126. | The government can influence demand of telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 127. | The government can influence supply of telehealth/online consultations services | **1** | **2** | **3** | **4** | **5** |
| 128. | The government can promote the benefits of telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 129. | Current Government policy of promoting telehealth/online consultations is impractical | **1** | **2** | **3** | **4** | **5** |
| 130. | I prefer face-to-face communications with the patients though not against using telehealth/online consultations | **1** | **2** | **3** | **4** | **5** |
| 131. | I am reluctant to provide telehealth/online consultations consultations | **1** | **2** | **3** | **4** | **5** |
| 132. | Telehealth/online consultations may facilitate providing misleading information to the patients | **1** | **2** | **3** | **4** | **5** |
| 133. | Telehealth/online consultations can be beneficial only for viewing diagnostic reports | **1** | **2** | **3** | **4** | **5** |
| 134. | Telehealth/online consultations can be beneficial only for scheduling appointments | | | | | |

# APPENDIX 8 FINALISED SURVEY INSTRUMENT

## <u>SURVEY FORM</u>

### Exploring the determinants of telehealth adoption by Healthcare Professionals (HCPs) in India

Dear Participant,

I am Avijit Chowdhury, a PhD student at the University of Southern Queensland (USQ), Toowoomba, Australia. You are invited as a select participant for your views on telehealth/online services usage by healthcare professionals in India. As you are aware, communication technologies have improved much over the last decade globally, the applications of such technologies have a profound influence in providing healthcare services and in your working environment. If you can spare some time to share your opinion on the usage of telehealth/online services/mobile technologies in healthcare, it may pave future pathway regarding its usage and applicability in Indian healthcare. Your participation will remain non-identifiable and remains confidential. Further, you may withdraw from the participation without citing any reason whatsoever. Appropriate ethics approval has been granted for this survey from USQ. Returning the completed survey will imply your tacit consent in participating in this survey. You may also feel free to contact the researchers for any clarifications or any information associated with this research study.

It is anticipated this research study will enhance the healthcare system in India by developing a framework for the effective use of telehealth in the Indian healthcare domain. Further, members of society can benefit from telehealth in terms of getting affordable healthcare services. It is expected that the research will contribute further to extend the viability of telehealth in your organisation and in the Indian healthcare domain.

Your views and opinion are very important and I hope you will participate in this survey. Your help is invaluable for the success of this research and can make a difference. Thank you for your valuable support and time.

**<u>PLEASE CIRCLE THE ONE APPLICABLE TO YOU</u>**

**1**. **Age Bracket** (in years): (a) 20-29 (b) 30-39 (c) 40-49 (d) ≥50

**2. Gender**: (a) Male (b) Female

**3. Educational Qualifications:** (a) Under Graduate (b) Post Graduate

**4. Occupation:** (a) Doctor (b) Paramedics (c) Healthcare Admin (d) Healthcare Technical Support (e) Other ……......

**5. Experience** (in years): (a) 0-9 (b) 10-19 (c) 20-29 (d) ≥30

**6. Employment:** (a) Public (b) Private

| **No.** | **PLEASE CIRCLE THE RESPONSE APPLICABLE TO YOUR ENVIRONMENT SD=Strongly Disagree 1, D=Disagree 2, N=Neither Agree nor Disagree 3, A=Agree 4, and SA=Strongly Agree 5** | **Scale** | | | | |
|---|---|---|---|---|---|---|
| | | **SD** | **D** | **N** | **A** | **SA** |
| 1. | **<u>Telehealth/online services</u>** can be beneficial to get to know the patient profile | 1 | 2 | 3 | 4 | 5 |
| 2. | can be beneficial to provide preliminary information to the patients | 1 | 2 | 3 | 4 | 5 |
| 3. | can be beneficial to view reports online | 1 | 2 | 3 | 4 | 5 |
| 4. | can be beneficial for early detection of patient conditions | 1 | 2 | 3 | 4 | 5 |
| 5. | can expedite referrals in rural/remote areas for long-term care patients | 1 | 2 | 3 | 4 | 5 |
| 6. | facilitate the referral services, for the emergency conditions of patients | 1 | 2 | 3 | 4 | 5 |
| 7. | facilitate to provide information regarding the prevention of diseases | 1 | 2 | 3 | 4 | 5 |
| 8. | can facilitate early treatment of the patient by using examining cameras | 1 | 2 | 3 | 4 | 5 |
| 9. | can facilitate to verify patient conditions by using examining cameras | 1 | 2 | 3 | 4 | 5 |
| 10. | can facilitate to prescribe diagnostic reports for the patients | 1 | 2 | 3 | 4 | 5 |
| 11. | can facilitate prescribing medicines to the patients | 1 | 2 | 3 | 4 | 5 |
| 12. | can facilitate the scheduling of appointments, for follow-up patients | 1 | 2 | 3 | 4 | 5 |
| 13. | can be convenient, for monitoring patients | 1 | 2 | 3 | 4 | 5 |
| 14. | can be beneficial for post-treatment counselling | 1 | 2 | 3 | 4 | 5 |
| 15. | can be beneficial for providing post-treatment rehabilitation services | 1 | 2 | 3 | 4 | 5 |
| 16. | can be beneficial to promote patient health education | 1 | 2 | 3 | 4 | 5 |
| 17. | can be beneficial to promote the prevention of diseases | 1 | 2 | 3 | 4 | 5 |
| 18. | can be beneficial to promote healthy diets | 1 | 2 | 3 | 4 | 5 |
| 19. | promote self-management of diseases | 1 | 2 | 3 | 4 | 5 |
| 20. | can be beneficial to promote improved health outcomes | 1 | 2 | 3 | 4 | 5 |
| 21. | help to improve the care I give to my patients | 1 | 2 | 3 | 4 | 5 |
| 22. | increase the effectiveness of healthcare delivery | 1 | 2 | 3 | 4 | 5 |
| 23. | **<u>Using telehealth/online services</u>** would make it easier to do my job | 1 | 2 | 3 | 4 | 5 |
| 24. | would increase my job efficiency | 1 | 2 | 3 | 4 | 5 |
| 25. | **<u>Telehealth/online services</u>** increase productivity in healthcare delivery | 1 | 2 | 3 | 4 | 5 |
| 26. | may facilitate improvement in the area of my job | 1 | 2 | 3 | 4 | 5 |
| 27. | facilitate improved health outcomes for the patients | 1 | 2 | 3 | 4 | 5 |
| 28. | Viewing medical report is easy using telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 29. | Analysing medical report is easy using telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 30. | I understand the nuances of technologies involved in providing telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 31. | My interaction with telehealth/online services applications is clear and understandable | 1 | 2 | 3 | 4 | 5 |
| 32. | Learning to provide telehealth/online services would be easy for me | 1 | 2 | 3 | 4 | 5 |
| 33. | The disease profile in rural and remote areas encourages to provide telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 34. | **<u>Telehealth/online services</u>** can facilitate promoting nutrition and hygiene in the rural/remote areas | 1 | 2 | 3 | 4 | 5 |
| 35. | can facilitate in providing emergency services in the rural/remote areas | 1 | 2 | 3 | 4 | 5 |
| 36. | The lack of facilities in rural/remote areas encourage the provision of telehealth/online services | 1 | 2 | 3 | 4 | 5 |

| No. | PLEASE CIRCLE THE RESPONSE APPLICABLE TO YOUR ENVIRONMENT SD=Strongly Disagree 1, D=Disagree 2, N=Neither Agree nor Disagree 3, A=Agree 4, and SA=Strongly Agree 5 | Scale | | | | |
|---|---|---|---|---|---|---|
| | | SD | D | N | A | SA |
| 37. | The distance to the nearest hospital in rural/remote areas can encourage telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 38. | **Telehealth/online services** can lessen the cost of healthcare services | 1 | 2 | 3 | 4 | 5 |
| 39. | can facilitate providing affordable healthcare to the rural/remote areas | 1 | 2 | 3 | 4 | 5 |
| 40. | can be beneficial to provide accessible healthcare to the rural/remote areas | 1 | 2 | 3 | 4 | 5 |
| 41. | help easy access to information | 1 | 2 | 3 | 4 | 5 |
| 42. | **There is enough support** for the health workers training in telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 43. | for the health professionals training in telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 44. | Medical education can be improved through telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 45. | Doctor-doctor collaboration is more critical in telehealth/online services than patient involvement | 1 | 2 | 3 | 4 | 5 |
| 46. | Expert opinion/second opinion can be solicited easily through the use of telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 47. | The broadband services used for telehealth/online services in the urban areas are satisfactory | 1 | 2 | 3 | 4 | 5 |
| 48. | The ICT infrastructure is robust in urban areas which can motivate to use telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 49. | There are several telehealth/online services applications to choose from | 1 | 2 | 3 | 4 | 5 |
| 50. | **Telehealth/online services** have the potential to be the alternative support solution to health services | 1 | 2 | 3 | 4 | 5 |
| 51. | can facilitate services to immovable/disabled/specially abled patients | 1 | 2 | 3 | 4 | 5 |
| 52. | can be the alternative support solution for rural/remote areas | 1 | 2 | 3 | 4 | 5 |
| 53. | can be the alternative support solution during natural disasters | 1 | 2 | 3 | 4 | 5 |
| 54. | **Providing telehealth/online services** is time-saving for healthcare professionals | 1 | 2 | 3 | 4 | 5 |
| 55. | is time-saving for the patients | 1 | 2 | 3 | 4 | 5 |
| 56. | The shortage of doctors in rural/remote areas can encourage providing telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 57. | **Telehealth/online services** can cater to overseas Indians | 1 | 2 | 3 | 4 | 5 |
| 58. | can provide information about treatment in India to overseas persons | 1 | 2 | 3 | 4 | 5 |
| 59. | prove to be economical both for the HCPs and the patients | 1 | 2 | 3 | 4 | 5 |
| 60. | save travelling distances both for the HCPs and the patients | 1 | 2 | 3 | 4 | 5 |
| 61. | can be a useful tool to provide allied healthcare services | 1 | 2 | 3 | 4 | 5 |
| 62. | I am using telehealth/online services for a considerable period of time | 1 | 2 | 3 | 4 | 5 |
| 63. | I consider myself as a forerunner in Indian telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 64. | **Telehealth/online services** are going to be an essential part of healthcare services in the near future | 1 | 2 | 3 | 4 | 5 |
| 65. | applications provide me a better understanding of the patient profile | 1 | 2 | 3 | 4 | 5 |
| 66. | I do not consider telehealth/online services as a requirement in healthcare practice | 1 | 2 | 3 | 4 | 5 |
| 67. | A reliable ICT infrastructure is important for telehealth/online services usage | 1 | 2 | 3 | 4 | 5 |
| 68. | Robust ICT infra (e.g. Broadband speed, towers) can be encouraging for telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 69. | Uninterrupted video link makes it comfortable to use telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 70. | Rural areas/remote areas need improved broadband services to provide telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 71. | Enough technical support is required to provide telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 72. | The inconvenience of using technology hinders telehealth/online services usage | 1 | 2 | 3 | 4 | 5 |
| 73. | **Telehealth/online services** platforms should be technologically upgraded for better online services | 1 | 2 | 3 | 4 | 5 |
| 74. | usage can increase if the online platforms are easy to use | 1 | 2 | 3 | 4 | 5 |
| 75. | Information security plays a major role in telehealth/online services usage | 1 | 2 | 3 | 4 | 5 |
| 76. | Confidentiality of information is necessary to start using telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 77. | Hacking of health data hinders telehealth/online services usage | 1 | 2 | 3 | 4 | 5 |
| 78. | Lack of ethical standards hinder telehealth/online services usage | 1 | 2 | 3 | 4 | 5 |
| 79. | Validation of doctors' credential is essential to provide telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 80. | There is a risk for the patient to get ill advice from quacks posing as HCPs online | 1 | 2 | 3 | 4 | 5 |
| 81. | The organisational ICT infrastructure is sufficient to provide telehealth/online services delivery | 1 | 2 | 3 | 4 | 5 |
| 82. | Additional remuneration is required to provide telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 83. | Adequate staff training facilities are provided for training in telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 84. | Organisation top management is encouraging enough to use telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 85. | The organisation provides support to acquire new skills in telehealth/online services/technology | 1 | 2 | 3 | 4 | 5 |
| 86. | There is a requirement for organisational policy for telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 87. | Standardised guidelines are required for providing telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 88. | There is a requirement for practical government policy on telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 89. | **The government** can influence the demand for telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 90. | can influence the supply of telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 91. | can promote the benefits of telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 92. | The current Government policy of promoting telehealth/online services is impractical | 1 | 2 | 3 | 4 | 5 |
| 93. | I prefer face-to-face communications though I am not against using telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 94. | I am reluctant to provide telehealth/online services | 1 | 2 | 3 | 4 | 5 |
| 95. | **Telehealth/online services** may facilitate providing misleading information to the patients | 1 | 2 | 3 | 4 | 5 |
| 96. | can be beneficial only for viewing diagnostic reports | 1 | 2 | 3 | 4 | 5 |
| 97. | can be beneficial only for scheduling appointments | 1 | 2 | 3 | 4 | 5 |

**Thank you for your time and support. If you need any further information about this research, do not hesitate to contact Assoc Prof A. Hafeez-Baig (abdulhb@usq.edu.au), Prof R. Gururajan (gururaja@usq.edu.au) or Avijit (avijit.chowdhury@usq.edu.au) +61447021698, +919830734150.**

# APPENDIX 9 ONLINE SURVEY LINK

**https://surveys.usq.edu.au/index.php/393744?lang=en**

# APPENDIX 10 IBM SPPS STATISTICS V27 OUTPUTS

## 10.1 Communalities Extracted

**Communalities**

| | Initial | Extraction |
|---|---|---|
| HP2 | 1.000 | .703 |
| HP4 | 1.000 | .641 |
| HP5 | 1.000 | .659 |
| HP6 | 1.000 | .663 |
| HP7 | 1.000 | .653 |
| HP8 | 1.000 | .500 |
| HP10 | 1.000 | .733 |
| HP11 | 1.000 | .680 |
| HP12 | 1.000 | .698 |
| HP13 | 1.000 | .729 |
| HP15 | 1.000 | .643 |
| PA3 | 1.000 | .738 |
| HF2 | 1.000 | .576 |
| HF3 | 1.000 | .719 |
| HF4 | 1.000 | .728 |
| HF5 | 1.000 | .676 |
| HF6 | 1.000 | .683 |
| TM7 | 1.000 | .604 |
| CA4 | 1.000 | .680 |
| CA8 | 1.000 | .804 |
| TI1 | 1.000 | .584 |
| TI2 | 1.000 | .709 |
| TI8 | 1.000 | .710 |
| TI10 | 1.000 | .759 |
| TI11 | 1.000 | .800 |
| TI12 | 1.000 | .558 |
| TI13 | 1.000 | .675 |
| TI14 | 1.000 | .752 |
| OI2 | 1.000 | .615 |
| OI6 | 1.000 | .648 |
| SL3 | 1.000 | .641 |
| SL4 | 1.000 | .695 |
| SL5 | 1.000 | .698 |
| TA3 | 1.000 | .782 |
| TA4 | 1.000 | .789 |
| TA7 | 1.000 | .840 |

| | | |
|---|---|---|
| TA15 | 1.000 | .731 |
| TA16 | 1.000 | .639 |

Extraction Method: Principal Component Analysis.

## 10.2 Total Variance Explained

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 6.419 | 16.892 | 16.892 | 6.419 | 16.892 | 16.892 | 5.537 | 14.570 | 14.570 |
| 2 | 5.460 | 14.369 | 31.261 | 5.460 | 14.369 | 31.261 | 3.883 | 10.218 | 24.788 |
| 3 | 4.443 | 11.693 | 42.954 | 4.443 | 11.693 | 42.954 | 3.365 | 8.856 | 33.644 |
| 4 | 2.493 | 6.559 | 49.513 | 2.493 | 6.559 | 49.513 | 3.328 | 8.758 | 42.403 |
| 5 | 2.358 | 6.206 | 55.719 | 2.358 | 6.206 | 55.719 | 3.274 | 8.617 | 51.019 |
| 6 | 2.166 | 5.700 | 61.419 | 2.166 | 5.700 | 61.419 | 3.128 | 8.232 | 59.251 |
| 7 | 1.624 | 4.274 | 65.693 | 1.624 | 4.274 | 65.693 | 2.296 | 6.042 | 65.293 |
| 8 | 1.173 | 3.088 | 68.781 | 1.173 | 3.088 | 68.781 | 1.325 | 3.488 | 68.781 |
| 9 | .958 | 2.521 | 71.301 | | | | | | |
| 10 | .910 | 2.396 | 73.698 | | | | | | |
| 11 | .813 | 2.139 | 75.837 | | | | | | |
| 12 | .729 | 1.919 | 77.756 | | | | | | |
| 13 | .706 | 1.858 | 79.613 | | | | | | |
| 14 | .652 | 1.715 | 81.329 | | | | | | |
| 15 | .573 | 1.507 | 82.836 | | | | | | |
| 16 | .544 | 1.432 | 84.269 | | | | | | |
| 17 | .523 | 1.376 | 85.644 | | | | | | |
| 18 | .479 | 1.261 | 86.906 | | | | | | |
| 19 | .437 | 1.150 | 88.055 | | | | | | |
| 20 | .420 | 1.106 | 89.162 | | | | | | |
| 21 | .402 | 1.059 | 90.220 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 22 | .368 | .969 | 91.189 | | | | | | |
| 23 | .333 | .877 | 92.066 | | | | | | |
| 24 | .323 | .849 | 92.916 | | | | | | |
| 25 | .288 | .757 | 93.673 | | | | | | |
| 26 | .281 | .740 | 94.413 | | | | | | |
| 27 | .253 | .665 | 95.078 | | | | | | |
| 28 | .248 | .652 | 95.731 | | | | | | |
| 29 | .231 | .607 | 96.337 | | | | | | |
| 30 | .219 | .577 | 96.914 | | | | | | |
| 31 | .203 | .536 | 97.450 | | | | | | |
| 32 | .178 | .467 | 97.917 | | | | | | |
| 33 | .177 | .465 | 98.383 | | | | | | |
| 34 | .152 | .400 | 98.783 | | | | | | |
| 35 | .138 | .363 | 99.146 | | | | | | |
| 36 | .116 | .304 | 99.451 | | | | | | |
| 37 | .108 | .284 | 99.734 | | | | | | |
| 38 | .101 | .266 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis.

## 10.3 Residual Statistics Multiple Linear Regression

**Residuals Statistics[a]**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 3.1887 | 4.5223 | 3.8475 | .29759 | 295 |
| Std. Predicted Value | -2.214 | 2.268 | .000 | 1.000 | 295 |
| Standard Error of Predicted Value | .033 | .111 | .062 | .017 | 295 |
| Adjusted Predicted Value | 3.1884 | 4.5205 | 3.8487 | .29794 | 295 |
| Residual | -1.71321 | 1.09406 | .00000 | .54517 | 295 |
| Std. Residual | -3.126 | 1.997 | .000 | .995 | 295 |
| Stud. Residual | -3.156 | 2.008 | -.001 | 1.002 | 295 |
| Deleted Residual | -1.74553 | 1.10708 | -.00124 | .55292 | 295 |
| Stud. Deleted Residual | -3.206 | 2.019 | -.002 | 1.005 | 295 |
| Mahal. Distance | .062 | 11.156 | 2.990 | 2.072 | 295 |
| Cook's Distance | .000 | .047 | .004 | .006 | 295 |
| Centered Leverage Value | .000 | .038 | .010 | .007 | 295 |

a. Dependent Variable: TA

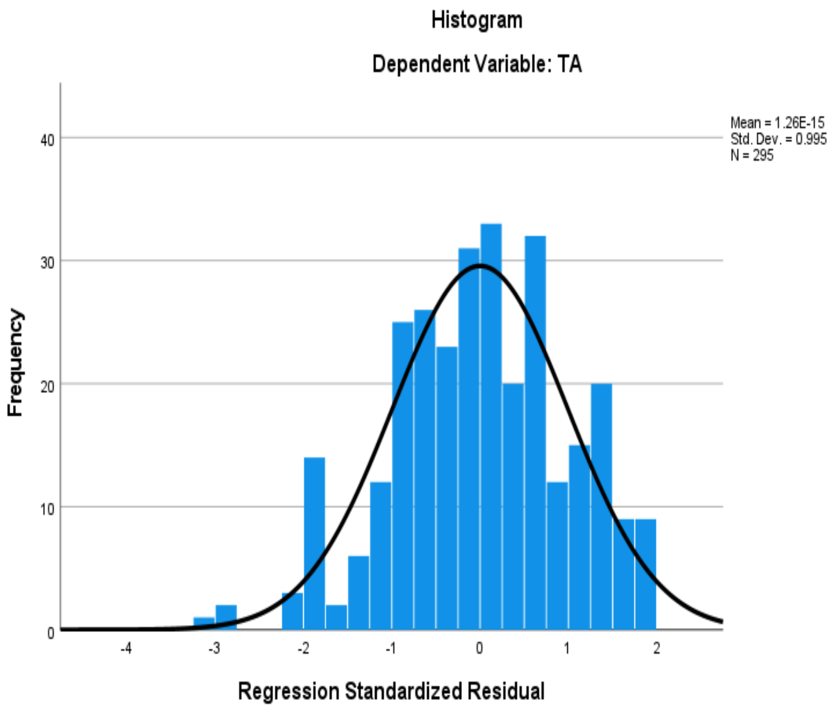
## 10.4 Collinearity Diagnostics

**Collinearity Diagnostics[a]**

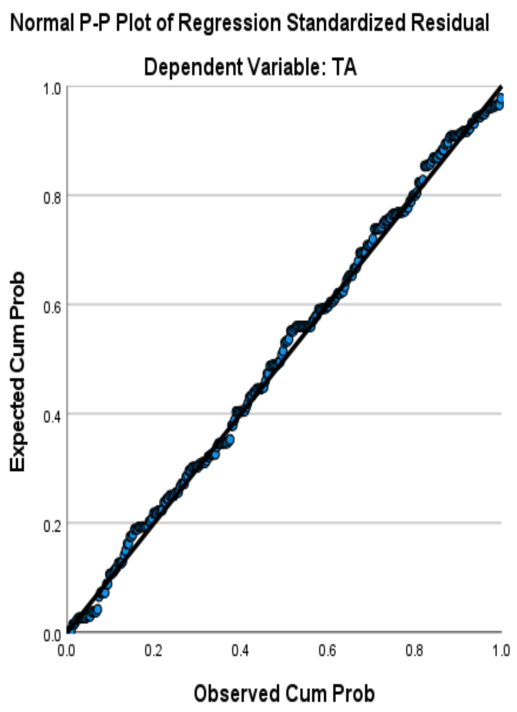
| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions (Constant) | SL | HF | Usefulness |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 3.946 | 1.000 | .00 | .00 | .00 | .00 |
| | 2 | .032 | 11.167 | .01 | .01 | .22 | .79 |
| | 3 | .015 | 16.234 | .07 | .35 | .69 | .20 |
| | 4 | .007 | 23.654 | .93 | .64 | .09 | .01 |

a. Dependent Variable: TA

## 10.5 Regression Standardised Residuals Plot




## 10.6 Normal P –P Plot of regression Standardised Residuals


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: TA
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

## APPENDIX 11 IBM SPSS AMOS V27 OUTPUTS

### 11.1 Standardised Regression Weights

| | | | Estimate |
|---|---|---|---|
| TA | <--- | HP | -.174 |
| TA | <--- | SL | .409 |
| TA | <--- | HF | .101 |
| TA | <--- | USFL | .270 |
| HP7 | <--- | HP | .618 |
| HP10 | <--- | HP | .815 |
| HP11 | <--- | HP | .738 |
| HP12 | <--- | HP | .867 |
| HP13 | <--- | HP | .629 |
| HP2 | <--- | HP | .776 |
| SL3 | <--- | SL | .820 |
| SL4 | <--- | SL | .673 |
| SL5 | <--- | SL | .681 |
| PA3 | <--- | SL | .601 |
| HF6 | <--- | HF | .575 |
| TI2 | <--- | HF | .958 |
| TI8 | <--- | HF | .598 |
| TA3 | <--- | USFL | .810 |
| TA4 | <--- | USFL | .543 |
| TA7 | <--- | USFL | .825 |
| TA6 | <--- | USFL | .664 |
| TA15 | <--- | TA | .799 |
| TA16 | <--- | TA | .754 |
| TI1 | <--- | TA | .663 |
| HF2 | <--- | TA | .619 |

### 11.2 Covariances

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| HP | <--> | SL | .053 | .020 | 2.626 | .009 | par_24 |
| HP | <--> | HF | .049 | .016 | 3.130 | .002 | par_25 |
| HP | <--> | USFL | .018 | .023 | .814 | .415 | par_26 |
| SL | <--> | HF | .095 | .022 | 4.270 | *** | par_27 |
| SL | <--> | USFL | .148 | .031 | 4.816 | *** | par_28 |
| HF | <--> | USFL | .082 | .024 | 3.391 | *** | par_29 |
| e3 | <--> | e4 | .057 | .024 | 2.372 | .018 | par_2 |
| e4 | <--> | e5 | .013 | .021 | .623 | .534 | par_3 |
| e3 | <--> | e5 | -.065 | .021 | -3.118 | .002 | par_4 |
| e2 | <--> | e3 | -.078 | .018 | -4.264 | *** | par_5 |

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| e2 | <--> | e6 | .067 | .025 | 2.688 | .007 | par_6 |
| e14 | <--> | e15 | .095 | .025 | 3.829 | *** | par_19 |
| e19 | <--> | e20 | -.067 | .031 | -2.198 | .028 | par_23 |
| e1 | <--> | e8 | -.049 | .014 | -3.579 | *** | par_34 |
| e2 | <--> | e10 | -.109 | .023 | -4.679 | *** | par_35 |
| e2 | <--> | e17 | .109 | .024 | 4.596 | *** | par_36 |
| e4 | <--> | e10 | -.060 | .017 | -3.566 | *** | par_37 |
| e5 | <--> | e15 | -.051 | .016 | -3.202 | .001 | par_38 |
| e6 | <--> | e13 | -.067 | .018 | -3.823 | *** | par_39 |
| e8 | <--> | e13 | .124 | .019 | 6.402 | *** | par_40 |
| e6 | <--> | e16 | -.082 | .024 | -3.403 | *** | par_41 |
| e9 | <--> | e16 | -.098 | .023 | -4.323 | *** | par_42 |
| e10 | <--> | e17 | -.135 | .030 | -4.433 | *** | par_43 |
| e10 | <--> | e16 | .017 | .026 | .668 | .504 | par_44 |
| e9 | <--> | e12 | -.072 | .017 | -4.128 | *** | par_45 |
| e13 | <--> | e17 | .321 | .036 | 8.854 | *** | par_46 |
| e12 | <--> | e17 | .202 | .037 | 5.399 | *** | par_47 |
| e7 | <--> | e17 | -.041 | .023 | -1.753 | .080 | par_48 |
| e13 | <--> | e16 | .075 | .028 | 2.682 | .007 | par_49 |
| e9 | <--> | e17 | -.119 | .023 | -5.271 | *** | par_50 |
| e11 | <--> | e16 | -.081 | .033 | -2.436 | .015 | par_51 |
| e12 | <--> | e15 | -.042 | .019 | -2.185 | .029 | par_52 |
| e4 | <--> | e12 | .049 | .016 | 2.973 | .003 | par_53 |
| e3 | <--> | e15 | .047 | .016 | 2.986 | .003 | par_54 |
| e9 | <--> | e15 | -.042 | .018 | -2.371 | .018 | par_55 |
| e13 | <--> | e15 | -.052 | .020 | -2.626 | .009 | par_56 |
| e12 | <--> | e16 | -.037 | .031 | -1.204 | .229 | par_57 |
| e6 | <--> | e15 | .066 | .021 | 3.063 | .002 | par_58 |
| e7 | <--> | e13 | .084 | .020 | 4.121 | *** | par_59 |
| e11 | <--> | e17 | .117 | .034 | 3.455 | *** | par_60 |
| e8 | <--> | e9 | .040 | .019 | 2.062 | .039 | par_61 |
| e7 | <--> | e14 | .031 | .016 | 1.917 | .055 | par_62 |
| e10 | <--> | e13 | .013 | .026 | .505 | .613 | par_63 |
| e10 | <--> | e12 | -.109 | .025 | -4.462 | *** | par_64 |
| e10 | <--> | e11 | -.114 | .029 | -3.925 | *** | par_65 |
| e7 | <--> | e11 | .030 | .021 | 1.427 | .154 | par_66 |
| e4 | <--> | e11 | .053 | .021 | 2.531 | .011 | par_67 |

**11.3 Squared Multiple Correlations**

| | Estimate |
|---|---|
| **TA** | .373 |
| **HF2** | .384 |

| | Estimate |
|---|---|
| **TI1** | .439 |
| **TA16** | .569 |
| **TA15** | .638 |
| **TA6** | .441 |
| **TA7** | .680 |
| **TA4** | .294 |
| **TA3** | .656 |
| **TI8** | .358 |
| **TI2** | .918 |
| **HF6** | .331 |
| **PA3** | .362 |
| **SL5** | .464 |
| **SL4** | .452 |
| **SL3** | .673 |
| **HP13** | .395 |
| **HP12** | .752 |
| **HP11** | .545 |
| **HP10** | .664 |
| **HP7** | .382 |
| **HP2** | .602 |

### 11.4 Standardised Total Effects

| | USFL | HF | SL | HP | TA |
|---|---|---|---|---|---|
| **TA** | .270 | .101 | .409 | -.174 | .000 |
| **HF2** | .167 | .062 | .253 | -.108 | .619 |
| **TI1** | .179 | .067 | .271 | -.115 | .663 |
| **TA16** | .203 | .076 | .309 | -.131 | .754 |
| **TA15** | .215 | .080 | .327 | -.139 | .799 |
| **TA6** | .664 | .000 | .000 | .000 | .000 |
| **TA7** | .825 | .000 | .000 | .000 | .000 |
| **TA4** | .543 | .000 | .000 | .000 | .000 |
| **TA3** | .810 | .000 | .000 | .000 | .000 |
| **TI8** | .000 | .598 | .000 | .000 | .000 |
| **TI2** | .000 | .958 | .000 | .000 | .000 |
| **HF6** | .000 | .575 | .000 | .000 | .000 |
| **PA3** | .000 | .000 | .601 | .000 | .000 |
| **SL5** | .000 | .000 | .681 | .000 | .000 |
| **SL4** | .000 | .000 | .673 | .000 | .000 |
| **SL3** | .000 | .000 | .820 | .000 | .000 |

| | USFL | HF | SL | HP | TA |
|---|---|---|---|---|---|
| **HP13** | .000 | .000 | .000 | .629 | .000 |
| **HP12** | .000 | .000 | .000 | .867 | .000 |
| **HP11** | .000 | .000 | .000 | .738 | .000 |
| **HP10** | .000 | .000 | .000 | .815 | .000 |
| **HP7** | .000 | .000 | .000 | .618 | .000 |
| **HP2** | .000 | .000 | .000 | .776 | .000 |

## APPENDIX 12 OUTPUT OF SKEWNESS AND KURTOSIS CALCULATION

**Sample size: 295**

**Number of variables: 7**

**Univariate skewness and kurtosis**

| | Skewness | SE_skew | Kurtosis | SE_kurt |
|---|---|---|---|---|
| PCA_New_HP | -0.1919354 | 0.1418968 | -0.44888054 | 0.282859 |
| PCA_New_HF | -0.3648323 | 0.1418968 | -0.65380702 | 0.282859 |
| PCA_New_ORGR | -0.5418211 | 0.1418968 | -0.03290087 | 0.282859 |
| PCA_New_SL | -0.3797071 | 0.1418968 | -0.35818715 | 0.282859 |
| PCA_New_TI | -0.7336892 | 0.1418968 | 0.55825469 | 0.282859 |
| PCA_New_Usefulness | 0.4678521 | 0.1418968 | -0.71269665 | 0.282859 |
| PCA_New_TA | -0.2129469 | 0.1418968 | -1.00728261 | 0.282859 |

**Mardia's multivariate skewness and kurtosis**

| | b | z | p-value |
|---|---|---|---|
| Skewness | 10.54334 | 518.3810533 | 0.0000000 |
| Kurtosis | 61.81116 | -0.9095377 | 0.3630664 |