INEQUITY AND INEQUALITY IN AUSTRALIAN MENTAL HEALTH AND CARE SYSTEMS: AN INVESTIGATION INTO THE ECONOMICS OF WELLBEING

A Thesis submitted by

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Professor Khorshed Alam (Principal supervisor)
Professor Jeff Gow (Associate supervisor)
Professor Sonja March (Associate supervisor)

ABSTRACT

In Australia, significant mental health inequalities still exist, and the population has lost 572,775 years of healthy life owing to mental illness. This results in a total direct and indirect cost to the Australian economy of $271 billion each year. As a result, mental health is critical for the Australian economy, and no one should be deprived the opportunity to achieve a good mental state. Thus, mental health equity is a critical component of Australia's health care system. Nevertheless, equity is a normative term, and applying equity to any process demands the application of positive economics principles. However, a review of the health disparity literature reveals a dearth of studies on mental health equity and the extent to which mental health inequity is understood in Australia is unclear.

The primary goal of this thesis is to analyse significant concerns in the pursuit of mental health equity in Australia and potential ways to address these issues. This thesis includes five essays that examine equity challenges in the context of mental health: i) to determine the prevalence of mental disorders in socioeconomic groups ii) to investigate the origin of mental health inequality in early life (relationship between family endowments and youth mental health disparities) iii) to investigate the origin of mental health inequality in adult life (influence of life shocks and mental health inequality) iv) to establish a methodological framework to assess mental health mobility using longitudinal data and lastly, v) to assess inequity in mental health service use. In summary, the determinants of mental wellbeing (i.e. socioeconomic inequalities) in the health system context are the subject of three essays. The remaining two essays address mental health service provision and accessibility issues, and mental health system outcomes.

The essays employ data from two nationally representative Australian surveys, namely the Household, Income and Labour Dynamics in Australia (HILDA) and National Health Survey (NHS), for its investigations. This thesis applied distributional analysis and health econometric modelling methods to explore the topic. This thesis contributes to the literature by creating methodological and empirical knowledge and offers policy prescriptions on designing equitable and cost-efficient mental health interventions.

Keywords: mental health, socioeconomic status, youth, adult, longitudinal design, fairness

CERTIFICATION OF THESIS

This thesis is the work of Rubayyat Hashmi except where otherwise acknowledged, with the majority of the authorship of the papers presented as a Thesis by Publication undertaken by the student. The work is original and has not previously been submitted for any other award, except where acknowledged.

Principal Supervisor: Professor Khorshed Alam

Associate Supervisor: Professor Jeff Gow

Associate Supervisor: Professor Sonja March

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

STATEMENT OF CONTRIBUTIONS

All the work presented in this thesis was carried out solely by Rubayyat Hashmi under the guidance of his supervisors Professor Khorshed Alam, Professor Jeff Gow and Professor Sonja March. I gratefully acknowledge the guidance and support of others during my PhD journey in the acknowledgement section of this thesis. The following detail is the agreed share of contribution for candidate and co-authors in the presented publications in this thesis:

Article 1:

Hashmi, R., Alam, K., Gow, J. and March, S., 2021. Prevalence of Mental Disorders by Socioeconomic Status in Australia: A Cross-Sectional Epidemiological Study. American Journal of Health Promotion, 35(4), pp.533-542.
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The overall contribution of Rubayyat Hashmi was 80% to the concept development, data management, analyses, interpretation, and drafting the final manuscript; Khorshed Alam, Jeff Gow and Sonja March were instrumental in developing the concept, editing, and offering critical intellectual feedback by 10%, 5% and 5%, respectively.

Article 2:

Hashmi, R., Alam, K., Gow, J. and March, S., 2021. Does maternal background matter? A multilevel approach to modelling mental health status of Australian youth using longitudinal data. Plos One. (Under Review).

The overall contribution of Rubayyat Hashmi was 70% to the concept development, data management, analyses, interpretation, and drafting the final manuscript; Khorshed Alam, Jeff Gow and Sonja March were instrumental in developing the concept, editing, and offering critical intellectual feedback by 10%, 10% and 10%, respectively.

Article 3:

Hashmi, R., Alam, K. and Gow, J., 2020. Socioeconomic inequalities in mental health in Australia: Explaining life shock exposure. Health Policy, 124(1), pp.97-105.
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The overall contribution of Rubayyat Hashmi was 75% to the concept development, data management, analyses, interpretation, and drafting the final manuscript; Khorshed Alam, and Jeff Gow were instrumental in developing the concept, editing, and offering critical intellectual feedback by 15%, and 10% respectively.

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DEDICATION

I dedicate my PhD thesis to my dear parents (Hashmi Mustafa Kamal and Yasmin Hasina) for their generous love, support, and encouragement in my life.

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LIST OF ABBREVIATION

ABS	Australian Bureau of Statistics
ADHD	Attention Deficit Hyperactivity Disorder
AHPF	Australian Health Performance Framework
AIHW	Australian Institute of Health and Welfare
AOO	Age Of Onset
AQF	Australian Qualification Framework
ASGS	Australian Statistical Geographic Standard
AUSEI06	Australian Socioeconomic Index 2006
BHPS	British Household Panel Study
BMI	Body Mass Index
CDC	Center for Disease Control
CES-D	Center for Epidemiological Studies Depression Scale
CI	Confidence Interval
CIDI	Composite International Diagnosis Interview
CIS-R	Clinical Interview Schedule- Revised
COVID-19	Coronavirus Disease 2019
CURF	Confidentialised Unit Record File
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders -IV
DSS	Department of Social Services
GAD	Generalized Anxiety Disorder
GHQ	General Health Questionnaire
HILDA	Household, Income and Labour Dynamics in Australia
HRIM	Health-Related Income Mobility
HRSWF	health-related social welfare function
ICD-10	International Classification of Diseases-10
IRHM	Income-Related Health Mobility
K10	Kessler Psychological Distress Scale
LGBTQI	Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, and Intersex
MCS	Mental Component Summary
MH	Mental Health

MHI-5	Mental Health Inventory-5
MMSE	Mini-mental state examination
NHMC	National Mental Health Commission
NHS	National Health Survey
NLF	Not in the Labour Force
NMHS	National Mental Health Strategy
NSMHWB	National Survey of Mental Health and Wellbeing
OECD	Organisation for Economic Co-operation and Development
OR	Odds Ratio
PHN	Primary Health Network
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRO	Patient Reported Outcome
PROSPERO	Prospective Register of Systematic Reviews
PSID	Panel Study of Income Dynamics
QALY	Quality-Adjusted Life-Years
RANZCP	Royal Australian and New Zealand College of Psychiatrists
SAH	Self-Assessed Health
SCQ	Self-completion Questionnaire
SD	Standard Deviation
SEIFA	Socio-Economic Indexes for Areas
SES	Socioeconomic Status
SF-36	Short Form-36
SOEP	German Socio-Economic Panel
SOS	Section of State
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
WHO	World Health Organization

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CHAPTER 1

INTRODUCTION

1.1 Introduction

"Of all the forms of inequality, injustice in health is the most shocking and inhuman," said Martin Luther King Jr. on 25 March 1966 at a Medical Committee for Human Rights Convention in Chicago (Galarneau 2018, p. 6). King's proclamation emphasises health as a social issue, and so health must appear prominently in any debate of social fairness and justice. While equality has no binding force as an abstract concept, the theory of justice in the modern world would lack significant credibility if it did not respect equality in some area where the theory has deemed it essential. According to Sen, this poses the question, "equality of what?" or "equity in what form?" (Sen 2002, p. 660). This is the point at which health becomes a crucial concern, elevating health equity to a key concept of social justice.

Sen stated (Sen 2002, p. 665),

> "Health equity has many aspects, and is best seen as a multidimensional concept. It includes concerns about achievement of health and the capability to achieve good health, not just the distribution of health care. But it also includes the fairness of process and thus must attach importance to non-discrimination in the delivery of health care."

Within this broad capacity of health equity, the primary interest in this thesis is to focus an equity lens on mental health in Australia. Unlike overall health, which encompasses a broad range of issues, mental health presents distinct and critical challenges. For example, mental disorders as a group account for the majority of disability globally (Collins et al. 2011). Additionally, there are significant treatment disparities worldwide which are exacerbated by stigma (Collins et al. 2011). The fear of stigma for mental illness is universal and long-lived in history and an important societal problem (Byrne 2001; Rössler 2016).

Australia established its first psychiatric institution in 1811 and has a long history of managing mental health issues (Dax 1989). Since the 1960s there has been a movement toward de-institutionalisation of psychiatric patients, which accelerated from the late

1980s. In 1992 there was massive mental health reform — the first National Mental Health Strategy was formulated, agreed by state, territory and federal health ministers of Australia (Willis et al. 2020). Despite a substantial need for consumer participation and considerations of socioeconomic factors in clinical practice guidelines, a recent study posited that an equity agenda is absent in the majority of mental health clinical practice guidelines (Gupta 2017). The study recommended that further evidence-based research be conducted to ensure an equity agenda is implemented in mental health clinical practice guidelines.

It is estimated that the societal cost of mental health is $221 billion in Australia (Productivity Commission 2020). If these substantial costs are inequitably dispersed among various disadvantaged populations, this should raise serious concerns regarding distributive justice, since such cost distribution is not fair. Consequently, mental health equity must be placed towards the top of government health policy agendas. As a result of this situation, the potential significance of an equity lens on this subject is considerable.

The major objective of this thesis is to examine key concerns with mental health equity in Australia, as well as potential solutions to these difficulties. The determinants of mental wellbeing (i.e., socioeconomic inequalities) in the health system are the subject of three studies of this thesis. The remaining two studies address mental health service provision and accessibility issues, and mental health system outcomes. This thesis is "PhD by publication" by nature and contributes to the literature by creating methodological and empirical knowledge and offers policy prescriptions on designing equitable and cost-efficient mental health interventions.

1.2 Australian mental healthcare system

Since 1992, the National Mental Health Strategy (NMHS) has served as the foundation for all mental health reforms and mental healthcare system planning in Australia. Currently, the NMHS is guided by primarily three documents: a) National Mental Health Policy 2008, b) Mental Health Statement of Rights and Responsibilities 2012, and c) Fifth National Mental Health and Suicide Prevention Plan 2017-2022. From the First National Mental Health Plan, the original reform objective was to shift service delivery and financing for mental health services from psychiatric hospitals to general hospitals/community settings and to strengthen the relationship between government

support services and non-governmental organisations through the adoption of consistent mental health legislation throughout the country. Gradually, now (the fifth mental health plan), the focus has shifted to more recovery-based services, social inclusion and regional planning for primary mental healthcare (Willis et al. 2020).

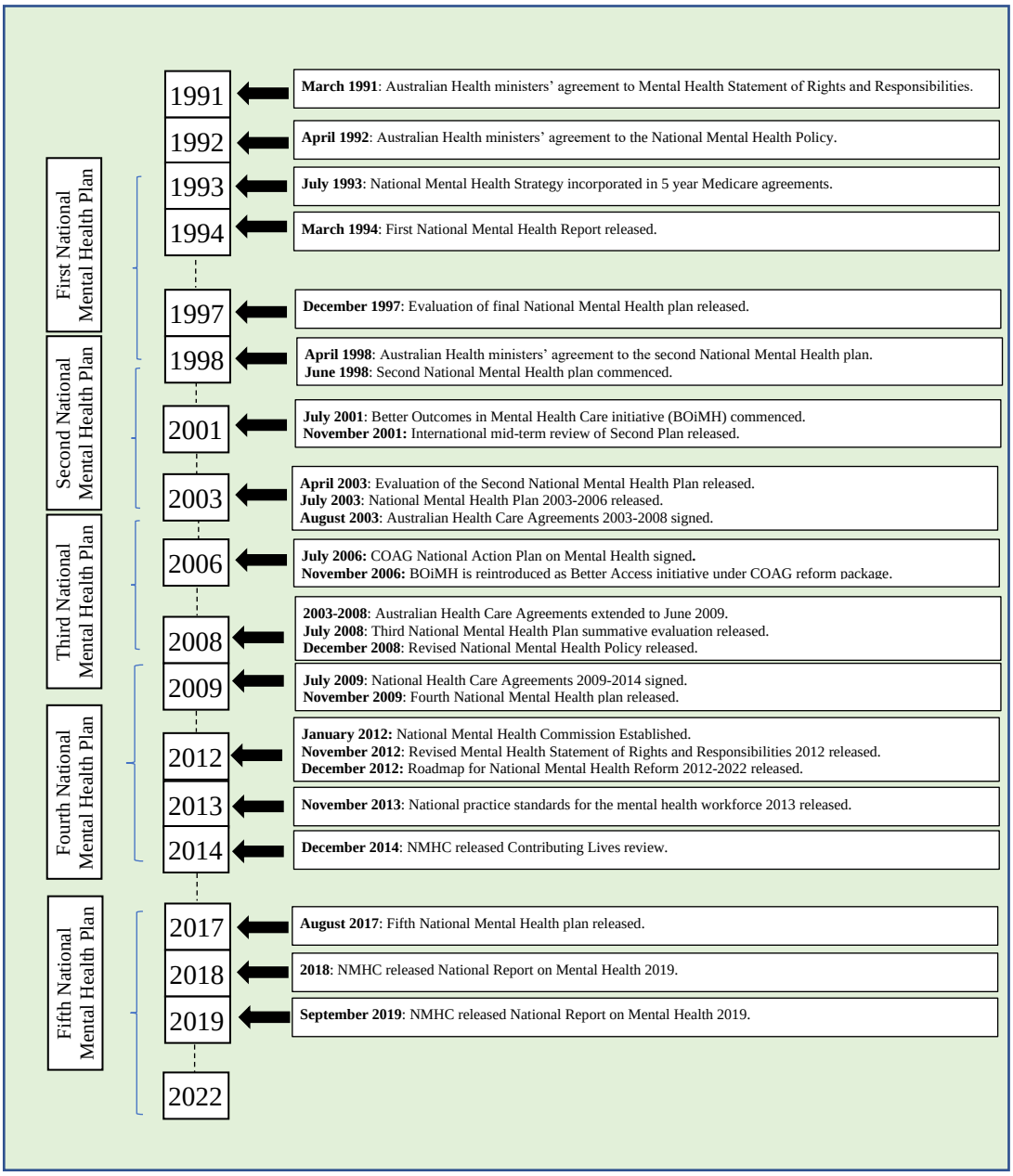

Figure 1.1: National Mental Health Strategy Milestones, 1991-2022

Source: Palmer and Short (2014) plus author additions

The evolution of the current mental health policy framework is shown in Figure 1.1 (adapted from Palmer and Short, 2014). It can be seen that the discussion about equity considerations in mental health policy only commenced in 2001. The service delivery

system is decentralised and provided through many community and private organisations and state/territory governments.

Australia's mental healthcare system is complicated, with numerous levels of responsibility and a complex mix of financing from Commonwealth, state, and territory governments, as well as private health insurers and individuals. The Commonwealth government funds Medicare-subsidised mental health services (Better Access Initiative), veterans' mental health services, PHN Primary Mental Health Care Flexible Funding Pool, subsidises mental health prescription medications under the Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS). The state and territory governments fund and manage public hospitals and community mental health services. The shared responsibility and arrangements of the Australian and state and territory governments were outlined in the Fifth National Mental Health and Suicide Prevention Plan (NMHC 2017).

Mental health services are provided by general practitioners (GPs), psychiatrists, psychologists, occupational therapists and social workers in a variety of settings such as in health promotion programmes, primary care, hospital emergency services, admitted hospital care, residential mental health care and community mental health care. Other support services such as disability support services and homelessness support services are also provided within the system.

Australia spent $10.6 billion, or $420 per person on mental health-related services during 2018-2019 and $9.99 billion of this was government mental health expenditure, representing 7.75% of total government health expenditure (AIHW 2021). Out of this $10.6 billion, State and territory government spent $6.4 billion, the Commonwealth government spent $3.6 billion and private individuals and other third party insurers spent $0.6 billion on mental health-related services (AIHW 2021). On average, spending increased by approximately 1.5% annually from 2014-15 to 2018-19. Despite the fact that spending on mental health services has increased over time, it has grown at a far slower rate than overall health spending (AIHW 2021). Figure 1.2 depicts a comparison between overall health expenditures and mental health-related expenditures (AIHW 2021).

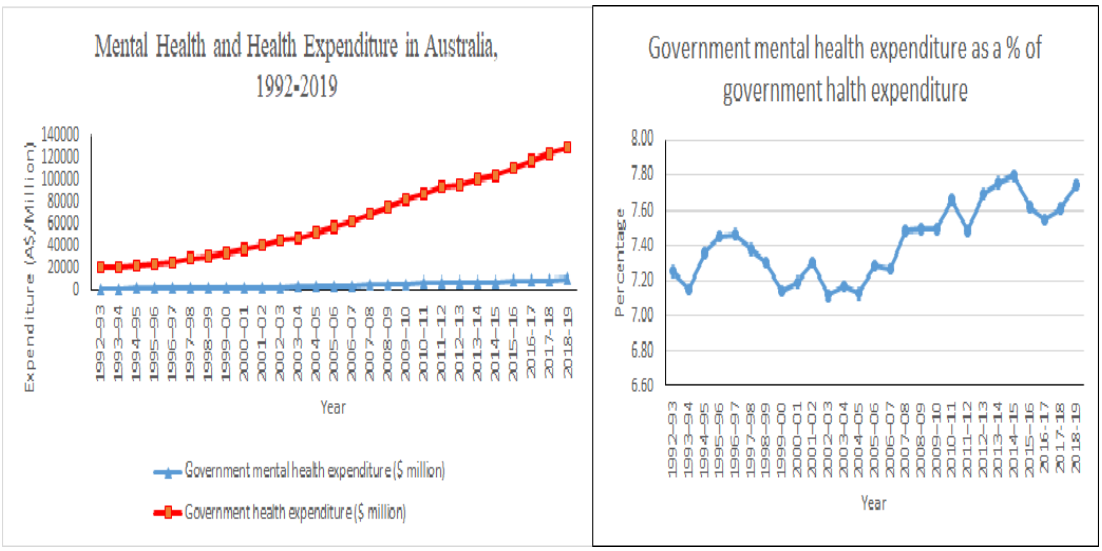

Figure 1.2: Comparison of Annual Mental Health and Health Expenditure in Australia (Source: AIHW (2021))

1.3 The state of mental health in Australia

Mental health is an essential aspect of health and wellbeing (WHO 2002). Poor mental health is a significant public health concern as it is associated with adverse health outcomes, civil right abuse, premature mortality and severe economic burden to society (WHO 2019). In Australia, mental illness is a pervasive and complicated problem. The 2007 National Survey of Mental Health and Wellbeing (NSMHWB) reported that almost half (46%) of all Australians aged 16-85 years have experienced mental illness at some point during their life (ABS 2008). In the Productivity Commission's latest inquiry report on mental health, there were 15.3 million (60%) of the population who were healthy, 5.9 million (23%) who were at risk of mental illness, and the remaining population (17%) who reported having mental illnesses (Productivity Commission 2020).

According to the Young Minds Matter survey, 560,000 children and adolescents aged 4–17 years (14%) had a mental health condition, with ADHD (7.4%), anxiety disorder (6.9%), major depressive disorder (2.8%), and conduct disorders (2.1%) being the most prevalent (Lawrence et al. 2015). The estimated 12-month treated prevalence of psychotic illnesses amongst the 18- to 64-year-old population was 4.5 cases per 1,000 individuals (Morgan et al. 2012). Approximately 20.1% or 4.8 million Australians were reported to have a mental health problem at the last National Health Survey (2017-18), with 13.1% having anxiety problems and 10.4% depression (ABS 2018).

While suicide is not exclusively contained to the mentally ill, ABS registered 3,128 suicides in 2017 and deemed suicidality as the 13th leading cause of death (ABS 2020). The NSMHWB also estimated that 94.2% who attempted suicide in the preceding year had a mental condition (ABS 2008). It is estimated that annually around 13 in 100,000 people killed themselves through self-inflicted injuries (ABS 2020).

Because mental illness is found in such an alarming percentage of the Australian population, the impact on society is quite substantial. Mental illness is the second largest contributor to years lived in disability and the fourth leading cause of total disease burden in Australia (AIHW 2019). By comparison, the worldwide burden of mental disorders is rated seventh, whereas it is placed fifth among OECD nations (AIHW 2019). In 2015, it was estimated that the Australian population lost 572,775 years of healthy life (12.1% of the total burden) due to mental and substance use disorder (AIHW 2019). However, it is to be noted that the burden of suicide is not counted under mental illness as it is counted under injury (Productivity Commission 2020). Since nearly two-thirds of health loss due to suicide is linked to mental illness, the burden of mental disorder becomes considerably greater when suicide is included (Ferrari et al. 2014).

Besides the reduction in health associated with sickness, mental illness also imposes a high economic cost. According to the Royal Australian and New Zealand College of Psychiatrists (RANZCP), severe mental illness cost around $56.7 billion per year in Australia (Victoria Institute of Strategic Economic Studies 2016). The Productivity Commission estimated that the annual cost to the Australian economy of mental illness was $70 billion in 2018-19, with direct spending on mental healthcare being $16 billion, lost productivity being $39 billion, and caregiver costs totalling $15 billion (Productivity Commission 2020). Furthermore, the Commission concluded that the annual cost of disability and early mortality attributable to mental illness and suicide was estimated to be an additional $151 billion (Productivity Commission 2020). Therefore, the costs and consequences of mental health disorders are severe in Australian society, and equitably managing mental health presents a highly complex challenge for the Australian community. To better grasp mental health equity challenges, the next section will examine the theoretical and conceptual frameworks of health equity.

1.4 Theoretical framework: Distributive justice

Much of the health equity literature emphasises overall health rather than mental health. Therefore, before developing the conceptual framework for analysing equity concerns in connection to mental health, it is crucial to evaluate the extensive body of literature on the topic of distributive justice.

Each society's economic, political, and social frameworks—its laws, institutions, and policies, for example—result in different distributions of benefits and burdens among its members. Distributive justice is concerned with arguments about which frameworks and/or consequent distributions are ethically desirable (Lamont & Favor 2017). Therefore, distributive justice theories should be viewed as offering moral guidance for the political processes and structures that shape the distribution of rewards and costs in societies, and any theories that do provide this type of moral direction on distribution, regardless of the nomenclature used, should be called the principles of distributive justice (Lamont & Favor 2017). Health economists have primarily considered three theories of distributive justice: i) Utilitarianism, ii) Maximin: Rawls' difference principle, and iii) Egalitarianism (Olsen 2011).

1.4.1 Utilitarianism

The utilitarian theory of Jeremy Bentham or the moral view of Utilitarianism holds that all actions are moral and just when society maximizes aggregate happiness or utility (Bentham 1789). Bentham's theory assumed that utility is a cardinal entity and thus can be measured, summed and maximised across individuals and society. Modern welfare theorist rejects Bentham's notion that happiness has cardinal properties and instead proposed the notion of ranking preferences. Welfare theorists use social welfare functions to establish the optimal social ordering by identifying individuals' preference ordering and utilising the information to find the maximum level of welfare possible for the community. The primary moral critique directed towards utilitarianism is its apathy towards inequality in the allocation of social goods. Additionally, preferences may not be an adequate guide for policy judgements, for example, in the case of the health sector, an individual's preference on health behaviour (smoking/drinking) might not necessarily make him/her better off.

1.4.2 Rawls' Social Contract Theory

The most widely cited example of contractarian theory is John Rawls' theory of justice, which holds that people enter into a contract with society and that their rights and duties to society are founded on that contract (Rawls 1971; Rawls 2001). Rawls defined justice as "fairness," which requires that justice govern the impacts of society's fundamental structure on members' life chances in order to guarantee that the burden and benefits of cooperation are distributed equitably. Rawls argues for two distinct principles to govern the fundamental structure:

1. Each person has an equal right to the most adequate scheme of equal basic liberties compatible with the same scheme of liberties for all; and
2. Social and economic inequalities are to be arranged so that they satisfy conditions: a) fair equality of opportunity conditions exist to all and b) the maximin principle i.e., prioritises the greatest benefit of the least-advantaged (for example, maximizing the wellbeing of the worst health in the health sector).

Critics argue that application of Rawls principle might result in the poverty of a community by pouring precious health care resources into what are effectively 'hopeless' situations, and that allocating money to individuals whose poor health is the product of their own risky behaviour or decisions is unjustifiable (Le Grand 1987; Mooney 1987).

1.4.3 Egalitarianism

Egalitarianism is an ideology that favours equality in some respects and considers it to be a prerequisite of justice. Egalitarian ideologies are based on the underlying assumption that all human beings are equal in basic value or moral standing. The simplest form of egalitarian view is that of strict egalitarianism which states that every person should have the same level of benefits and burdens. Since this principle restricts freedom, egalitarian theory was further evolved into 'luck egalitarianism,' which focuses on the role of chance in resource allocation (Dworkin 1981b, 1981a; Anderson 1999). According to this view, justice requires that inequalities in people's well-being be decided entirely by the responsible choices they make, rather than by inequalities in their unchosen circumstances. Thus, luck egalitarians distinguish between outcomes caused by brute luck (being struck by a bolt of lightning) and those caused by

intentional choices (fair gambles). Two distinct answers in terms of implementation arise from luck egalitarians ideals. The first is the equality of opportunity principle which proposes to create a 'level playing field' by equalising opportunities (Arneson 1989; Roemer 1998; Roemer & Trannoy 2016). The other is Amartya Sen's capability approach which postulates that freedom to attain well-being is of main moral significance and well-being should be defined in terms of an individual's capabilities and functioning (Sen 1982, 1992).

1.4.4 Choice of welfare in health: Utilitarianism, Rawlsian or Egalitarianism?

To analyse health policy objectives on the ground of equity and fairness, health economists have integrated the idea of distributive justice through equity-efficiency trade-off model. In this model, technologically and economically feasible efficient distribution of health is depicted as points on the health frontier. Trade-offs between different types of health-related objectives are analysed through a social welfare function within a context of distributive justice.

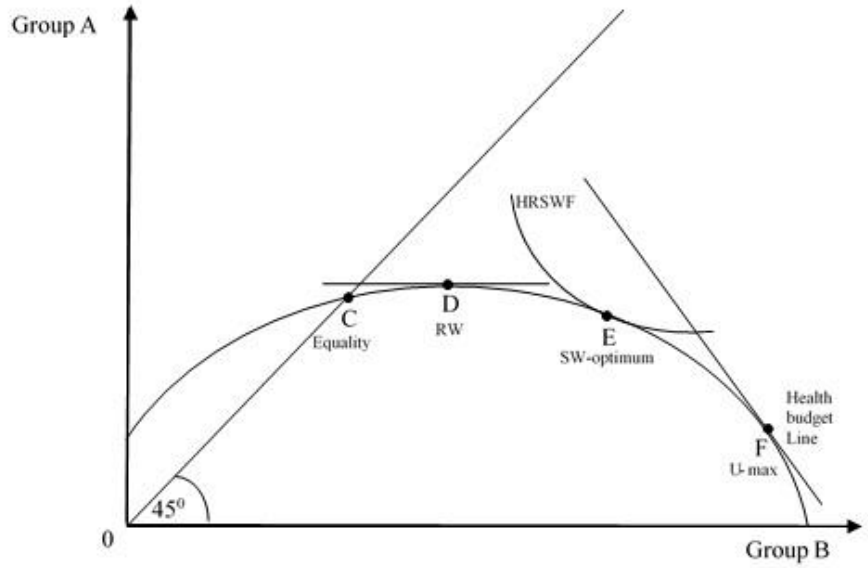

Figure 1.3: Health frontier and HRSWF: equity and efficiency trade-off

Source: Olsen (2011)

Figure 1.3 illustrates these concepts under the assumptions that: i) total health care budget is fixed and distributed between two groups A and B, ii) the health production function is concave to the origin, and iii) health outcomes are cardinally measurable and comparable, such as through quality-adjusted life-years (QALYs).

The axes in the figure shows the cardinal measure of health of the two groups. The 45-degree line intersects the health frontier at point C which shows the egalitarian view of equal health between A and B. Point D shows the Rawlsian view of the maximum health for the worst group. Since the health budget curve tangent at point F on the health frontier, it is the utilitarian interpretation (maximum health) of justified health distribution.

The equity and efficiency trade-off has shown at point E on the health frontier tangent with the health-related social welfare function (HRSWF). HRSWF portrays a society's choice on health distribution and is developed with various degrees of restrictions in the literature (Wagstaff 1991; Culyer & Wagstaff 1993; Dolan 1998; Williams & Cookson 2000; Abasolo & Tsuchiya 2004).

The health economist usually focuses on the Pareto section of points between D and F, though points between C and D could also be relevant if the egalitarian view is a focus on health objectives. Points outside of C and F are not consistent with the theory of justice.

Thus, in summary, the theory explains the following:

- Each point in the health frontier portrays society's trade-off among different population groups' health status
- According to a society's relative preference on utilitarianism, egalitarianism or Rawlsian distributional justice, the society will choose a point in the health frontier.
- A country's choice on the health frontier compared to other countries might be different depending on a society's values on justice as well as the knowledge on the choice it is choosing.

1.4.5 Egalitarian view: Defining equity in health from a health economist perspective

In health economics, the term 'equity' refers to fairness in the distribution of health and in narrower terms, fairness means reducing inequality whereas in broader terms it concerns distributive justice (Williams & Cookson 2000). Whitehead defined the most broadly recognised and concise concept of health equity (Whitehead 1992, p. 433):

"Equity in health implies that ideally, everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that none should be disadvantaged from achieving this potential, if it can be avoided".

She also defined equity in health care as "equal access to available care for equal need", "equal utilization for equal need", and "equal quality of care for all" (Whitehead 1992, p. 434). In general, equity in health often refers to social justice in health, when everyone has equal rights and opportunity of being well (Braveman & Gruskin 2003).

As the focus of this thesis is on mental health, it is postulated that all of the previous definitions of health equity apply equally to mental health and hence the terms health and mental health will be used interchangeably when discussing equity.

1.5 Conceptual framework: Equity in mental health and healthcare as a performance indicator

Essentially, the theoretical framework of distributive justice is a normative concept. To translate it into positive economics, some kind of measurable or performance framework is needed. The conceptual framework of this thesis is adopted from the Australian Health Performance Framework (AHPF) and Health System Performance Logic Model agreed by Australian and state/territory health ministers(AIHW 2018). The AHPF provides a framework to assess the Australian health care system through its inputs, process and outcomes. The logic model indicates how this framework could be used to evaluate the health system and identifies key domains, components and process. The logic model also includes the equity component which indicates the Australian government's preference/policy choice towards an egalitarian view of justice. The AHPF is designed for the whole health system. Since this applies to the mental health system as well, we used the framework to help identify the research questions.

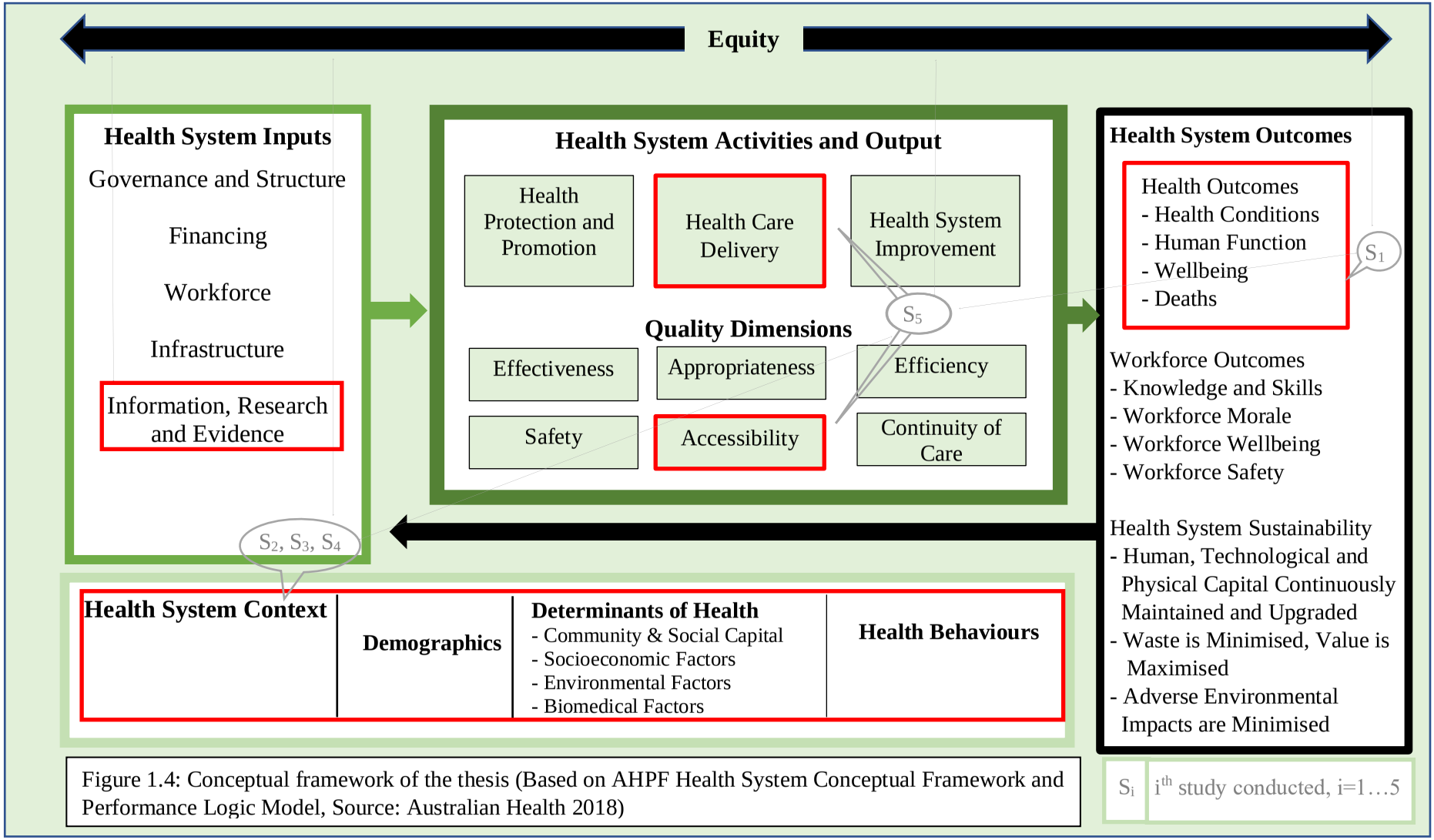

Figure 1.4: Conceptual framework of the thesis (Based on AHPF Health System Conceptual Framework and Performance Logic Model, Source: Australian Health 2018)

Figure 1.4 depicts the AHPF logic model. The studies undertaken in this thesis are classified as belonging to the relevant area of the health system as seen in Figure 1.4. For example, study 1 is in the health system outcomes domain; studies 2, 3, 4 in the health system context domain; and lastly, study 5 is in the health system activities and output domain. In each area, gaps are identified and investigated as a separate chapter in this thesis.

1.6 Overview of literature on equity in the mental health context

The idea of distributive justice is as applicable to mental health as it is to any other component of health, as is the requirement for gathering evidence on the extent to which this critical societal aim has been achieved. In evaluating the general principles and theories of distributive justice, this thesis will examine mental health equity in health system inputs, outcomes, contexts, and outputs. As such, the following themes in the literature are studied to inform the thesis's objective (each chapter covers their respective body of literature in detail; this is a general overview):

1.6.1 Social determinants of mental health

Social determinants of mental health increase the risk of psychiatric disorder and are important factors that generate mental health inequality (Arundell et al. 2020; Compton & Shim 2020). Among all the determinants of mental health, this thesis is interested in two particular determinants: a) impact of mother's background on early-life mental health, and b) adverse life experiences and adult mental health.

A growing body of research indicates the critical role of maternal background on children's and adolescents' mental health (Arroyo-Borrell et al. 2017; Meyrose et al. 2018; Cui et al. 2019). Additionally, growing evidence indicates that low socioeconomic status (SES) is a significant predictor of mental health issues in children and adolescents (Koivusilta et al. 2006; McLaughlin et al. 2011; Reiss 2013).

Another aspect of social determinants of mental health that requires study from a life cycle perspective is life shocks. Life shocks are traumatic experiences that occur during a person's lifetime (Corman et al. 2011; Curtis et al. 2013). Previous research has established a substantial link between two types of life shocks: financial difficulty and adverse life experiences, and poor mental health (Dalgard et al. 1995; Kornblith

et al. 2001; Volanen et al. 2007; Butterworth et al. 2009; Bradshaw & Ellison 2010; Selenko & Batinic 2011).

1.6.2 The measurement of socioeconomic inequality

Socioeconomic inequality in health – the discrepancy in health status between the affluent and the poor — is a cause of concern from an equity perspective since the systematic presence of such inequalities is questioned morally. The dominant empirical approach to measuring socioeconomic inequality in the literature is the concentration index approach (Van Ourti et al. 2014). The concentration index (CI) is a rank dependent inequality measure created by Kakwani (1980) and implemented in the health sector by Wagstaff et al. (1991) to quantify socioeconomic health disparities. The properties and generalisation of this class of bi-variate rank dependent indices were further developed by Wagstaff and Doorslaer (2004), Wagstaff (2005), Erreygers (2009aa), Wagstaff (2009), Erreygers (2009ab), Erreygers and Van Ourti (2011a), Wagstaff (2011b), Erreygers and Van Ourti (2011b), Wagstaff (2011a), Kjellsson and Gerdtham (2013) and Kjellsson et al. (2015).

Wagstaff et al. (2003) were the first to emphasise the usefulness of concentration indexes in the health domain by applying the existing decomposition approach to effectively understand the underlying causes of health inequalities. They demonstrated that when health can be described as a linear function of K factors (for example, socioeconomic status, demographics, and lifestyle), socioeconomic health inequality can be expressed as a weighted sum of the concentration indices in these factors. The approach has recently been extended for longitudinal decomposition in order to better understand the dynamics of health mobility (Jones & López Nicolás 2004; Allanson et al. 2010; Allanson & Petrie 2013b, 2013a).

In comparison to overall health, investigations on decomposing socioeconomic mental health inequality are comparatively few. The earliest study by Mangalore et al. (2007) found that socioeconomic inequalities exist in mental health in Britain. Three studies in Iran also explored socioeconomic inequality in mental health and found that age, gender and socioeconomic status are important contributors to mental health inequality (Morasae, Forouzan, Majdzadeh, et al. 2012; Veisani & Delpisheh 2015; Najafi et al. 2020). Similar findings for elderly adults were also found in India and China (Sun et al. 2020; Srivastava et al. 2021).

1.6.3 The measurement of socioeconomic inequity in the delivery of healthcare

When measuring inequity of healthcare utilisation, most of the literature has focused on horizontal equity which means 'equal treatment for equal need' as opposed to vertical equity which means 'greater resources for those with greater needs'. Measuring vertical equity is challenging(Vallejo-Torres & Morris 2014). A significant contribution to estimating vertical equity was suggested by Sutton (2002). The method is however still debated on the grounds that when the response to need-based health care use varies with socioeconomic status (SES) then disentangling vertical equity from horizontal equity is problematic (Fleurbaey & Schokkaert 2011). The majority of studies follows the methodology suggested by Wagstaff and van Doorslaer (2000).

Most of the empirical studies usually assess horizontal inequity in general health care delivery (Pulok, van Gool, Hajizadeh, et al. 2020; Pulok, van Gool, et al. 2020c; Pulok, van Gool, et al. 2020b, 2020a). Research on inequity in mental health service delivery is scant. A recent Turkish study on assessing horizontal equity in the utilization of mental healthcare services and found that there is a greater need for gender-focused policies to improve service delivery (Başar & Öztürk 2020). There exist no studies that assess inequity in Australian mental health care.

1.7 Research motivation and scope of the thesis

There is a growing debate on the extent of increases in inequality in Australia, particularly in the mental health sector (Harvey et al. 2017; Jorm 2018). Inequality in the Australian mental health sector can potentially undermine the future performance of Australia's economy as well as its social cohesion. Inequity in mental health provision in Australia is also a major concern for policymakers. To improve the mental health system, policymakers need research to assist its guidance.

Any normative discussion of mental health equity must begin with a constructive examination of the social determinants of mental health, society's inequalities in mental health and inequities in mental health service use. Based on the literature on such topics, certain gaps in the existing body of knowledge were discovered which are described below:

1. Existing studies to assess the prevalence of mental disorder do not report disorders according to socioeconomic status. Thus, the effect of socioeconomic

status on mental disorder prevalence rates are unknown in Australia. Better understanding the mental health requirements of different socioeconomic classes can enhance the more efficient allocation of healthcare resources.

2. Most of the current literature on the influences of maternal background and childhood circumstances on mental health status either focus on younger youths being included with 'children and adolescents', (e.g., age 1-18 years) or older youths being included with 'adults' (e.g., 15-64 years). However, the Age Of Onset (AOO) studies have identified that the majority of mental disorder incidence occurs at the stages of youth (age 14-17), particularly when young people transition to adulthood. Thus, the impact of maternal background on this transitioning phase on an individual's mental health outcome is not clear. Understanding the early childhood determinants of mental health that generates socioeconomic inequality is important for policy makers.
3. Existing research indicates a high correlation between adverse life experiences and mental health. However, research on the distributional aspects of these events (particularly financial hardship and negative life events) on mental health status is limited. No Australian studies have addressed this connection in the socioeconomic inequality literature.
4. The recent development in the properties and generalisations in cross-sectional concentration indices are not reflected in the current longitudinal socioeconomic inequality studies. A generalised framework is needed to address this issue.
5. The current understanding of the policy impacts on mental health equity through service delivery is deficient. The reason being the current methodology needs improvement so that it can be used to assess the complex health service delivery system as a whole. There is currently no study that has assessed the mental healthcare delivery system in Australia.

1.8 Research objectives and questions

This thesis investigates critical issues relating to inequality and inequity in the context of Australia. The thesis has four objectives. They are as follows:

1. To investigate undiscovered social determinants of mental health that contribute to health inequality

2. To develop and refine methodologies to assess inequality and inequity in mental health

3. To assess mental health inequity and inequality in the Australian health system

4. To assist policymakers by making recommendations based on thesis findings.

Therefore, this thesis contributes to the existing body of knowledge in this field of research by developing methodological and empirical knowledge, presenting comprehensive evidence of the extent to which the equity goal is met in mental health, highlighting the implications of inequity in mental healthcare service delivery in Australia, and offering policy prescriptions for designing equitable and cost-effective mental healthcare services.

To meet the research objectives, the five studies included in this thesis address the following research questions:

Study 1:

1. How prevalent are mental disorders in various social strata in Australia currently?

Study 2:

2. To what degree does maternal history and adolescent circumstances influence mental health status during the young adulthood?

Study 3:

3. To what extent can life disruptions (such as financial struggles and adversity) have a distributional impact on mental health inequality in Australia?

Study 4:

4. Is it possible to formulate the bivariate rank dependent inequality assessment in a generalised context suitable for longitudinal analysis?

Study 5:

5. How much inequity (need-adjusted shortfall) exists in the use of psychiatric treatment in Australia?

Each of these research question constitutes one chapter of this thesis. The detail structure of this thesis is discussed in the next subsection.

1.9 Structure and content of the thesis

This dissertation is divided into eight chapters and includes five studies on mental health and healthcare disparity in Australia. Below is a detailed summary of each chapter of the thesis.

Chapter one provides the background and rationale of the thesis and describes the theoretical and conceptual underpinnings of the thesis. The chapter narrates a brief review of literature on equity in the mental health context that identifies the gaps in the existing evidence and conveys the research aims and motivations of the thesis.

Chapter two presents a narrative overview of the literature on socioeconomic inequalities in mental health. This chapter aims to synthesise the current knowledge about the social and economic variables contributing to mental health inequalities. In light of recent academic interest in equity issues in mental health, this analysis of the literature deduces implications for distributive justice in the field of mental health.

Chapter three is a study about the rise in mental disorders among the poor in Australia. This study discusses the prevalence rates according to socioeconomic status for three broad categories of psychiatric illnesses, further classified into fourteen disease subtypes. This article attempts to understand the disparities of mental health need across different social demographics and highlights the need to shape evidence-based health promotion policies that improve the efficiency of health resource allocation strategies.

Chapter four examines the effect of opportunity deprivation on youth mental health inequality. This study investigates, in particular, whether maternal background and individual circumstances have any impacts on youth mental health condition. The study examined the effect of opportunity deprivation on mental health status in a cohort of adolescents transitioning to youth over a ten-year period. Confirming the significance of those consequences is critical for designing early diagnosis and prevention strategies for mental disorders.

Chapter five is an article on socioeconomic inequalities in mental health in Australia. This research explains the impact of adverse life events on mental health using

concentration indices. The innovation of this research is to include life shocks in the analysis of mental health inequalities by conducting an in-depth longitudinal examination of the factors that contribute to mental health disparities, with far-reaching implications for healthcare decision making.

Chapter six is a methodological study suggesting a framework for decomposing socioeconomic health inequality using longitudinal data. This study puts forward an umbrella paradigm for longitudinal decomposition based on a generalised approach for cross-sectional decomposition of all bi-variate rank dependent indices. The framework is demonstrated by measuring socioeconomic inequalities in mental health in Australia using data from the annual HILDA panel study.

Chapter seven presents a method to assess inequity in psychiatric service use in Australia. The article suggested that service delivery gaps across time and place can be quantified using the GINI index in need-adjusted psychiatric treatment. Using data from the HILDA panel survey, the study uses the proposed approach to examine if inequity in psychiatric care delivery has changed since Australia's mental health policy overhaul in the early 2000s.

Chapter eight concludes this thesis by summarising all of the findings from each study and discussing the policy implications of these findings. It also highlights the study's strengths and limitations, as well as providing guidance for future research and policy recommendations.

CHAPTER 2
SOCIOECONOMIC INEQUALITY IN MENTAL HEALTH: A SYSTEMATIC LITERATURE REVIEW ON CONCENTRATION INDEX APPROACH

ABSTRACT

Social inequalities in mental health are a major cause of concern for a number of governments. The extent of socioeconomic inequalities in mental health throughout the world, as well as the factors that create them, are poorly understood. The goal of this review is to summarise research on socioeconomic inequalities in mental health and to establish the groundwork for this thesis. Studies that utilised a concentration index approach and applied it to mental health were eligible for this review. Published studies were identified through a systematic search of SCOPUC, Pubmed, CINAHL and Psycinfo. There were 31 articles that met the eligibility requirements. The review synthesises data on concentration index for 15 countries and assesses the factors that contributes to inequalities using the PROGRESS-Plus framework. While there is room for improvement, Australia has been found to perform well in terms of social inequalities in mental health compared to other countries. Additional research is necessary to enable a better understanding of the factors that contribute to mental health inequality.

Keywords: Concentration index, PROGRESS, mental health, socioeconomic factors, inequality

2.1 Introduction

In 2016, more than one billion people worldwide were suffering from mental illness, accounting for 7% of the global disease burden. (Rehm & Shield 2019). A variety of biological, psychological, and social influences come into play when it comes to mental illnesses. It has been demonstrated that social determinants account for a significant portion of the observed unequal distribution of mental illnesses within and between nations (Patel et al. 2010). Thus, socioeconomic inequality in health is defined as systematic differences in health outcomes across socioeconomic groups (Lawlor & Sterne 2007). To gain a clearer picture of socioeconomic inequality in mental health, a thorough evaluation of existing studies is required.

Health economists established the concentration index as a de facto analytical tool to measure socioeconomic inequality in health (Kakwani 1980; Wagstaff et al. 1991; Kakwani et al. 1997; Van Ourti et al. 2014). A concentration index is a bi-variate rank depended index that originated from the income inequality literature. The index value ranges from -1 to 1 if it is a relative inequality variant and can take any real value if it is an absolute inequality variant. However, a zero value always indicates no inequality. A negative value usually indicates a pro-poor distribution and vice-versa. Overtime, the index has been developed for both cross-sectional (Wagstaff 2005; Erreygers 2009b; Erreygers & Van Ourti 2011a; Wagstaff 2011b) and longitudinal applications (Jones & López Nicolás 2004; Jones & López Nicolás 2006; Allanson et al. 2010; Allanson & Petrie 2013b, 2013a). Furthermore, the index has been utilised to decompose the measured inequality into its causes (Wagstaff et al. 2003) and could be used to quantify inequity in healthcare utilisation (Wagstaff & van Doorslaer 2000).

The literature on socioeconomic inequality in mental health using the concentration index approach has grown recently. This chapter reviews and synthesises the existing research that has employed concentration index as the dominant approach in evaluating economic inequality in mental health. This review aims to systematically study all of the prior research on the topic and outline a complete picture of how that inequality differs, as well as what factors influence that inequality and establish the gap in knowledge on the topic that this thesis is predicated upon.

2.2 Methods

This review is currently being registered with the International Prospective Register of Systematic Reviews (PROSPERO). The study adheres to the revised version of "Preferred Reporting Items for Systematic reviews and Meta-Analyses" (PRISMA) (Page, M. J. et al. 2021) and PRISMA-E 2012 (Welch et al. 2012) equity reporting guidelines for review process. The research questions for this review are: 1) What is the extent of socioeconomic inequality in mental health in the world 2) What recognised factors affect social inequalities in mental health? The purpose of this review is to summarise the findings from the current literature in order to lay the groundwork for future research undertakings.

2.2.1 Outcome

The primary outcome of this study is mental health. Mental health outcome is measured either through instruments or self-reported mental illness data. Table 2.1 contains a list of mental health outcomes and their descriptions.

2.2.2 Eligibility criteria

Studies published utilising concentration index technique to evaluate socioeconomic inequality in mental health were eligible for inclusion in this review. There were no exclusion criteria on the publication period or the population groups (e.g., age, gender, or geographic location) for this study. However, this review excluded research that were not published in the English language or not in a peer-reviewed journal. The review also did not include any studies that only focused in mental healthcare.

2.2.3 Data sources and search strategy

The databases listed below were searched, and they include publications through to the end of June 2021:

- Scopus
- Medline (via Pubmed)
- PsycINFO (via EBSCO Host)
- CINAHL (via EBSCO Host)

Table 2.1: List of mental health outcome measures

Sl	Instrument	Outcome	Health status interpretation
1.	12 item General Health Questionnaire (GHQ-12)	Summative index of mental health	Higher value (e.g ≥3 indicates poor mental health)
2.	28 item General Health Questionnaire (GHQ-28)	Summative index of mental health	Higher mental health implies poorer mental health
3.	Center for Epidemiological Studies Depression Scale (CES-D)	Clinically significant depressive symptoms (CSDS)	Higher values indicates possible cases of mental disorder
4.	Kessler Psychological Distress scale (K-10)	Summative index of distress, measuring anxiety and depression	Higher value indicates worse mental health
5.	Short Form -36 (SF-36)	Five-question Mental Health Inventory (MHI-5) and Mental Component Score (MCS)	Higher value indicates better mental health
6.	Mini-mental state examination (MMSE)	Summative index of mental health	Higher value indicates better cognitive ability
7.	Patient Reported Outcome (PRO) (less formal)	Score or cases of mental disorder	Higher value indicates worse mental health
8.	Composite International Diagnosis Interview (CIDI)	Probable cases of mental illnesses	Higher number of cases indicates worse mental health
9.	Clinical Interview Schedule- Revised (CIS-R)	Probable cases of mental illnesses	Higher score or cases indicates worse mental health

The search strategy was developed in the Scopus database and applied to the other databases with appropriate modification. First the keywords “Concentration index” or “Concentration indices” were searched in the title abstract and keywords section of articles. Then the following keywords were searched within the initial search: “mental” or “behavioural” or “behavioural” or “psychiatric” or “psychological” or “distress”. The combined search query was the following: (TITLE-ABS-KEY ("concentration index" or "concentration indices")) AND (TITLE-ABS-KEY (mental or behavioral or

behavioural or psychiatric or psychological or distress)). All retrieved search results for each database were then exported to the Endnote X8 referencing software.

2.2.4 Selection of studies

First duplicates were removed using the Endnote X8 referencing software's automated process. After the automated check-up, the duplicate check procedure was done manually again for further filtration. After removing duplicates, titles and abstracts were screened to identify relevant studies. Following that, the full text of the selected papers was screened to assess their suitability for inclusion in this review. The reference lists of all the studies selected for full-text screening were also examined for any potential additional eligible research papers.

2.2.5 Data extraction and analysis

Data extraction and analysis were done once the relevant studies were selected. Data were extracted from the selected publications using a standardised form generated in the Microsoft Excel 2016 programme. From the included studies the following data items were retrieved: 1) first author 2) publication year 3) country of the study 4) region of the study (if applicable) 5) study period 6) number of study participants 7) study population types 8) study population age group 9) outcome type 10) instrument type 11) reported concentration index values 12) study design type 13) study variables and factors and 14) key results and summaries of the evidence. The gathered data were then synthesised through the use of descriptive analysis.

2.3 Results

2.3.1 Study selection

A total of 616 articles were retrieved from all databases with 144 duplicates removed. 31 articles were eventually included in this review after screening and assessing eligibility criteria. The PRISMA 2020 flow diagram of this review is shown in Figure 2.1:

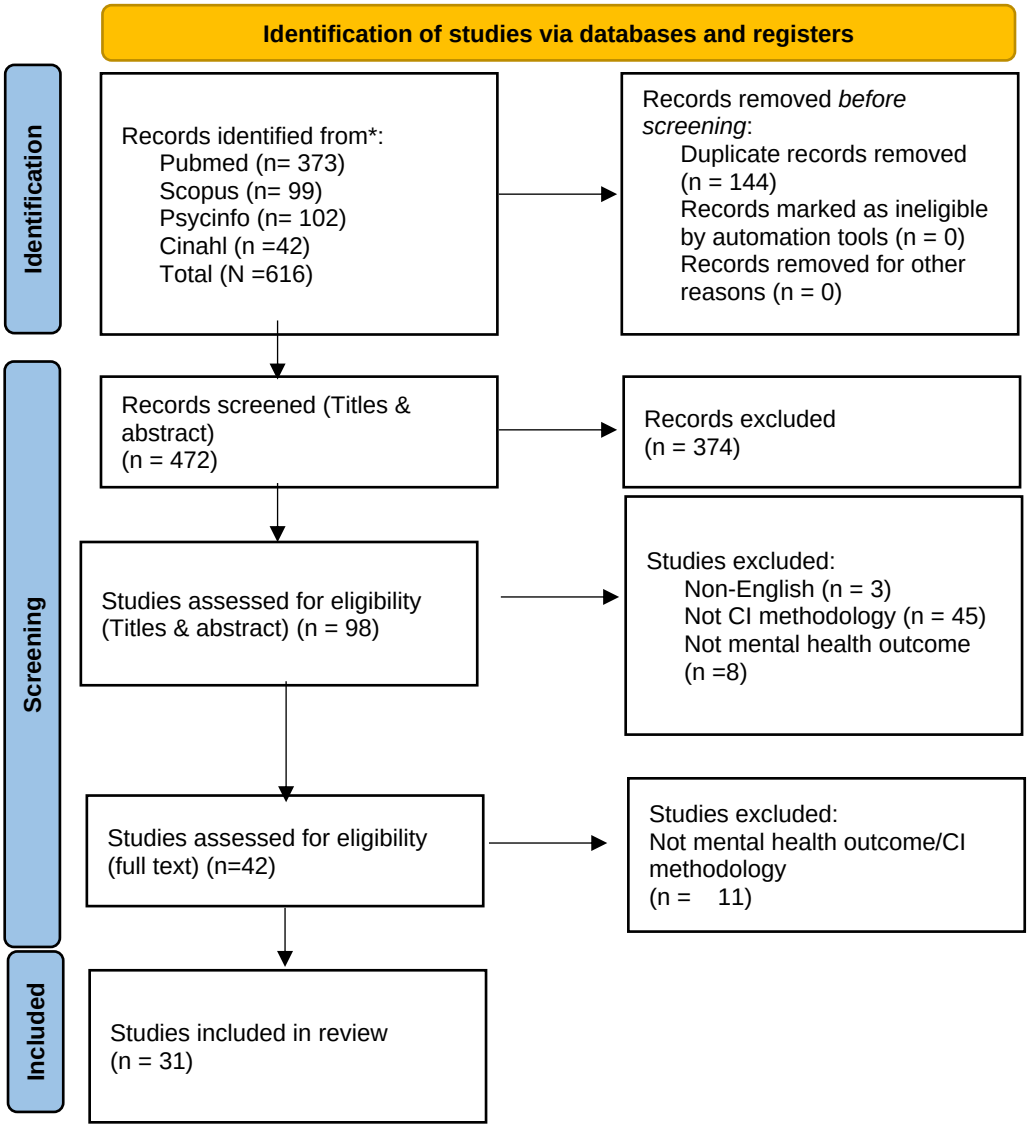

Figure 2.1: PRISMA 2020 flow chart for review of studies

2.3.2 Study characteristics

The studies included in this review involves 8,484,442 participants in 15 countries. Out of the studies 29% (n=9) analyse data only using the concentration index (Clarke, P. et al. 2002; Mangalore et al. 2007; Hong et al. 2011; Mangalore & Knapp 2012; Morasae, Forouzan, Asadi-Lari, et al. 2012; Enticott et al. 2017; Karimian et al. 2017; Harouni et al. 2018; Calderon-Villarreal et al. 2020). The remaining 71% (n=22) includes concentration index with decomposition analysis in the study design (Gundgaard & Lauridsen 2006; Lee & Jones 2007; Morasae, Forouzan, Majdzadeh, et al. 2012; Gunasekara et al. 2013; Christiani et al. 2015; Ramezani Doroh et al. 2015;

Veisani & Delpisheh 2015; Amroussia et al. 2017; Hajizadeh et al. 2019; Hong & Lee 2019; Mutyambizi et al. 2019; Zeng & Jian 2019; Hashmi et al. 2020; Linder et al. 2020; Najafi et al. 2020; Sun et al. 2020; Veisani et al. 2020; Deng & Liu 2021; León-Giraldo et al. 2021; Nie et al. 2021; Srivastava et al. 2021; Sun et al. 2021). Of these 22 studies, 4 studies used the Oaxaca-Blinder decomposition method (Zeng & Jian 2019; Linder et al. 2020; Veisani et al. 2020; León-Giraldo et al. 2021). All studies focused an adult population. Some studies focused on special population groups such as ethnic minorities (Mangalore & Knapp 2012; Hajizadeh et al. 2019), women (Gunasekara et al. 2013; Christiani et al. 2015; Mutyambizi et al. 2019; Calderon-Villarreal et al. 2020) and older age populations (Sun et al. 2020; Deng & Liu 2021; Srivastava et al. 2021; Sun et al. 2021).

2.3.3 Country analysis

Table 2.2: Country frequency in included studies

	Countries	Frequency
1.	Australia	4
2.	Canada	2
3.	China	5
4.	Colombia	1
5.	Denmark	1
6.	India	1
7.	Indonesia	1
8.	Iran	8
9.	Mexico	1
10.	New Zealand	1
11.	South Africa	1
12.	South Korea	2
13.	Sweden	2
14.	Taiwan	1
15.	UK	3
	Total	34*

Note: *Australia was included in three studies in conjunction with other countries.

The 31 studies included in this review analysed data from 15 different countries. The frequency distribution of the countries is shown in Table 2.2. All studies undertook concentration index assessment. The socioeconomic inequality of mental health assessment of these studies is shown in Table 2.3:

Table 2.3: Country analysis of selected studies

sl	Article	Country	Period	Instrument	CI
1.	Amroussia et al. (2017)	Sweden	2014	GHQ-12	-0.15
2.	Calderon-Villarreal et al. (2020)	Mexico	2014	CES-D	0.16
3.	Christiani et al. (2015)	Indonesia	2007-2008	CES-D	-0.0545
4.	Clarke, P. et al. (2002)	Australia, England	1995 -1996	SF-36	0.009, 0.000
5.	Deng and Liu (2021)	China	2018	MMSE	-0.046
6.	Enticott et al. (2017)	Australia, Canada	2011/2, 2012	K10	-0.16, -0.15
7.	Gunasekara et al. (2013)	Australia, New Zealand	2008, 2008/9	SF-36	0.020, 0.012
8.	Gundgaard and Lauridsen (2006)	Denmark	2000-2001	SF-36	0.008
9.	Hajizadeh et al. (2019)	Canada	2012	K10	-0.054
10.	Harouni et al. (2018)	Iran	2012	GHQ-28	-0.1004
11.	Hashmi et al. (2020)	Australia	2012-2017	SF-36	0.015 to 0.019
12.	Hong et al. (2011)	South Korea	1998-2007	PRO	-0.126 to -0.287
13.	Hong and Lee (2019)	South Korea	2015	PRO	-0.128
14.	Karimian et al. (2017)	Iran	2011	CIDI 2.1	-0.29
15.	Lee and Jones (2007)	Taiwan	2001	SF 36	0.00944, 0.0147
16.	León-Giraldo et al. (2021)	Colombia	2018, 2014	SRQ-20	-0.091, -0.189
17.	Linder et al. (2020)	Sweden	2011, 1994	PRO	-0.369, -0.249
18.	Mangalore and Knapp (2012)	England	2000	CIS-R	-0.0502
19.	Mangalore et al. (2007)	UK	2000	CIS-R	-0.0798, -0.1057
20.	Morasae, Forouzan, Asadi-Lari, et al. (2012)	Iran	2007	GHQ-28	-0.063
21.	Morasae, Forouzan, Majdzadeh, et al. (2012)	Iran	2007	GHQ-28	-0.673
22.	Mutyambizi et al. (2019)	South Africa	2014	CES-D	-0.276
23.	Najafi et al. (2020)	Iran	2014	PRO	-0.012
24.	Nie et al. (2021)	China	2020	PRO	0.04
25.	Ramezani Doroh et al. (2015)	Iran	2012	SF-36	0.016
26.	Srivastava et al. (2021)	India	2011	GHQ-12	-0.23
27.	Sun et al. (2020)	China	2015	CES-D	-0.0158
28.	Sun et al. (2021)	China	2011, 2014	PRO	0.0309, 0.0269

Table 2.3: Country analysis of selected studies (continued)

sl	Article	Country	Period	Instrument	CI
29.	Veisani and Delpisheh (2015)	Iran	2014	GHQ-28	-0.049
30.	Veisani et al. (2020)	Iran	2016-17	GHQ-28	-0.013
31.	Zeng and Jian (2019)	China	2011, 2015	CES-D	-0.005, -0.028

2.3.4 Variables and factors assessment

The variables and factors in the 22 studies that performed the decomposition analysis were also evaluated. The review assessed the studies using the PROGRESS-Plus elements (O'Neill et al. 2014). which is the suggested framework in the PRISMA-Equity extension for identifying variables that classify health opportunities and outcomes. The PROGRESS acronym refers to factors such as: “place of residence”, “race”, “occupation”, “gender”, “religion”, “education”, “socioeconomic status” and “social capital”. The Plus term refers to additional factors such as discrimination characteristics, relationship features and time dependent relationships and status. The frequency with which PROGRESS-Plus variables appear in the 22 studies included are shown in Table 2.4.

Table 2.4: PROGRESS-Plus assessment of studies

Sl	PROGRESS-plus factors	Frequency
1	Place of residence	16
2	race/ethnicity/culture/language	8
3	Occupation/employment	18
4	Gender/sex	21
5	Religion	1
6	Education	21
7	Socioeconomic status	20
8	Social capital	8
9	Disability/ health condition	5
10	Relationship features	21
11	Time-relationship	16

Of the 22 studies, nine studies used eight PROGRESS-Plus factors or more in their analysis (Lee & Jones 2007; Amroussia et al. 2017; Hajizadeh et al. 2019; Hong &

Lee 2019; Mutyambizi et al. 2019; Hashmi et al. 2020; León-Giraldo et al. 2021; Nie et al. 2021; Srivastava et al. 2021). The other 22 studies include at least four factors.

2.4 Discussion

The purpose of this chapter is to analyse worldwide socioeconomic inequality in mental health and to describe the variables that contribute to such inequalities. This review has highlighted a number of knowledge gaps that need to be addressed. For example, the review revealed that except Zeng and Jian (2019), Hashmi et al. (2020), Linder et al. (2020), Veisani et al. (2020), and León-Giraldo et al. (2021); all studies are cross-sectional in nature. The literature on socioeconomic inequality in mental health lacks an agreed framework for longitudinal analysis. In addition, the review has shown that studies were focused heavily on adult population groups. However, the majority of mental disorder incidence occurs in the early stages of life and prevention strategies require assessment of socioeconomic inequality for the young and adolescents (Kessler et al. 2007; Girolamo et al. 2012). Future studies should be focussed on investigating mental health outcomes in different socioeconomic strata for the young and adolescents.

Given the heterogeneity of the outcomes, we have to be cautious about our interpretation. However, since all inequality values are expressed as concentration indices, a board comparison can be done, albeit with caution. The review showed that the welfare state and developed nations more generally are substantially better at maintaining low socioeconomic inequality in the area of mental health in comparison with developing or poorer countries. By examining the concentration index, it is reasonable to conclude that Australia outperformed the majority of nations included in this analysis. However, Australia still has room for improvement as it lags behind nations such as Canada, Denmark, and the United Kingdom which have substantial welfare states.

The PROGRESS-Plus criteria were used in a diverse manner throughout the research covered. Although most studies covered most of the PROGRESS-Plus factors, only Srivastava et al. (2021) included all the factors. Further, PROGRESS-Plus also excluded many factors such as health behaviours that are important for implementing policy. Further research on the decomposition of socioeconomic inequality in mental

health is required. PROGRESS-Plus criteria also need to be revised in light of increasing studies on socioeconomic inequalities in mental health.

While earlier systematic reviews examined the connection between socioeconomic position and mental health, this review quantified socioeconomic inequality in mental health. It also attempted to standardise the findings of prior investigations in a methodical manner. However, caution should be exercised in interpreting the various outcomes. Additionally, the distinction between relative and absolute inequality should be studied carefully. To help explain these positions, each of these elements have been listed in its own table.

2.5 Conclusion

This is the first comprehensive review of socioeconomic inequality in mental health using concentration index as a criterion. Socioeconomic inequality in mental health exist in all countries studied in this review. However, developed countries perform better than developing countries. Australia outperforms most other countries but trails behind Canada, Denmark, and the United Kingdom in mental health inequality. Numerous factors may contribute significantly to inequalities in mental health. However, research on the juvenile and teenage populations, as well as longitudinal studies, were not common. Further research on the elements that contribute to socioeconomic inequality in mental health is needed.

CHAPTER 3

PREVALENCE OF MENTAL DISORDERS BY SOCIOECONOMIC STATUS IN AUSTRALIA: A CROSS-SECTIONAL EPIDEMIOLOGICAL STUDY

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ABSTRACT

Purpose: To present the prevalence of 3 broad categories of mental disorder (anxiety-related, affective and other disorders) by socioeconomic status and examine the associated socioeconomic risk factors of mental disorders in Australia.

Design: A population-based, cross-sectional national health survey on mental health and its risk factors across Australia.

Setting: National Health Survey (NHS), 2017-2018 conducted by the Australian Bureau of Statistics (ABS).

Participants: Under aged: 4,945 persons, Adult: 16,370 persons and total: 21,315 persons

Measures: Patient-reported mental disorder outcomes

Analysis: Weighted prevalence rates by socioeconomic status (equivalised household income, education qualifications, Socio-Economic Index for Areas (SEIFA) scores, labour force status and industry sector where the adult respondent had their main job) were estimated using cross-tabulation. Logistic regression utilizing subsamples of underage and adult age groups were analysed to test the association between socioeconomic status and mental disorders.

Results: Anxiety-related disorders were the most common type of disorders with a weighted prevalence rate of 20.04% (95% CI: 18.49-21.69) for the poorest, 13.85%

(95% CI: 12.48-15.35) for the richest and 16.34% (95% CI: 15.7-17) overall. The weighted prevalence rate for mood/affective disorders were 20.19% (95% CI: 18.63-21.84) for the poorest, 9.96% (95% CI: 8.79-11.27) for the richest, and 13.57% (95% CI: 12.99-14.17) overall. Other mental disorders prevalence were for the poorest: 9.07% (95% CI:7.91-10.39), the richest: 3.83% (95% CI: 3.14-4.66), and overall: 5.93% (95% CI: 5.53-6.36). These patterns are also reflected if all mental disorders were aggregated with the poorest: 30.97% (95% CI: 29.15-32.86), the richest: 19.59% (95% CI: 18.02-21.26), and overall: 23.93% (95% CI: 23.19-24.69). The underage logistic regression model showed significant lower odds for the middle (AOR: 0.75, 95% CI: 0.53 -1.04, $p < 0.1$), rich (AOR: 0.71, 95% CI: 0.5-0.99, $p < 0.05$) and richest (AOR: 0.6, 95% CI: 0.41-0.89, $p < 0.01$) income groups. Similarly, in the adult logistic model, there were significant lower odds for middle (AOR: 0.84, 95% CI: 0.72-0.98, $p < 0.05$), rich (AOR: 0.73, 95% CI: 0.62-0.86, $p < 0.01$) and richest (AOR: 0.76, 95% CI: 0.63-0.91, $p < 0.01$) income groups.

Conclusion: The prevalence of mental disorders in Australia varied significantly across socioeconomic groups. Knowledge of different mental health needs in different socioeconomic groups can assist in framing evidence-based health promotion and improve the targeting of health resource allocation strategies.

Keywords

Mental Disorders, Public Mental health, Community Health, Health Disparities, Social Class, Health Care Policy, Health Promotion

3.1 Purpose

The literature from the 1990s and early 2000s documented the inverse relationship between socioeconomic status and mental disorders, highlighting the importance of understanding the prevalence rate of mental illness in different socioeconomic groups (Dohrenwend et al. 1992; Williams et al. 1992; Miech et al. 1999; Muntaner et al. 2004). However, gaps continue to exist in understanding these epidemiological issues despite some progress being made in estimating the prevalence of mental disorders globally (Steel et al. 2014b). Questions especially remain as to whether there are significant differences of prevalence rates among various socioeconomic strata for different type of disorders. There are also issues regarding the selection of the measures of socioeconomic status; for example, whether socioeconomic status should be assessed using educational attainment, income level or occupational status. Research on the prevalence of mental disorder by socioeconomic status are limited and often lack granulated details that are fundamental to develop resource allocation strategies for health policy (Kessler et al. 2012; Williams et al. 2016; Huang et al. 2019).

Like many other developed countries, mental disorders create a significant health burden in Australia (Whiteford et al. 2013; Rehm & Shield 2019). Mental and substance use disorders are the third most common disease/illness and account for almost 12% of the total disease burden in Australia (Moon et al. 2019). The prevalence of mental disorder were fairly stable in between 2001 and 2014, but the cost and level of disability associated with mental disorder is rising in Australia (Harvey et al. 2017). Efficient resource allocation strategies are necessary to account for these rising costs. One possible solution is to devise health policies that target specific socioeconomic groups where a particular disease has high prevalence. In order to devise such health policies, knowledge of the prevalence rate of different type of mental disorder by socioeconomic categories are required. Thus, the current study investigates the prevalence of three broad categories of mental disorder (anxiety related, affective and other disorders) broken down into fourteen disease subcategories in detail by socioeconomic status (income level, educational attainment and occupational status) using Australian National Health Survey data. The study also investigates the association with mental disorder and socioeconomic status for under-aged and adult population. A detailed investigation like this one should inform policy makers on

differential resource allocation strategies for Australia. Such an investigation would also provide evidence to other countries on their efforts to reduce the burden of mental disorders.

3.2 Methods

3.2.1 Design

Data for this study were obtained from the National Health Survey (NHS): 2017-18, basic Confidentialised Unit Record Files (CURFs) dataset. This was the eighth comprehensive national survey of the NHS series conducted by the Australian Bureau of Statistics (ABS) (ABS 2018). The survey provides national benchmark information on a range of health-related issues. Numerous studies have been conducted to (https://www.abs.gov.au/websitedbs/d3310114.nsf/4a256353001af3ed4b2562bb00121564/ef2e056d5ba710f1ca25728a000dcdb4!OpenDocument) further test the reliability and validity of the NHS and NHS's ability to provide valid national and within state estimates. Further details on sampling design can be found elsewhere (ABS 2019).

3.2.2 Sample

The survey was conducted across Australia and excluded only very remote areas and discrete Aboriginal and Torres Strait Islander communities. Private dwellings were selected at random using multistage area sampling and the final sample contains 16,384 fully responding dwellings (76.1% response rate). Within each selected dwelling one adult (18 years and over) and one child (0-17 years) were randomly selected for inclusion in the survey, yielding a total sample size of 21,315 persons (Under aged: 4,945 persons and Adult: 16,370 persons). A comprehensive description of the study participants of NHS 2017-18 has been described elsewhere(ABS 2019).

3.2.3 Outcome measurement

NHS collected information on mental, behavioural and cognitive conditions by showing a prompt card on conditions and asking the respondent "Do you have any of these conditions?" (The respondent was informed to include any conditions they currently have and are managing with treatment or medication). If the respondent had the condition displayed at the prompt card, the interviewer then asked "Which one?" and collected data for all the conditions the respondent had at the time of the interview.

The study constructed the anxiety related, affective and other disorder categories if the respondent had a condition on the respective category. For example, if a respondent had both panic disorder and post-traumatic stress disorder then that respondent counted once in the anxiety related disorder category. If a respondent had at least one condition then the respondent was counted once in the total condition category.

3.2.4 Explanatory variables

The study used demographic and socioeconomic variables for regression analyses. The demographic variables include the usual age and gender variables. For socioeconomic characteristics, the study included equivalised household income quintile (poorest/poor/middle/rich/richest), education qualifications (year 12 or below/diploma & certificates/bachelor/postgraduate), Socio-Economic Index for Areas (SEIFA) scores (1st/2nd /3rd /4th /5th quintile), labour force status (employed/ unemployed/ not in the labour force) and industry sector (mining/ financial & insurance/rental, hiring & real estate/agriculture, forestry & fishing/construction/manufacturing/ transport, postal & warehousing/ public administration & safety/wholesale trade/ healthcare & social assistance/professional, scientific & tech/arts & recreation/ accommodation & food/electricity, gas, water & waste/administrative & support/other services/education & training/retail trade/information media & telecom) where the adult respondent had their main job. Out of 21,315 respondents, approximately 13% (n= 2,861) for the income variable and 3% (n=552) for the education variable were undetermined/not known. These missing values were imputed using the hot-deck matching imputation method by age, sex and industry criteria in this study.

3.2.5 Statistical analysis

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Guidelines informed the analyses of this study (von Elm et al. 2007). In the descriptive analysis, the characteristics of the study population are presented in the form of frequency (n), the unweighted percentage (%) with 95% confidence interval (CI) and the weighted percentage (%) with 95% CI. All weighted estimates calculated in this study were based on ABS instructions using their sampling weights. Prevalence was estimated using the cross-tabulation method and portrayed in figures using bar graphs. Socioeconomic correlates were examined via logistic regression utilising subsamples of underage and adult age groups. The estimated coefficients of the logistic

regression are presented in both odds ratios (OR) and adjusted odds ratios (AOR) respectively, together with associated 95% CIs. All analyses were performed using the STATA 15.0 software (StataCorp. 2019).

3.2.6 Ethical considerations

This study used de-identified secondary microdata for those consenting to its use for research purposes. The ABS followed standardized data collection procedures. The data is available from the Australian Bureau of Statistics for researchers of approved organisations who meet the criteria for access to confidential data.

Table 3.1: Characteristics of the study population

Variables	n	Unweighted % (95% CI)	Weighted % (95% CI)
Age			
Under aged			
0-4 years	1498	7.03(6.69-7.38)	6.44(6.04-6.86)
5-9 years	1318	6.18(5.87-6.52)	6.58(6.16-7.02)
10-14 years	1251	5.87(5.56-6.19)	6.08(5.67-6.51)
15-17 years	878	4.12(3.86-4.39)	3.51(3.22-3.82)
Adult			
18-39 years	5217	24.48(23.9-25.06)	31.26(30.4-32.13)
40-64 years	6966	32.68(32.05-33.31)	31.12(30.34-31.91)
65 years and over	4187	19.64 (19.12-20.18)	15.03 (14.5-15.57)
Gender			
Male	10086	47.32 (46.65-47.99)	49.54 (48.66-50.41)
Female	11229	52.68 (52.01-53.35)	50.46 (49.59-51.33)
Income			
Poorest	4126	19.36(18.83-19.89)	17.04(16.42-17.68)
Poor	4009	18.81(18.28-19.34)	18.13(17.49-18.8)
Middle	4397	20.63(20.09-21.18)	21.93(21.21-22.67)
Rich	4525	21.23(20.69-21.78)	22.26(21.53-22.99)
Richest	4258	19.98(19.45-20.52)	20.65(19.94-21.37)
Education			
Year 12 or below	6276	38.34(37.59-39.09)	37.14(36.18-38.11)
Diploma & certificates	5417	33.09(32.37-33.82)	32.58(31.67-33.52)
Bachelor	3030	18.51(17.92-19.11)	20.1(19.31-20.92)
Postgraduate	1647	10.06(9.61-10.53)	10.18(9.6-10.78)
Under aged population	4945	23.2(22.64-23.77)	22.6(21.89-23.33)
Labour force status			
Employed	9936	46.62(45.95-47.29)	50.71(49.84-51.57)
Unemployed	412	1.93(1.76-2.13)	2.27(1.99-2.58)
Not in the labour force	6022	28.25(27.65-28.86)	24.42(23.72-25.13)
Under aged population	4945	23.2(22.64-23.77)	22.6(21.89-23.33)
Index of Relative Socio-economic disadvantage -2016 (SEIFA)			
1st Quintile (most disadvantaged area)	4042	18.96(18.44-19.5)	17.86(17.22-18.52)
2nd Quintile	4313	20.23(19.7-20.78)	20.05(19.367-20.76)
3rd Quintile	4593	21.55(21-22.11)	20.62(19.94-21.33)
4th Quintile	4343	20.38(19.84-20.92)	20.71(20.02-21.42)
5th Quintile (least disadvantaged area)	4024	18.88(18.36-19.41)	20.75(20.03-21.48)

3.3 Results

Table 3.1 provides the unweighted and weighted general characteristics of 21,315 study participants. The sample was well balanced by gender (weight adjusted male [49.54%] and female [50.46%]). Age was also evenly distributed among underage [0-17 years, n=4945], young adults [18-39 years, n=5217], middle and older aged adults [40-64 years, n=6966] and senior adults [65+ years, n= 4,187] population. At the time of the study, 50.71% of the adult population were employed with a 2.27% unemployment rate evidenced. More than one third of the adult population [37.14%] had year 12 or below education with another one third [32.58%] possessing diploma or certificates education level. Income quintiles were distributed with approximately 20% in each group and stratified from poorest to richest. Similarly, indices of relative socioeconomic disadvantage (SEIFA) were also distributed approximately 20% in each group and stratified from first quintile to fifth quintile. As shown in Table 3.1, weightings did not have a strong effect on the socioeconomic distribution indicating response rates were comparable across the major socioeconomic groups.

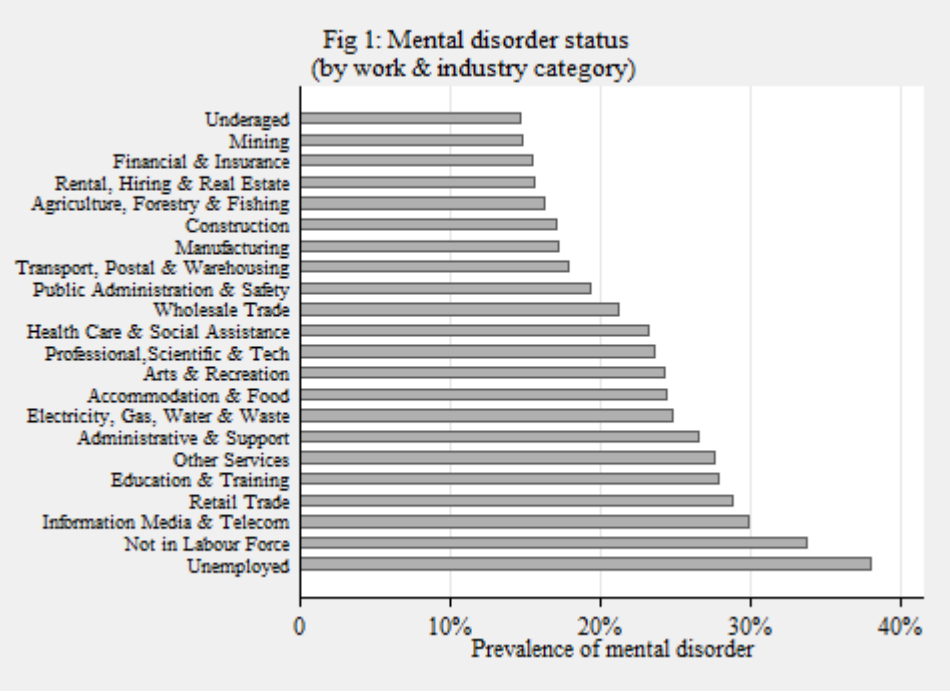

Figure 3.1: Distribution of mental disorder status by work and industry category

Labour force (LF) status and industry sector of the main job are one of the main indicators of the socioeconomic status of the respondent. The prevalence of mental disorder by work status and industry category is shown in Figure 3.1 and unemployed

individuals had the highest prevalence of mental disorder (38.12%) followed by individuals who were not in the labour force (33.88%). The under aged group, where psychological problems usually start had the lowest prevalence rate as expected (14.84%). The three industries where mental disorder were most prevalent were: information media & telecommunications (30.04%), retail trade (28.89%) and education & training (27.96%) sectors. On the contrary, mining (14.89%), financial and insurance services (15.62%) and rental, hiring and real estate services (15.8%) were the three least prevalent mental disorder industries. In general, except for a few industries, the prevalence rate in most industries were relatively homogeneous.

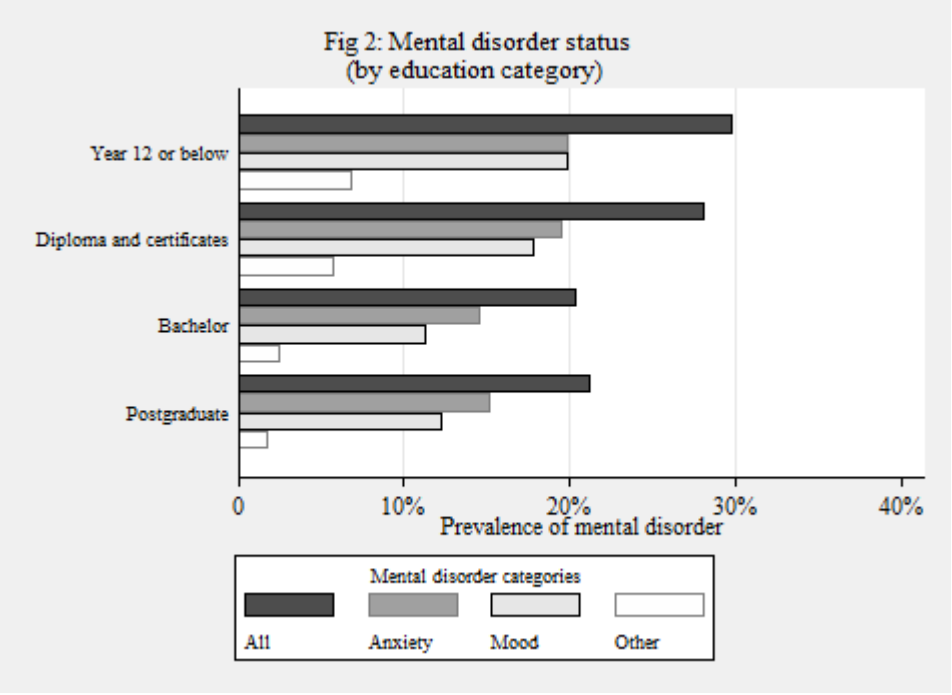

Figure 3.2: Distribution of adult mental disorder status by education category

Education level is another important indicator of socioeconomic status of an individual. Figure 3.2 shows the prevalence of mental disorder by education level. It clearly shows that lower education levels had a higher prevalence of mental disorders across all categories. Bachelor and postgraduate degree holders had an almost similar disorder pattern, with approximately 21% of all disorders, 15% of anxiety disorders and 12 % of mood disorders. However, diploma/certificate holders (all: 28.23% anxiety: 19.61%: mood: 17.95%) and people who only completed year 12 or below (all: 29.92% anxiety: 20.02% mood: 19.91%) had significantly higher mental disorders in all disease categories. Anxiety related disorders were the most prevalent disorder across all education groups, followed by mood disorder groups.

Table 3.2: Distribution of mental condition status stratified by income category

	Poorest		Poor		Middle		Rich		Richest		All groups	
Mental disorders	n	Weighted % (95% CI)	n	Weighted % (95% CI)	n	Weighted % (95% CI)	n	Weighted % (95% CI)	n	Weighted % (95% CI)	n	Weighted % (95% CI)
Anxiety related disorders	**879**	**20.04% (18.49-21.69)**	**770**	**18.41% (16.93-19.99)**	**722**	**16.44% (15.08-17.89)**	**638**	**14.03% (12.78-15.39)**	**580**	**13.85% (12.48-15.35)**	**3589**	**16.34% (15.7-17)**
Anxiety disorder, including GAD	420	9.82% (8.66-11.12)	359	8.93% (7.84-10.16)	299	6.98% (6.06-8.03)	278	6.51% (5.65-7.5)	227	5.73% (4.85-6.77)	1583	7.46% (7-7.93)
Panic disorder/Panic attacks	227	4.99% (4.2-5.92)	228	5.08% (4.27-6.04)	138	3.2% (2.57-3.98)	109	2.8% (2.23-3.51)	110	2.98% (2.29-3.87)	812	3.71% (3.39-4.07)
Phobic anxiety disorders	182	3.61% (2.98-4.37)	145	3.46% (2.78-4.29)	73	1.79% (1.32-2.43)	58	1.45% (1.07-1.95)	36	0.79% (0.51-1.21)	494	2.12% (1.89-2.38)
Obsessive Compulsive disorder	90	2% (1.53-2.61)	72	1.92% (1.39-2.66)	65	1.42% (1.04-1.93)	62	1.38% (0.95-2)	60	1.45% (1.05-1.99)	349	1.61% (1.39-1.85)
Post Traumatic Stress disorder	159	2.97% (2.42-3.63)	103	2.33% (1.76-3.07)	79	1.53% (1.16-2.01)	68	1.3% (0.95-1.78)	46	0.88% (0.61-1.28)	455	1.73% (1.53-1.96)
Feeling anxious, nervous or tense	515	11.54% (10.34-12.86)	470	11.11% (9.94-12.39)	437	9.8% (8.74-10.97)	351	7.35% (6.46-8.36)	338	7.98% (6.95-9.15)	2111	9.41% (8.92-9.93)
Mood (Affective) disorders	**908**	**20.19% (18.63-21.84)**	**731**	**17.18% (15.72-18.74)**	**546**	**12.37% (11.18-13.65)**	**474**	**10.09% (9.04-11.25)**	**413**	**9.96% (8.79-11.27)**	**3072**	**13.57% (12.99-14.17)**
Depression	562	12.3% (11.04-13.69)	477	10.91% (9.76-12.18)	298	6.5% (5.63-7.49)	280	5.73% (4.94-6.63)	235	5.09% (4.33-5.98)	1852	7.83% (7.38-8.29)
Feeling depressed	498	11.1% (9.88-12.42)	370	8.77% (7.68-10.01)	301	7.04% (6.14-8.06)	236	4.99% (4.25-5.85)	224	5.83% (4.88-6.94)	1629	7.34% (6.89-7.81)
Other mood (affective) disorders	92	2.18% (1.62-2.92)	56	1.59% (1.1-2.29)	33	0.91% (0.59-1.39)	25	0.56% (0.34-0.92)	17	0.41% (0.21-0.78)	223	1.07% (0.89-1.28)
Other mental disorders	**354**	**9.07% (7.91-10.39)**	**317**	**7.96% (6.95-9.1)**	**230**	**5.52% (4.69-6.5)**	**197**	**4.22% (3.54-5.03)**	**173**	**3.83% (3.14-4.66)**	**1271**	**5.93% (5.53-6.36)**
Alcohol and drug problems	94	2.29% (1.72-3.03)	68	1.31% (0.96-1.79)	46	1.15% (0.8-1.66)	27	0.54% (0.33-0.89)	44	1.03% (0.69-1.53)	279	1.21% (1.03-1.42)
Behavioural, cognitive and emotional problems	72	2.38% (1.78-3.19)	74	2.11% (1.58-2.8)	56	1.34% (0.93-1.91)	56	1.11% (0.81-1.52)	42	0.76% (0.51-1.15)	300	1.49% (1.28-1.72)
Autism spectrum disorders	49	1.55% (1.08-2.21)	56	1.53% (1.11-2.1)	45	1.33% (0.91-1.94)	44	1.05% (0.73-1.51)	27	0.72% (0.42-1.21)	221	1.21% (1.02-1.44)
Other problems of psychological development	98	2.56% (1.99-3.28)	119	3.06% (2.45-3.82)	82	1.89% (1.43-2.51)	71	1.5% (1.1-2.05)	58	1.2% (0.87-1.66)	428	1.99% (1.76-2.25)
Other mental and behavioural problems	137	3.2% (2.52-4.06)	116	2.99% (2.37-3.76)	50	1.3% (0.93-1.84)	42	0.98% (0.66-1.45)	28	0.59% (0.36-0.98)	373	1.71% (1.5-1.96)
All disorders	**1339**	**30.97% (29.15-32.86)**	**1163**	**28.01% (26.25-29.83)**	**1016**	**23.12% (21.56-24.76)**	**933**	**20.04% (18.59-21.58)**	**825**	**19.59% (18.02-21.26)**	**5276**	**23.93% (23.19-24.69)**

Income is the most important indicator of socioeconomic status of an individual. The estimated weighted prevalence rate of mental disorders by income group is shown in Table 3.2. Incomes were divided into quintiles (poorest, poor, middle, rich and richest) and each disorder was also subsumed into its broader mental disorder category (anxiety related, mood/affective and other). The last column of Table 3.2 shows the overall prevalence rate by disease category. Of the study population, 16.34% (95% CI: 15.7-17) had at least one type of anxiety related disorder. The poorest population had a 20.04% (18.49-21.69) prevalence rate of anxiety related disorders compared with the richest who had 13.85% (12.48-15.35). The most prevalent anxiety related condition was feeling anxious, nervous or tense (symptoms) at 9.41% (8.92-9.93) followed by anxiety disorder, including Generalised Anxiety Disorder (GAD) with 7.46% (7-7.93). Other less common anxiety related disorders were panic disorder/attack 3.71%, (3.39-4.07), phobic anxiety disorder 2.12%, (1.89-2.38), post-traumatic stress disorder (PTSD) 1.73%, (1.53-1.96), and obsessive-compulsive disorder (OCD) 1.61%, (1.39-1.85). The prevalence of all these disorders were higher among the poorest compared to the richest (anxiety disorder [poorest/richest]: 9.82%/5.73%; panic disorder: 4.99%/2.98%; phobia: 3.61%/0.79%; OCD: 2%/1.45%; PSTD: 2.97%/0.88%; symptoms of feeling tense: 11.54%/7.98%).

The overall prevalence of mood/affective disorders at 13.57% (95% CI: 12.99-14.17) were lower than the anxiety related disorders. However, like anxiety related disorders, the poorest 20.19%, (18.63-21.84) had higher prevalence than the richest 9.96%, (8.79-11.27) for mood disorders as well. Depression was the most common affective disorder, with 12.3% (11.04-13.69) for the poorest, 5.09% (4.33-5.98) for the richest and 7.83% (7.38-8.29) for the overall prevalence rate. The next most prevalent affective conditions were symptoms of feeling depressed (poorest: 11.1% [9.88-12.42], richest: 5.83% [4.88-6.94], overall: 7.34% [6.89-7.81]) followed by the other mood disorders category (poorest: 2.18% [1.62-2.92], richest: 0.41% [0.21-0.78], overall: 1.07% [0.89-1.28]).

These patterns of a high prevalence of mental disorder among the poor compared to the rich can be seen also in the other disorder category (poorest: 9.07% [7.91-10.39], richest: 3.83% [3.14-4.66], overall: 5.93% [5.53-6.36]). The major categories in the other disorder category mainly include problems that develop in early childhood such as: behavioural, cognitive and emotional problems (poorest: 2.38% [1.78-3.19],

richest: 0.76% [3.14-4.66], overall: 1.49% [1.28-1.72]), autism spectrum disorders (poorest: 1.55% [1.08-2.21], richest: 0.72% [0.51-1.15], overall: 1.21% [1.02-1.44]), and other problems of psychological development (poorest: 2.56% [1.99-3.28], richest: 1.2% [0.87-1.66], overall: 1.99% [1.76-2.25]). Alcohol and drug problems were another important subcategory in the other groups that also showed highest prevalence in the lower socioeconomic group (poorest: 2.29% [1.72-3.03], richest: 1.03% [0.69-1.53], overall: 1.21% [1.03-1.42]).

In each disease category, the study has found consistently that there exists a gradual increase in prevalence rates from higher income groups to lower income groups. This pattern was also reflected in the aggregated all mental disorders case (poorest: 30.97% [29.15-32.86], richest: 19.59% [18.02-21.26], overall: 23.93% [23.19-24.69]). The overall prevalence rate thus does not portray how severely prevalent mental disorders are in the lowest income strata of Australian society.

3.3.1 Mental disorder association with socioeconomic factors

Socioeconomic factors were significantly associated with mental disorders (Table 3.3). Since mental disorder patterns differ between underage (0-17year) and adult (18+ years), this study conducted two separate logistic regression for these two groups. In addition to odds ratio (OR) and adjusted odds ratio (AOR), the 95% confidence intervals for each model are also provided in Table 3.3.

0-4 years was the reference group for age in the underage logistic regression model. 5-9 years (AOR: 5.77, 95% CI3.79-8.77, $p<0.01$), 10-14 years (AOR: 7.24, 95% CI: 4.78-10.95, $p<0.01$) and 15-17 years (AOR: 10.38, 95% CI: 6.75-15.95, $p<0.01$) were significant and had higher odds than the reference group. 18-39 years was the reference group for age in the adult logistic regression model. 40-64 year (AOR: 0.91, 95% CI: 0.82-1.01, $p<0.1$) and 65 + years (AOR: 0.46, 95% CI: 0.4-0.53, $p<0.01$) were significant and had lower odds than adults aged 18-39 years. Both in the underage and adult models, being female was significant. However, odds for females were lower in the underage model (AOR: 0.71, 95% CI: 0.58-0.88, $p<0.01$) but higher in the adult model (AOR: 1.41, 95% CI: 1.28-1.55, $p<0.01$).

Table 3.3: Association between mental disorder status and socioeconomic factors of study participants (N=21315)

	Population group							
	Under age model				Adult model			
Variables	OR	95% CI	AOR	95% CI	OR	95% CI	AOR	95% CI
Age								
0-4 years	1		1		NA			
5-9 years	5.65***	(3.72-8.58)	5.77***	(3.79-8.77)	NA			
10-14 years	7.1***	(4.69-10.75)	7.24***	(4.78-10.95)	NA			
15-17 years	10.25***	(6.68-15.74)	10.38***	(6.75-15.95)	NA			
18-39 years	NA				1		1	
40-64 years	NA				0.97	(0.88-1.08)	0.91*	(0.82-1.01)
65 years and over	NA				0.85***	(0.76-0.96)	0.46***	(0.4-0.53)
Gender								
Male	1		1		1		1	
Female	0.72***	(0.58-0.88)	0.71***	(0.58-0.88)	1.49***	(1.36-1.63)	1.41***	(1.28-1.55)
Income								
Poorest	1		1		1		1	
Poor	0.87	(0.62-1.22)	0.87	(0.61-1.23)	0.87*	(0.76-1)	0.97	(0.84-1.11)
Middle	0.74*	(0.54-1.02)	0.75*	(0.53-1.04)	0.67***	(0.59-0.77)	0.84**	(0.72-0.98)
Rich	0.68**	(0.49-0.94)	0.71**	(0.5-0.99)	0.54***	(0.47-0.62)	0.73***	(0.62-0.86)
Richest	0.61***	(0.43-0.86)	0.6***	(0.41-0.89)	0.52***	(0.45-0.6)	0.76***	(0.63-0.91)
Education								
Year 12 or below	NA				1		1	
Diploma & certificates	NA				0.92	(0.83-1.02)	1.05	(0.94-1.18)
Bachelor	NA				0.6***	(0.53-0.69)	0.71***	(0.62-0.82)
Postgraduate	NA				0.63***	(0.54-0.75)	0.79***	(0.66-0.94)
Labour force status								
Employed	NA				1		1	
Unemployed	NA				2.11***	(1.61-2.78)	1.66***	(1.26-2.19)
Not in the labour force	NA				1.76***	(1.6-1.93)	1.92***	(1.68-2.20)
SEIFA-2016								
1st Quintile	1		1		1		1	
2nd Quintile	1.08	(0.78-1.5)	1.11	(0.79-1.55)	0.8***	(0.7-0.92)	0.9	(0.78-1.03)
3rd Quintile	0.87	(0.62-1.21)	0.95	(0.67-1.34)	0.72***	(0.62-0.82)	0.84**	(0.73-0.97)
4th Quintile	0.92	(0.67-1.28)	1.02	(0.72-1.45)	0.71***	(0.62-0.82)	0.87*	(0.76-1.01)
5th Quintile	0.86	(0.62-1.19)	0.95	(0.66-1.35)	0.55***	(0.47-64)	0.73***	(0.62-0.86)
Constant			0.05	(0.03-0.08)			0.42***	(0.35-0.5)

Notes: *** p < 0.01, ** p < 0.05, and * p < 0.1. 95% CIs are in the parentheses. NA= Not Applicable. The reference groups have odds ratio of 1.

The underage model had income and index of relative socio-economic disadvantage - 2016 (SEIFA) as the socioeconomic variables whereas adult model had education level and labour force status in addition to income and SEIFA variables. The study found significant effects of socioeconomic status in both models with lower odds corresponding to higher status. For example, the underage model showed significant lower odds for the middle (AOR: 0.75, 95% CI: 0.53-1.04, p<0.1), rich (AOR: 0.71, 95% CI: 0.5-0.99, p<0.05) and richest (AOR: 0.6, 95% CI: 0.41-0.89, p<0.01) income groups. Similar results were also found in the adult model. There were significant lower odds for middle (AOR: 0.84, 95% CI: 0.72-0.98, p<0.05), rich (AOR: 0.73, 95% CI: 0.62-0.86, p<0.01) and richest (AOR: 0.76, 95% CI: 0.63-0.91, p<0.01) income groups. When education level was examined, bachelor degree (AOR: 0.71, 95% CI: 0.62-0.82, p<0.01) and post graduate degree (AOR: 0.79, 95% CI: 0.66-0.94, p<0.01)

holders showed significant lower odds than the 12 year or below education level holders. The unemployed (AOR: 1.66, 95% CI: 1.26-2.19, p<0.01) and not in the labour force (AOR: 1.92, 95% CI: 1.68-2.20, p<0.01) groups also showed significant higher odds than the employed group in the labour force status category. To account for relative disadvantage and advantage of geographic areas, both underage and adult model included the Index of Relative Socio-economic disadvantage (IRSD) variable from the SEIFA. Every geographic area in Australia received a SEIFA score which gives a measure of how relatively disadvantaged area is compared with other areas in Australia. The individuals in the study population who resided in the most disadvantaged area are assigned in the 1st quintile and who reside in least disadvantaged area are assigned in the 5th quintile and so forth. The adult model showed significant lower odds for the 3rd, 4th and 5th quintile (3rd: 0.84, 95% CI: 0.73-0.97, p<0.05; 4th: 0.87, 95% CI: 0.76-1.01, p<0.1; and 5th: 0.73, 95% CI: 0.62-0.86, p<0.01). Disadvantaged areas shows adverse outcomes for the adult model. However, in the underage model SEIFA variables did not produce any significant results. Thus, in conclusion, both odds ratio and adjusted odds ratio in both models showed consistently the significant association of socioeconomic status on worse mental health outcomes.

3.4 Discussion

Using a recent nationwide health survey in Australia, this study has reported detailed and overall mental disorder prevalence rates across different socioeconomic strata. The results of the aggregate mental disorder distribution of this study broadly concur with the estimates of other existing studies in Australia (Henderson et al. 2000; Rosenman 2002; Teesson et al. 2009; Teesson et al. 2010; Teesson et al. 2011; Williams et al. 2016). However, the existing literature did not account for socioeconomic status. This leads to the major findings of this study that there exists substantial variation in mental health disease prevalence rates between those individuals in low and high socioeconomic strata. The overall prevalence rate did not capture the severity of some diseases, which were much more prevalent in individuals with lower socioeconomic status. For example, the poorest socioeconomic group had a prevalence rate of 12.3% for depression, whereas the overall prevalence rate of depression was 7.83%. This gap was even wider if one considers the rates between the poorest and richest. Similar patterns were exhibited for every mental disorder studied.

The aggregated effect of this pattern was also reflected in the overall mental disorder prevalence rate. Contrary to the overall prevalence rate of 23.93%, the poorest had a much higher prevalence rate of 30.97%.

The findings from this study indicate that anxiety disorder and depression prevalence rate are similar. The United States (Karg et al. 2012; Attridge 2019) has a comparable rate for depression but smaller for anxiety disorder. On the contrary, Canada (McRae et al. 2016; Attridge 2019) and United Kingdom (Stansfeld et al. 2016; Attridge 2019) have lower prevalence rates in mood and/or anxiety disorder. Both Australia and the United States have a much higher prevalence rate in depression than the global average (Steel et al. 2014a) . However, as discussed earlier that these rates do not reflect the severity of prevalence rates in the lower socioeconomic strata. In addition, mental health is affected by numerous social determinants of health (Compton & Shim 2020) and its impact varies from country to country. Thus, it would be presumptuous to assume that the prevalence rates according to socioeconomic status will be similar across countries. Future research in other developed countries is needed to understand the complexities of prevalence rates in this area.

In line with the existing evidence, the findings of the regression analysis suggests that lower income level, educational attainment and labour force status are significantly and negatively associated with mental disorders (Sareen et al. 2011; Schofield et al. 2013; Esch et al. 2014; Hashmi et al. 2020). In addition, several noteworthy finding emerges comparing the under-aged and adult regression models. The study finding indicates that the adjusted log-odd ratios are lower for the rich individuals in the under-aged model than the rich individuals in the adult model suggesting that affluent environment in early age considerably lower the risk of mental disorder. Furthermore, the adult model showed significant lower odds of mental disorders to individuals who reside in higher quintile SEIFA scored areas (advantageous socioeconomic areas). Contrary to this, no such findings were suggested in the underage model. The gender risk also switches in the under-aged and adult model suggesting that female gradually have a higher risk of mental disorder as they age. Further research are needed to understand these phenomena.

This study is the first of its kind that quantitatively illustrates the current magnitude of mental disorders in different socioeconomic strata in Australia. There are important

implications of using such information for intervention strategies and health promotion of mental healthcare. Those in lower socioeconomic backgrounds, in unemployment, residing in disadvantageous areas or with lower education are at greater risk of suffering from mental illness. It may be that they are at greater risk of developing mental disorders, or that they are unable to seek support for conditions when needed which would reduce their prevalence or impact. Greater systemic and societal-level interventions are likely needed to reduce risk, prevent mental illness and enhance access to mental health support for such disadvantaged populations. Intervention strategies such as target-based psychological support, community engagement, social and financial barrier reduction, and improved access to care can be used to reduce social inequalities in mental health (Castillo et al. 2019; Arundell et al. 2020). To effectively evaluate mental health equity, such interventions would need nationwide baseline data and comparable control groups to measure the efficacy of mental health interventions (Simpson et al. 2018). Given the paucity of quantitative research in this area, this study opens up a path to future research endeavours in such areas.

Nevertheless, it is important to recognize the limitations of this study. First, some very remote areas and discrete Aboriginal and Torres Strait Islander communities in Australia were out of scope in the National Health Survey by design. Thus, the instrument itself lacked cultural competence and health equity specific to the Aboriginal and Torres Strait Islander communities residing in very remote areas. In the modern multicultural world, promotion of cultural competency increasingly recognized as a key strategy for improving the quality and effective- ness of mental healthcare access and delivery. We recommend that the Australian government should conduct future surveys that display cultural competency so that future studies can focus on multicultural groups. Besides, since our study only addresses socioeconomic disadvantages as national estimates, care should be taken in interpreting such investigation for various minority subpopulation groups such as indigenous, ethnic, LGBTQI groups, people with disabilities and others. Further research requires for these study populations using culturally appropriate methodologies. Second, we have to note that symptoms and problems like “feeling depressed” and “behavioural, cognitive and emotional problems” reported in NHS are not standard diagnoses listed in International Classification of Dis- eases (ICD) or Diagnostic and Statistical Manual of Mental Disorders (DSM). Even though Australian Bureau of Statistics (ABS) and

Family Medicine Research Centre at the University of Sydney developed the condition list for NHS based on ICD- 10, some of the results were not available to classify the most detail condition level of ICD-10 due to the nature of NHS sample surveys. Third, the health conditions are self-reported and were not assessed using screening tools such as Composite International Diagnostic Interview (CIDI) or Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (SCID). Thus, the usual clinical limitations of self-reported study apply here. Finally, this study is a cross- sectional study, hence recall bias might influence the prevalence rates.

In summary, the prevalence rate of mental disorders among socioeconomic groups were not homogeneous. In Australia, lower socioeconomic groups had very high prevalence rates compared with the overall prevalence rate. The study analysis contributes significantly to a deeper understanding of individual mental disorder prevalence rates across different socioeconomic strata. Understanding the mental health needs of different socioeconomic strata will help improve the targeting of resource allocation strategies in Australia and abroad. This knowledge can help guide future policies and practices and also offer valuable information to other developed countries.

3.5 SO WHAT? Implications for Health Promotion Practitioners and Researchers

3.5.1 What is already known on this topic?

Existing literature suggests that there is an association between socioeconomic status and mental disorders. However, little has been documented about the prevalence rates of mental disorders in different socioeconomic strata. The systematic reviews on this topic are limited.

3.5.2 What does this article add?

This study highlights the fact that the overall prevalence rates of mental disorders do not capture the severity of mental disorders in the lowest socioeconomic strata. In Australia, the difference in the overall mental disorder prevalence rate between the poorest and the richest class is 11.38%. This difference is significantly high compared to the average rate of 23.93%. It has been found that the lower socioeconomic groups consistently have a higher prevalence rate than the richer socioeconomic groups in all

14 types of mental disorders. There exists considerable mental health inequality in Australia due to lower socioeconomic background, low education, labour force condition and underdeveloped geography.

3.5.3 What are the implications for health promotion practice or research?

In a multicultural society, understanding the mental health needs of different socioeconomic classes can help improve health system resource allocation strategies. Further research is required for minority groups such as indigenous, ethnic, and LGBTQI groups, and people with disabilities for greater understanding of perceived mental health inequalities. Policies and funding needed to be directed toward the most disadvantaged such that, care is delivered in a culturally competent manner to improve mental health outcomes. Hence, the interplay between mental health and socials determinant of health needed to be reinforced and target-based measurable and effective interventions strategies are required to be developed.

Authors' Note

RH conceptualized the study, conducted the data analysis and drafted the manuscript. KA, JG and SM offered advice, critical comments and edited the draft manuscript. All authors contributed to revisions of the manuscript and approved the final version of the manuscript prior to its submission.

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CHAPTER 4

DOES MATERNAL BACKGROUND MATTER? A MULTILEVEL APPROACH TO MODELLING MENTAL HEALTH STATUS OF AUSTRALIAN YOUTH USING LONGITUDINAL DATA

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ABSTRACT

Purpose: Most previous research place great store on the influence of maternal background on child and adolescents' mental health. However, age of onset studies indicates that the majority of the mental health disease prevalence occurs during the youth years. This study investigates the relationship of maternal background and individual circumstance on youth mental health status.

Method: Data from 975 participants and 4632 observations of aged cohort 15 to 19 years in the Household, Income and Labour Dynamics in Australia (HILDA) longitudinal study were followed for 10 years (2007-2017).

Results: The findings suggest that not all dimensions of maternal background (especially education) have impacts on youth mental health. We found household income (AOR: 1.572, 95% CI: 1.017-2.43) and living arrangement (AOR: 1.586, 95% CI: 1.097-2.294) significantly increases mental disorder odds whereas maternal education or occupation fixed effects were not significant. Individual-level circumstances have much stronger impact on youth mental health. We found financial shock (AOR: 1.412, 95% CI: 1.277-1.561), life event shock (AOR: 1.157, 95% CI: 1.01-1.326), long term health conditions (AOR: 2.855, 95% CI: 2.042-3.99), smoking (AOR: 1.676, 95% CI: 1.162-2.416), drinking (AOR: 1.649, 95% CI: 1.286-2.114) and being female (AOR: 2.021, 95% CI: 1.431-2.851) have significant deteriorating effects on youth mental health.

Conclusions: Our finding is in contrast to the majority of studies in the literature which give a preeminent role to maternal characteristics in child and youth mental health status. Mental health interventions should consider the heterogeneity of adverse youth circumstances and health-related behaviours.

Keywords: Equity, Parental Characteristics, Socioeconomic Status, Family Background, Mental Health

4.1 Introduction

Social gradients in physical and mental health status exist and good mental health is not equally distributed (Fryers et al. 2003; Marmot & Bell 2012; Hashmi et al. 2021). Understanding the determinants of socioeconomic inequality is important for policymakers and researchers alike. While socioeconomic inequalities in adult mental health dominate current research, a growing body of literature currently points to the importance of maternal background on children and adolescents' mental health (Arroyo-Borrell et al. 2017; Meyrose et al. 2018; Cui et al. 2019). Accumulating evidence also suggests that lower socioeconomic status (SES) is an important marker of mental health problems in children and adolescents (Koivusilta et al. 2006; McLaughlin et al. 2011; Reiss 2013).

Although child and adolescent periods appear to be emerging points for mental disorders, Age Of Onset (AOO) studies have identified that the majority of mental disorder incidence occurs at the early stages of youth, particularly when young people transition to adulthood (Kessler et al. 2007; Girolamo et al. 2012). The problem in the literature relating to the influences of maternal background and childhood circumstances on mental health status is that the age bands in these studies are broad, obscuring the stages of youth by either younger youths being included with 'children and adolescents', (e.g., age 1-18 years) or older youths being included with 'adults' (e.g., 15-64 years) (McLaughlin et al. 2011; Reiss et al. 2019; Hashmi et al. 2020). The circumstances experienced by individuals in their childhood and adolescent period are certainly much different than the period when they are transitioning to youth and adulthood. Thus, the impact of maternal background on this transitioning phase on an individual's mental health outcome is not clear and may very well be different.

In this paper, we tried to address this issue by selecting a 15-19 years age cohort and following the cohort for ten years (up to six measurement points) to investigate the impact of youth circumstances on mental health outcomes. Although significant advances have been made in our understanding of the impact of maternal background on childhood mental health status, considerable knowledge gaps still exist. For instance, we do not understand how different attributes that constitute maternal social class variations (such as mothers' education, income or occupational status) contributes to the variation in youth mental status or how such inequalities evolve over time. Little is known about the variability of individual-level and social class level characteristics on mental health outcome inequalities for youth and young people.

Thus, the primary goal of this paper is to fill this knowledge gap and attempt to provide a link between prior studies on childhood and adult mental health inequalities. In addition, the focus on Australian youth complements existing US, UK or European studies on youth mental health inequalities. Our study extends the literature to another developed country with a different social welfare system and norms that provide different perspectives on mental health equity issues. We also extend the scope of our research by using improved modelling techniques, for example, utilising multi-level modelling to assess mental health outcomes, which is another major contribution of this study.

4.2 Methods

4.2.1 Data source

All our analyses are based on sample data from the Household, Income and Labour Dynamics in Australia (HILDA) panel survey (Department of Social Services et al. 2020). This nationally representative household survey has been carried out annually from 2001 through 2018 (waves 1-18). It interviews and subsequently reinterviews all members aged 15 years and over of the same selected household every year. More than 30,000 individuals (40,000+ enumerated) have participated in the survey over the years and on average 15,000 individuals have been interviewed every year. A 90% wave on wave response rate for the HILDA survey is comparable with other large longitudinal surveys like the British Household Panel Study (BHPS) or Panel Study of Income Dynamics (PSID). Details of HILDA sample design, survey response rates and attrition rates can be found elsewhere (Summerfield et al. 2019).

4.2.2 Inclusion criteria of the samples

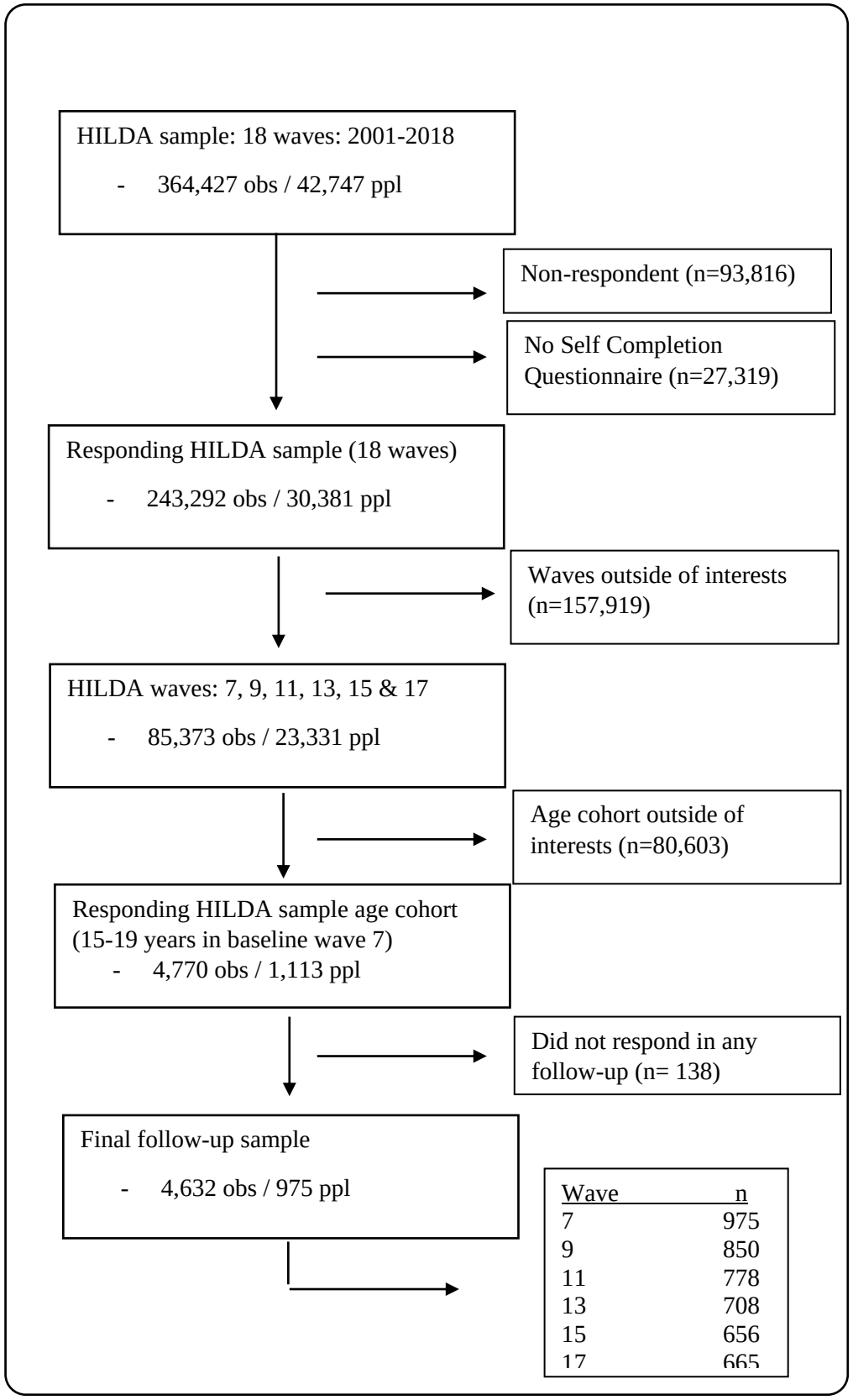

Figure 4.1: Participants flow into the sample

For the purpose of this study, we limit the sample to young Australians aged 15-19 years (late adolescent period) at the baseline wave (wave 7) and then followed the participants for 10 years (up to six measurement points) which covers youth (20-24 years) and transition to adulthood phase (25-29 years) in the follow-up. We chose to start from wave 7, because the HILDA survey did not start to collect Kessler Psychological Distress Scale (K10) scores (our main outcome of interest) in earlier waves and it provides the score subsequently in every odd wave (every two years) thereafter. Thus, we constructed an unbalanced panel data using wave 7, 9, 11, 13, 15 and 17. To be included in the analyses, the participants had to be interviewed in the baseline wave 7 and has to appear in at least one of the follow-up waves. Our final sample contains 975 participants across the six waves with a total of 4,632 observations. The 15-19 age cohort was thus followed up to 25-29 years with an average of 5.18 observations per person. The participant flow into the sample is shown in Figure 4.1.

4.2.3 Outcome variable, exposure variables and other covariates

This study uses the Kessler Psychological Distress Scale (K10) as the measure of mental health outcomes and is the main dependent variable for analyses (Kessler et al. 2002). In clinical practice, the scale is used to assess the likelihood of having a mental disorder; for example, a person with a score of 10-15 has a low risk of having a mental disorder whereas a person with a score of 20-24 is likely to have a mild mental disorder, a score of 25-30 would indicate a likely moderate mental disorder and a person with a score of 30-50 is likely to have a severe mental disorder (Wooden 2009). In the analyses, we use a dichotomous K10 variable (where a score of greater than 20 depict the likelihood of a mental disorder) as measures of our dependent variable for mental health performance (Andrews & Slade 2001).

Following Roemer's equality of opportunity theory (Roemer 1998; Roemer & Trannoy 2016) we classify all our exposure variables into two types: i) circumstances category and ii) effort category. The theory of equality of opportunity revolves around the goal of compensating for 'negative' circumstances (such as the parental background) on health outcomes while disregarding the health inequalities generated by effort category variables (such as lifestyle or health habits) that can be attributed to the behaviour of an individual. We use the biological mothers' education level and

occupational status, household income and family living arrangements (whether the participant lived with both parents at the age of 14 years old) to determine the maternal background status as a group level characteristic of the circumstances category. We define maternal education level as low if the highest qualification level obtained by the mother is secondary level or lower. We use the Australian Socioeconomic Index 2006 (AUSEI06) occupational status scale as the measure of the occupational status of the mother (McMillan et al. 2009). We assign occupational status as low if the value range falls in the lowest quintile. Similarly, we assign household income as low if the equivalised household income range falls in the lowest quintile. Using household income, family living arrangement, maternal education and occupational status we have constructed 16 (2x2x2x2) different types of maternal background history groups for the multilevel analyses.

We use the number of financial shocks, the number of life event shocks and long term health conditions in the individual level circumstances category (Hashmi et al. 2020). The number of financial shock variable shows the number of adverse financial events the study participant has experienced (for example: went without meals or asked for financial help from friends or family). Similarly, the life event shock variable shows the number of life events related to grief, loss or injury the study participant has suffered (for example the death of a family member or serious personal injury). The list of events that constitutes financial and life event shocks are given in the appendix. We use negative health habits such as being obese (as a proxy of unhealthy eating and lack of exercising), being a daily smoker and regular drinker (drinks more than four standard drink/day), and positive health habits such as being an active member of a sporting/hobby/community-based club or association as an effort type of variables. This study also included gender and rural residency as demographic covariates in the analyses on the basis of past literature (Silva et al. 2016). In addition, we construct our time variable by setting zero at the baseline wave 7 and subsequently adding two for each additional measurement point (since between wave time period is two years and there are up to six measurement points) to get a ten-year follow-up at wave 17 (t= 0,2,4,6,8, and 10).

4.2.4 Statistical Analyses

The authors constructed an unbalanced longitudinal data set of the youth cohort by linking an individual's record who participated in the baseline (wave 7) at age 15-19 years and in one of the follow-up waves (9, 11, 13, 15 and 17). Descriptive statistics and mental health opportunity profile were summarised to understand the impact of maternal background characteristics on youth mental health. Visual trends of the psychological distress scale were analysed for group-level characteristics. Traditional single level regression analysis such as the logistic regression model only assumes fixed-effect impacts of dependent variables and does not allow for random effects of intercepts and slopes for individual and group-level characteristics. However, the data structure can be nested or clustered by some observable characteristics that create similarity between individuals and ignoring these phenomena can violate the independence assumption of regression analysis. Multi-level models allow for a nested data structure and make it possible to study sources of variance at different levels of an outcome variable (Evans et al. 2018). In our analyses, we used both single-level logistic regression and multilevel logistic regression models. we have nested our data structure into three levels: i) time, ii) individual, and iii) maternal background history (a total of 16 different background history types; for example, a background history type could be: household income: high, mothers' education: low, mothers' occupation: low and family living arrangement - whether not lived with both biological parents: yes.) We assigned unique identifiers for each group for the analysis. We control for individual fixed effects characteristics like circumstances and effort covariates in level 2 and group-level fixed effects characteristics like various maternal background characteristics in level 3. All statistical analyses were conducted using Stata 15 (StataCorp. 2019).

4.3 Results

4.3.1 Describing the sample

Table 4.1 displays the socio-demographic characteristics of the study population by mental health status. It can be seen that age groups do not vary significantly in mean K10 score both in the baseline wave and in all waves average. However, in our sample, males have a lower average K10 score than females in both baseline wave and all waves average. Richer household income group has on average two-point lower K10 scores at baseline and approximately three points in all waves average. Those youth,

who did not live with both biological parents at age 14, have two-point higher average K10 scores both in baseline and all waves average. Maternal education level does not indicate any significant difference in average scores between education groups. However, mothers with lower occupational status have approximately one point higher average scores. All groups have approximately six to seven points of standard deviation which indicates considerable variability at the individual level.

Table 4.1 Socio-demographic characteristics of the study population by mental health status

	Baseline (wave 7)		All waves	
	N (%)	**K10 score Mean (std)**	**N (%)**	**K10 score Mean (std)**
Gender				
Male	465 (47.69)	15.76 (5.87)	2,109 (45.53)	16.39 (6.51)
Female	510 (52.31)	17.78 (6.92)	2,523 (54.47)	17.77 (7.25)
Age				
15 years	197 (20.21)	16.62 (6.84)	197 (4.25)	16.62 (6.84)
16 years	240 (24.62)	16.60 (6.29)	240 (5.18)	16.60 (6.29)
17 years	184 (18.87)	17.38 (6.43)	363 (7.84)	17.22 (6.74)
18 years	195 (20)	16.8 (6.26)	399 (8.61)	16.84 (6.43)
19 years	159 (16.31)	16.77 (6.89)	466 (10.06)	16.85 (6.79)
HH Income group (Lowest quintile)				
Low	222 (22.77)	18.37 (7.65)	931 (19.78)	19.34 (8.32)
High	753 (77.23)	16.36 (6.07)	3716 (80.22)	16.59 (6.46)
Mother's Education (Low= secondary or lower)				
Low	204 (20.92)	16.80 (6.67)	1759 (37.97)	17.71 (7.27)
High	771 (79.08)	16.80 (6.48)	2873 (62.03)	17.00 (6.87)
Mother's occupational status (Lowest quintile)				
Low	216 (22.15)	17.43 (7.12)	943 (20.36)	18.46 (7.88)
High	759 (77.85)	16.64 (6.33)	3689 (79.64)	16.80 (6.66)
Did not live with both parents				
No	652 (66.87)	16.03 (5.69)	3169 (68.42)	16.56 (6.46)
Yes	323 (33.13)	18.41 (7.7)	1463 (31.58)	18.40 (7.79)

For a deeper understanding of maternal background groups, the mental health opportunity profile of the study participants is provided in Table 4.2. Depending upon household income, maternal education, maternal occupation and living history arrangement of the participant, 16 types of background groups are identified. The groups are ranked in ascending order according

to the average K10 score (lower score implies better mental health). Out of 16 groups, there are three groups with high risk level of developing a mental disorder. Three more groups also show a K10 average of more than 19 and sightly avoid entering into the high-risk group. In addition, the high household income attribute has been clustered into lower rankings and vice versa.

Table 4.2: Mental health opportunity profile

Rank	HH income	Mother's education	Mother's occupational status	Did not live with both parents	Group sample size (n)	Average k10 score of the participant	Risk level
1	High	Low	High	No	328	16.1	Low
2	High	High	High	No	2032	16.25	Low
3	High	Low	Low	Yes	68	16.53	Low
4	High	High	Low	No	208	16.62	Low
5	High	High	High	Yes	731	17.12	Low
6	Low	High	High	No	231	17.17	Low
7	Low	High	Low	No	100	17.48	Low
8	High	Low	High	Yes	97	17.52	Low
9	High	Low	Low	No	150	17.69	Low
10	High	High	Low	Yes	87	18.72	Low
11	Low	Low	Low	No	81	19.26	Low
12	Low	Low	High	Yes	46	19.28	Low
13	Low	Low	High	No	39	19.97	Low
14	Low	High	High	Yes	185	20.7	High
15	Low	Low	Low	Yes	107	20.89	High
16	Low	High	Low	Yes	142	21.15	High

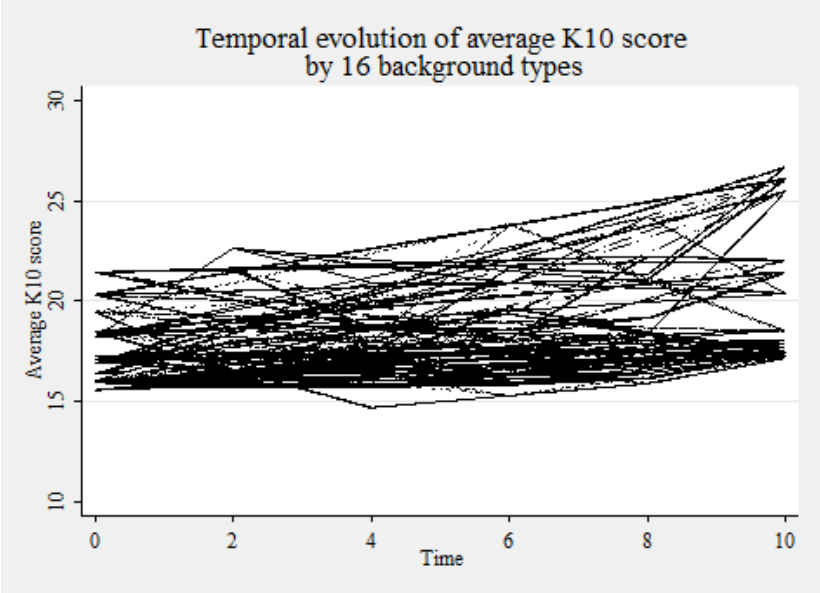

Figure 4.2: Temporal evolution of mental health Status (K10 score) by background

To further investigate, we plot the temporal evolution by the 16 maternal background types in Figure 4.2. The thick line (trend values varies between 15 and 25) shows that there also exist a lot of group level variability overtime in the average K10 scores. The trend analysis thus indicates both individual and group level variability and justifies analysing the data through a multi-level modelling approach.

4.3.2 Regression analysis

The results of the regression models are in Table 4. 3. Since, a single point change in the average K10 score might not mean anything unless it drives up into other risk categories Table 4.3 considers a dichotomous dependent variable ($K10 \geq 20$ implies a higher risk of mental disorder) which measures risks through nonlinear estimation of odds ratios. The 'null' model results are shown in the first column. The 'null' model considers no explanatory variable and focuses just between and within individual variability. The random effect variances estimate for both maternal background level (level 3 $\sigma 2v0$ is 0.423 and SE is lower at 0.202) and individual level (level 2 $\sigma 2u0$ is 4.101 and SE is also much lower at 0.422) of the null model justifies the use of the multi-level approach. The second model in Table 3 shows the fixed effect logit estimates for comparison purpose. Unlike multilevel (ML) models, the logit does not have a random component and only shows fixed effects of the variables. To understand the maternal background variability, we do not consider the fixed effect of maternal background in the third model (Mixed 1 multilevel model). However, the final multilevel model (mixed 2) considers maternal background fixed effects. Individual fixed effects are considered in all models.

The individual-level circumstances category variables are highly significant in all models. For example, exposure to an additional financial shock has a 1.4 times higher risk of having a mental illness than individuals who do not experience a shock (logit Adjusted Odds Ratio [AOR]: 1.321, 95% CI: 1.243-1.404; Mixed 1 AOR: 1.436, 95% CI: 1.298-1.589 and Mixed 2 AOR: 1.412, 95% CI: 1.277-1.561). Similarly, a single life event shock increases the risk of having a mental disorder by 1.15 times higher (logit AOR: 1.156, 95% CI: 1.059-1.262; Mixed 1 AOR: 1.161, 95% CI: 1.013-1.331 and Mixed 2 AOR: 1.157, 95% CI: 1.01-1.326). This is considerable if you consider the possibility of experiencing multiple life events and financial shocks in a period. In

Table 4.3: Parameter estimates of different logit regression models

(Depedent variable: Whether likely to have mental disorder- i.e. K10 ≥ 20)

	Null			Logit			Mixed 1			Mixed 2		
Fixed effects	Estimate (OR)	Std error	95% CI	Estimate (AOR)	Std error	95% CI	Estimate (AOR)	Std error	95% CI	Estimate (AOR)	Std error	95% CI
Intercept	0.296***	0.059	(0.2-0.437)	0.168***	0.017	(0.138-0.204)	0.075***	0.018	(0.047-0.12)	0.05***	0.011	(0.322-0.078)
Wave (time)				1.019	0.011	(0.998-1.04)	0.999	0.022	(0.957-1.042)	1.00	0.022	(0.961-1.047)
Individual characteristics												
Gender - Female (Ref.: Male)				1.484***	0.108	(1.286-1.712)	2.063***	0.363	(1.461-2.913)	2.021***	0.355	(1.431-2.851)
Rural resident - Yes (Ref. : No)				0.759*	0.095	(0.593-0.97)	0.89	0.195	(0.579-1.366)	0.899	0.197	(0.586-1.383)
Number of financial shock				1.321***	0.041	(1.243-1.404)	1.436***	0.074	(1.298-1.589)	1.412***	0.072	(1.277-1.561)
Number of life event shock				1.156***	0.052	(1.059-1.262)	1.161*	0.081	(1.013-1.331)	1.157*	0.08	(1.01-1.326)
Long term health condition - Yes (Ref. : No)				2.232***	0.212	(1.853-2.688)	2.934***	0.502	(2.098-4.103)	2.855***	0.488	(2.042-3.99)
Club activities - Yes (Ref. : No)				0.651***	0.05	(0.559-0.758)	0.623***	0.078	(0.487-0.797)	0.635***	0.08	(0.496-0.812)
Daily smoker - Yes (Ref. : No)				1.241*	0.125	(1.018-1.512)	1.801**	0.339	(1.246-2.604)	1.676**	0.313	(1.162-2.416)
Heavy drinker - Yes (Ref. : No)				1.344***	0.099	(1.163-1.554)	1.651***	0.209	(1.288-2.117)	1.649***	0.209	(1.286-2.114)
Obese - Yes (Ref. : No)				1.131	0.11	(0.935-1.367)	1.372	0.269	(0.935-2.014)	1.311	0.256	(0.895-1.921)
Background characteristics												
Household Income - Low (Ref. : High)				1.258*	0.116	(1.05-1.506)				1.572*	0.349	(1.017-2.43)
Mothers Education - Low (Ref. : High)				0.972	0.088	(0.814-1.162)				0.921	0.203	(0.597-1.421)
Mothers' occupation - Low (Ref. : High)				1.188	0.109	(0.992-1.423)				1.314	0.296	(0.845-2.043)
Did not live with both parents - Yes (Ref. : High)				1.183*	0.091	(1.017-1.376)				1.586*	0.298	(1.097-2.294)
Random effects												
Background (level 3)												
Intercept variance σ^2_{v0}	0.423	0.202	(0.166-1.08)				0.078	0.082	(0.01-0.608)	7.14e-32	3.89e-17	
Individual (level 2)												
Intercept variance σ^2_{u0}	4.101	0.422	(3.353-5.017)				4.068	0.718	(2.878-5.749)	4.116	0.720	(2.921-5.8)
Wave variance σ^2_{u1}							0.062	0.015	(0.039-0.098)	0.062	0.015	(0.039-0.099)
Covariance σ^2_{v0v1}							-0.091	0.071	(-0.231-0.048)	-0.098	0.071	(-0.238—0.041)
ICC												
$rho_{background}$	0.054	0.024	(0.022-0.127)				0.011	0.011	(0.001-0.076)	9.64e-33	5.26e-18	
$rho_{individual \mid background}$	0.579	0.026	(0.527-0.629)				0.558	0.043	(0.472-0.64)	0.556	0.043	(0.47-0.063)

addition, the study results also found that individuals who have long term health conditions are approximately 2.9 times highly likely to have a mental condition (logit AOR: 2.232, 95% CI: 1.853-2.688; Mixed 1 AOR: 2.934, 95% CI: 2.098-4.103 and Mixed 2 AOR: 2.855, 95% CI: 2.042-3.99).

The individual effort or lifestyle category variables such as 'daily smoker', 'heavy drinker' and 'active membership of club or sporting activities' are also significant in all models. Club activities have a positive effect on mental health (logit AOR: 0.651, 95% CI: 0.559-0.758; Mixed 1 AOR: 0.623, 95% CI: 0.487-0.797 and Mixed 2 AOR: 0.635, 95% CI: 0.496-0.812). On the contrary, negative habits such as smoking (logit AOR: 1.241, 95% CI: 1.018-1.512; Mixed 1 AOR: 1.801, 95% CI: 1.246-2.604 and Mixed 2 AOR: 1.676, 95% CI:1.162-2.416) and drinking (logit AOR: 1.344, 95% CI: 1.163-1.554; Mixed 1 AOR: 1.651, 95% CI: 1.288-2.117 and Mixed 2 AOR: 1.649, 95% CI: 1.286-2.114) have deteriorating effects on mental health. This study, however, did not find any significant association of being obese and mental health for the study cohort in all our models. In the case of demographic variables, the study found that women are twice as likely as men to have a mental disorder (logit AOR: 1.484, 95% CI: 1.286-1.712; Mixed 1 AOR: 2.063, 95% CI: 1.461-2.913 and Mixed 2 AOR: 2.021, 95% CI: 1.431-2.851). However, the 'rural resident' variable was found to be significant in only the logit estimate (AOR: 0.759, 95% CI: 0.593-0.97). In addition, the study found an insignificant association between the sample period (time variable) and mental disorder of the study cohort.

In our findings, individual-level fixed effects have much stronger impacts on mental health than maternal background characteristics. We found that only household income and parental living arrangement (whether participants did not have the opportunity to live with both biological parents) were significant. Individuals who grew up in a poor household have approximately 1.6 times more likely to have mental disorder compared to youth who grew up in an affluent family (logit AOR: 1.258, 95% CI: 1.05-1.506; Mixed 2 AOR: 1.572, 95% CI: 1.017-2.43). Similarly, individuals who did not grow up with both biological parents in their childhood have approximately 1.6 times more likely to have mental disorder compared to the youths who grew up with both parents (logit AOR: 1.183, 95% CI: 1.017-1.376; Mixed 2 AOR: 1.586, 95% CI: 1.097-2.294).

However, in our study, neither the mother's education nor her occupational status were significant in any model. In addition, the random variances of maternal background in multilevel models were much lower compared to the null model (Null σ2v0: 0.423, 95% CI: 0.166-1.08 and Mixed 1 σ2v0: 0.078, 95% CI: 0.01-0.608). Indeed, the background variance disappears if fixed effect background characteristics are considered. Contrary to background random effects, individual-level intercept variances are much larger (Null σ2u0: 4.101, 95% CI: 3.353-5.017, Mixed 1 σ2u0: 4.068 95% CI: 2.878-5.749 and Mixed 2 σ2u0: 4.116, 95% CI: 2.921-5.8). In summary, rather than the group level maternal backgrounds, the driving forces in mental health outcomes of the youths are the individual-level characteristics.

4.4. Discussion

The present study aimed to investigate the influence of group-level maternal background characteristics and individual level circumstances-effort characteristics on the performance of youth mental health over time in Australia. For this purpose, the study sampled the 15-19 years cohort data from the long-running HILDA survey and followed 10 years for up to six measured points. Past research amassed substantial evidence in linking maternal education and occupation, with a child's health outcomes (Reiss 2013; Arroyo-Borrell et al. 2017; Meyrose et al. 2018). However, contrary to this, we did not find any evidence linking youths' mental health with mother's education in any of our regression results. Perhaps, the thesis examined by Patrick West in earlier research plays a role in this context. West argued that youth, in contrast to childhood, possess a process of equalisation which removes the influences of certain dimensions of family background differences (such as maternal education in our case) in youth mental health (West 1997). Few studies have explored this area, and further work is needed for the youth age groups. It is possible that as youth become more independent that the influence of mothers' education becomes less important. We did, however, find a significant impact of household income and family living arrangement on the mental health performance of the youth. This impact is supported by other empirical literature (Reiss 2013; Arroyo-Borrell et al. 2017; Perales et al. 2017; Meyrose et al. 2018).

In order to investigate the underlying value judgement of individual effects, we followed the equality of opportunity theory and categorised our variables into

circumstances and effort groups (Roemer 1998; Roemer & Trannoy 2016). Our estimated results are consistent with the theory. We found that financial shocks, life event shocks and long-term health conditions significantly deteriorate youth mental health condition. These findings are consistent with the adverse event literature (Dalgard et al. 1995; Schilling et al. 2007; Hashmi et al. 2020). In addition, we found that negative health habits such as smoking and drinking worsen mental health where as positive social habits such as a club or sporting activities favours mental health, which is also in line with existing research (Buttery et al. 2014). Certainly, as youth become independent, the role of social relationships with people outside of families become particularly important in bolstering mental health.

One of the major contributions of this study is that we considered individual and group level variability through a multilevel modelling technique that other studies in the literature ignore. We found that there exists significant variability in individual-level characteristics. In addition, individual-level slope and intercepts also varied across time. However, compared with individual effects, the group level impact of maternal background characteristics did not vary. The implication of our finding is that, even though even though some dimensions of maternal background have significant influences, the impact of maternal background is much smaller than the individual effects such as financial and adverse life events, long-term health conditions, and health behaviour related activities (smoking and drinking habits).

Our results and findings have some interesting implications. Our findings stimulate discussion about the mechanism of maternal background linking the mental health childhood and adult cohorts. The findings suggest, more research is needed both in childhood and adult cohorts to further our understanding as to the impact of maternal background. Whilst maternal background may shape health in early childhood, its role in shaping youth health and mental health may not be so clear. On the other hand, there are a number of factors that are clearly linked to youth mental health trajectories, including their physical health during ages 15-19. Policy makers might therefore be interested in implementing health-related behavioural interventions to promote both physical and mental health. Another observation of this study also suggests the importance of providing ongoing support to youth who have experienced financial and adverse life events in order to prevent long-term mental illness. This may include financial, care coordination and emotional support to manage the consequences of the

adverse events in the short-term and trauma-informed psychological care in the long-term. Detailed research in the methodology and design of such interventions as well as estimation of the associated delivery costs of such program is needed.

4.5 Conclusions

In summary, our findings contribute to current knowledge by drawing attention to the lack of impact of maternal background on youth mental health. It is imperative that future research examines further the link of maternal background between younger and older age cohorts. The main strength of our study is the use of an equality of opportunity framework and multilevel modelling techniques to address critical questions on youth mental health in Australia. Policy-wise, mental health interventions should consider the heterogeneity of adverse youth circumstances and health-related behaviours. This research will provide essential insights into how to improve such interventions.

CHAPTER 5

SOCIOECONOMIC INEQUALITIES IN MENTAL HEALTH IN AUSTRALIA: EXPLAINING LIFE SHOCK EXPOSURE

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Declaration of Competing Interest

Rubayyat Hashmi, Khorshed Alam and Jeff Gow declare no conflict of interest.

Highlights

- 24.7% to 40.5% of the mental health inequality are due to life-shocks.
- Mental health inequality due to life shocks is large in Australia.
- Lower SES groups experience more life shocks than higher SES groups.
- Financial hardship shocks contribute up to 35% of inequality in socioeconomic inequality.

ABSTRACT

Background

Recent research suggests that there exists a strong link between life shocks and mental health. However, research on the distributional aspects of these shocks on mental health status is limited. In the health inequality literature, no Australian studies have examined this relationship.

Objective

This study examines the distributional impact of life shocks (negative life events and financial hardships) on mental health inequality among different socioeconomic groups in a longitudinal setting in Australia.

Methods

This study analysed the data of 13,496 individuals from the Household, Income and Labour Dynamics in Australia (HILDA) survey, waves 12-17 (2012-2017). Using concentration index and Blinder-Oaxaca approaches, the study decomposed socioeconomic inequalities in mental health and changes in inequalities in mental health over the study period. The study used frailty indices to capture the severity of life shocks experienced by an individual.

Results

The results suggest that exposure to just one life shock will result in a greater risk of mental disorder in the most disadvantaged socioeconomic groups. The results also indicate that 24.7% to 40.5% of pro-rich socioeconomic mental health inequality are due to life shocks. Financial hardship shocks contribute to 21.6% to 35.4% of inequality compared with 2.3% to 5.4% inequality generated by negative life event shocks across waves.

Conclusions

Lower SES groups experience more life shocks than higher SES groups and in turn generate higher socioeconomic mental health inequality. Policies aimed at reducing socioeconomic inequality in mental health should account for these shocks when designing interventions.

5.1 Introduction

Unequal distribution of mental health status among different socioeconomic groups constitutes a serious challenge in achieving equitable mental health care (Pickett & Wilkinson 2010; Macintyre et al. 2018). The challenge arises not only because the justification for unfair distribution is debatable but also the identification of the root causes of the unfair distribution is difficult to ascertain (Fleurbaey & Schokkaert 2011). Indeed, the Grand Challenges in Global Mental Health initiative (a consortium of researchers, advocates and clinicians) has set the identification of root causes, risk and protective factors as a top priority for research in the area over the coming decade (Collins et al. 2011). Some recent advances include identification of socioeconomic mental health inequalities in adults (Morasae, Forouzan, Majdzadeh, et al. 2012) and in children and adolescents (Reiss 2013). This research is ongoing and since socioeconomic differences in mental health status evolve over a life course, a multidimensional perspective is needed to understand the causal pathway(s) (van Kippersluis et al. 2010).

One particular dimension that needs attention in mental health inequalities from a life course perspective is life shocks. Life shocks are adverse events that people experience during their life (Corman et al. 2011; Curtis et al. 2013). Depending on the circumstances, some of these events may have severe psychological impacts on the individuals involved. This study investigates two kinds of life shocks: negative life events and financial hardship. Previous studies have shown a strong association between financial hardship and adverse mental health (Butterworth et al. 2009; Bradshaw & Ellison 2010; Selenko & Batinic 2011) and negative life events and adverse mental health (Dalgard et al. 1995; Kornblith et al. 2001; Volanen et al. 2007). Even though these studies have found an association between life shocks and mental health, the distributional impact of exposure to life shocks on socioeconomic mental health inequality is poorly understood. Little attention has been paid to the impact of life shocks (negative life events and/or financial hardship) on the socioeconomic gradient of mental health. Understanding these short-run shocks is crucial to designing efficient policies for social support, such as cash transfers and developing effective social programs including psychological support.

A concentration index measures the degree of socioeconomic inequality in a health variable. Figure 5.1 shows the time trend of a concentration index constructed from both mental health inventory 5 (MHI-5) and mental component score (MCS) in Australia between 2012 and 2017. It shows that socioeconomic mental health inequality is increasing overtime. This socioeconomic disparity on mental health, raises questions on the factors that contribute to this inequality. In addition, life shock exposure by socioeconomic status also shows that lower socio-economic groups have significantly higher exposure to life shocks than higher socioeconomic groups. (See Figure A1 and A2 of Appendix A in supplemental data). Thus, the objective of this study is to assess the impact of life shocks on socioeconomic inequality in the mental health status of Australian adults in a longitudinal framework. To this end, the study seeks to address three specific research questions. i) Is the impact of life shocks on mental health status significant for Australian adults? ii) If so, to what extent do these life shocks contribute to the inequality in mental health status between rich and poor individuals? and iii) What are the temporal impacts of the effects of life shocks on income related mental health inequality? In Australia, one in five people experience some form of mental illness annually. Given such circumstances, the motivation for this study is to explain such research questions in an Australian setting to assist those experiencing mental health issues. Understanding the contribution of life shock exposure to mental health inequality will help develop mitigating strategies for individuals who are vulnerable to such exposure and hopefully lead to more equitable health policies and practices.

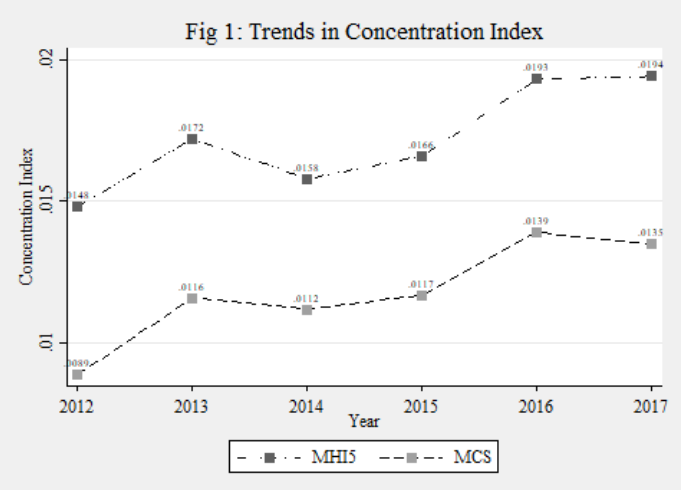

Figure 5.1: Trends in concentration indices using MHI5 and MCS as health variable and equivalent household income as ranking variable by wave

5.2 Methods

5.2.1 Data and study variables

5.2.1.1 The HILDA Dataset

The Household, Income and Labour Dynamics of Australia (HILDA) dataset is a nationally representative household-based longitudinal survey in Australia. The survey which commenced in 2001 is conducted annually. All members of the household are enumerated in the data collection procedure. However, individual and household level data are collected using both face-to-face interviews and self-completion questionnaires for those aged 15 years or older. HILDA data from wave 12 to wave 17 (2012-2017) were analysed in this study. The study included the new top-up samples that were introduced in wave 11. To compare waves, the study constructed a balanced panel of 13,496 individuals. A missing observation analysis was conducted for item non-response and the analysis found that on average 9% of responses were missing for the life shocks and mental health score variables (see Table 10 of Appendix A in supplemental data for missing analysis). The missing responses were imputed though the last observation carry forward method to produce conservative estimates. The socio-demographic and SES variables did not have a nonresponse problem. To account for sample attrition and panel characteristics, the longitudinal weights for wave 12 to wave 17 in HILDA data were used to adjust all calculations. The estimated population size after longitudinal weight adjustment was 16,699,284. Detailed information on survey design and sample weights can be found elsewhere (Summerfield et al. 2018).

5.2.1.2 Measures

In the health inequality literature, models are constructed according to their research objectives and use policy-relevant social determinants of health measures along with the SES and demographic variables (Morasae, Forouzan, Majdzadeh, et al. 2012; Hajizadeh et al. 2018). For this study's purpose, the following measures were used:

5.2.1.2.1 Mental health

This study used the Mental Health Inventory (MHI-5) of the Short Form 36 instrument (SF-36), a widely validated and reliable mental health measure (Sanson-Fisher & Perkins 1998; Butterworth & Crosier 2004). This instrument has been used in a large body of medical literature (Crosier et al. 2007; Leese et al. 2008; Ulvik et al. 2008)

and health economics literature (Green 2011; Bechtel et al. 2012). The scale is constructed from five items (nervous, down in dumps, peaceful, sad and happy) and its value ranges from 0-100. Higher scores imply higher levels of mental health. The MHI-5 measure also has clinical significance. A cut-off point of 76 MHI-5 score can be used to define a case of common mental disorder (Kelly et al. 2008). The study also constructed the Mental Component Score (MCS) using HILDA SF-36 questionnaire responses for sensitivity analyses (see Appendix A in supplemental data for the sensitivity results).

5.2.1.2.2 Life shocks (Negative life event and financial hardship)

A negative life event is defined as direct exposure to a traumatic event as experienced by an individual, for example, separation from spouse, serious personal injury or being detained in jail (American Psychiatric Association 2013). Financial hardship occurs when individuals experience adverse economic shocks or circumstances. For example, went without meals or being unable to heat home (Kahn & Pearlin 2006). This study uses nineteen life shocks (seven financial hardship and twelve negative life event items) to account for the effect of life shocks on socio-economic inequalities in mental health. The list of life shock items and their descriptive statistics are provided in Table 5.1. A frailty index (FI) is used to measure the intensity of negative life events and financial hardship. FI is widely used in the health and aging literature to measure accumulation of deficits in health from aging (Mitnitski et al. 2001). It is expected that individuals with lower SES will accumulate considerable more adverse outcomes over their life time and the FI is thus a simple measure that can capture these adverse effects. The formula for measuring the frailty index is (Searle et al. 2008):

$$\text{frailty index (FI)} = \frac{\text{Number of adverse outcome presents}}{\text{Number of adverse outcome measured}} \qquad (5.1)$$

The range of this index is between 0 and 1. Higher values indicate that the respondent has accumulated a greater number of life shocks.

5.2.1.2.3 Income

Equivalised household disposable income was used to measure SES and construct the income component of the CI (Concentration Index). The study used a 'modified OECD' equivalence scale to measure disposable household income. The formula for equivalised household income is given by (ABS 2006):

$$\text{Equivalised income} = \frac{\text{Household Disposable income}}{(1 \text{ x first adult} + .5 \text{ x additional adult} + .3 \text{ x additional child})} \quad (5.2)$$

5.2.1.2.4 Other control variables

Education and labour force status along with equivalised income quartiles were used to control for other characteristics of SES in the analysis. Demographic characteristics like age and gender were also controlled for in the analysis. Since previous studies have found a link between mental health and club/sporting activities, the study also controlled for that factor (Eime et al. 2013). Respondents in the HILDA survey were asked as to whether they were: "currently an active member of a sporting/hobby/community based club or association?" and the study used it as a dummy variable to indicate club participation. The study also controlled for long term health conditions. Previous studies have found strong relationships between mental health and long term health conditions (Scott et al. 2007).

5.2.2 Statistical analysis

The study first analysed the relationship of life shock exposure (mean scores of financial hardship index and negative life events) and income. The analyses found that the lower quartile income group has significantly higher life shock exposure than the higher quartile income groups (see Figures A1 and A2 of Appendix A in supplemental data). Using the concentration index to measure socioeconomic health inequality, the study also found that socioeconomic mental health inequality was increasing in the study period as portrayed in Figure 5.1 and thereby the study research questions were formulated. Descriptive statistics in Table 5.1 show the population characteristics of the variables. To account for survey design and survey weights, the SVY command of STATA 15.0 software is used for all calculations (STATA 2019). The CONINDEX command is used to calculate concentration indices (O'Donnell et al. 2016).

5.2.2.1 Concentration index and cross-sectional decomposition

The concentration index (CI) is a rank dependent inequality index that measures socioeconomic inequality in health (Wagstaff et al. 1989). The value of the CI is bounded by -1 and 1, and is defined as follows (Kakwani 1980; Kakwani et al. 1997):

$$CI = \frac{2}{\bar{h}} cov(h_i, R_i) \quad (5.3)$$

$$=> CI = \frac{2}{n\bar{h}} \sum_{i=1}^{n} h_i R_i - 1 \qquad (5.4)$$

Where, a population of n individuals with health levels h_i is ranked by income or by some other SES, ordered from poorest to richest given fractional rank $R_i = \frac{2i-1}{2n}$, $\bar{h} = \frac{\sum_{i=1}^{n} h_i}{n}$ and $i = 1, 2, \ldots, n$. A positive (negative) value of the CI indicates that the health variable is concentrated among the rich (poor) and the health variable has a pro-rich (pro-poor) distribution.

Wagstaff et al. (2003) in their seminal paper showed that if health is a linear function of k factors (e.g., demographic, lifestyle and SES) then the CI is a weighted sum of the socio-economic inequalities in these factors. Thus, the CI can be decomposed given the following regression model:

$$h_i = \alpha + \sum_{j=1}^{k} \beta_j x_{ij} + u_i \qquad (5.5)$$

Where, α and $\beta_j, j = 1 \ldots k$ are coefficients to be estimated, and u_i is the error term with $E[u_i] = 0$. Substituting (5.5) into (5.4) and with some algebra, Wagstaff et al. (2003) showed the following:

$$CI = \sum_k \eta_k CI_k + GC_u/\bar{h} \qquad (5.6)$$

Where, $\eta_k = \beta_k \frac{\bar{x}_k}{\bar{h}}$ measures the average elasticities or the magnitude of the effect of k factors and CI_k is the concentration index of factor x_k. The first term $\eta_k CI_k$ of each factor x_k indicates the contribution to socioeconomic inequality by x_k. Thus, $\sum_k \eta_k CI_k$ is the total contribution of socio-economic inequality explained by the model. The residual term, CI_u, is the error term measuring unexplained socioeconomic inequality. The following steps are taken to decompose the concentration index:

Step 1: An OLS regression of mental health score (MHI-5) on life shocks (financial hardship and negative life events), age categories and gender dummies, income quartiles, education, labour force status, club/sporting activities and long-term health conditions for each wave was first run (using the svy command). The regression results are shown in Table 5.2.

Step 2: Using the svy and mean command the study also calculated mean values of all variables.

Step 3: Using the mean values and beta coefficients from the OLS regression, elasticities were calculated for all independent variables.

Step 4: Concentration indices of all independent variables were calculated using the conindex and svy command.

Step 5: Following equation 5.4, elasticities and concentration indices of each independent variables were then multiplied to get the relevant contribution of the variable.

Step 6: All previous steps were repeated to get a pooled estimates using the panel data. Pooled estimate reflects the average contribution of factors for all waves.

Step 7: All previous steps were repeated to conduct sensitivity analysis using mental component score (MCS) as the dependent variable instead of MHI-5 (see Appendix A in supplemental data for the sensitivity results).

5.2.2.2 Decomposing changes in CI

From Figure 5.1 it is clear that socioeconomic mental health inequality is rising in Australia over the study period. Thus, the third objective of this study was formulated where the research objective is to investigate the temporal impacts of life shocks on mental health inequality using the Oaxaca (1973) and Blinder (1973) type decomposition approach. Wagstaff et al. (2003) first used the Oaxaca-Blinder type decomposition in the health economics literature to analyse the factors that change health inequality. Using equation 5.6 and applying the Oaxaca-Blinder method, the following equation for time period t and $t-1$ results:

$$\Delta CI = \sum_k \eta_{kt}(CI_{kt} - CI_{kt-1}) + \sum_k CI_{kt-1}(\eta_{kt} - \eta_{kt-1}) + \Delta \mathrm{G}CI_u/\bar{h} \qquad (5.7)$$

The first and second terms in equation 5.7 show that the extent of changes in the CI are due to changes in inequality in the determinants of health and changes in their elasticities, respectively. The third term is the residual or unexplained component. The following steps were taken to analyse the decomposition in the changes in the concentration index of mental health.

Step 1: Using the methods described in the previous section, estimate all elasticities and concentration indices of all factors.

Step 2: Subtract previous period elasticities from current elasticities for all factors. Similarly subtract previous period concentration indices from current period concentration indices for all factors.

Step 3: For each factor multiply wave wise change in concentration indices with current period elasticities ($\Delta C\eta$) and multiply wave wise change in elasticities with current period concentration indices ($\Delta\eta C$) as in equation 5.7.

Step 4: Adding $\Delta C\eta$ and $\Delta\eta C$ for each factor will result in the total contribution to changes in that factor. The compiled results of all these factors are provided in Table 4 (see Appendix A in supplemental data).

Step 5: Similar analyses were done using MCS score as a dependent variable for sensitivity analysis (see Appendix A in supplemental data for the sensitivity results).

5.3 Results

5.3.1 Descriptive statistics

Table 5.1 shows the longitudinal survey weight adjusted summary statistics of wave 12 and wave 17 of HILDA data for all key variables. The weight adjusted HILDA sample statistics are nationally representative and it infers results for 16.7 million in-scope individuals in the target population. The key objective variables in this study are mental health (MHI-5 score), and life shocks (financial hardship and negative life events). The mean mental health score is 74.5 and 73.35 for wave 12 and wave 17 respectively indicating average mental health population score has worsened. Since the threshold mental health score is 76, the risk of suffering mental illness for an average Australian is now greater. The mean value of financial hardship index and negative life event index are 0.063 and 0.053 respectively for wave 12. These values were reduced to 0.059 and 0.046 respectively in wave 17. This implies the Australian population as a whole experienced a lower number of life shocks in wave 17 than wave 12.

Table 5.1: Longitudinal survey weight adjusted sample characteristics (wave 12 and 17) of variables of interest in the HILDA database (observations: 13,496; population size: 16,699,284)

Variables	Wave 12		Wave 17	
	Mean	SD	Mean	SD
SF-36 mental health score (MHI5)	74.503	16.851	73.353	17.579
SF-36 mental health score (MCS)	49.117	10.081	48.265	10.570
Financial hardship score	0.063	0.147	0.059	0.147
Variables used to construct financial hardship score:				
Could not pay electricity, gas or telephone bills on time	0.126	0.330	0.112	0.314
Could not pay the mortgage or rent on time	0.059	0.234	0.055	0.226
Pawned or sold something	0.046	0.208	0.042	0.200
Went without meals	0.030	0.169	0.035	0.181
Was unable to heat home	0.030	0.169	0.030	0.169
Asked for financial help from friends or family	0.116	0.318	0.105	0.305
Asked for help from welfare/community organisations	0.033	0.177	0.032	0.175
Negative life events score	0.053	0.074	0.0455	0.068
Variables used to construct negative life events score:				
Separated from spouse	0.034	0.181	0.027	0.162
Serious personal injury/illness	0.081	0.270	0.079	0.268
Serious injury/illness to family member	0.156	0.361	0.122	0.325
Death of spouse or child	0.009	0.093	0.008	0.089
Death of close relative/family member	0.127	0.330	0.108	0.308
Death of a close friend	0.117	0.319	0.107	0.307
Victim of physical violence	0.015	0.121	0.011	0.102
Victim of a property crime	0.036	0.185	0.026	0.159
Detained in jail	0.002	0.040	0.002	0.046
Close family member detained in jail	0.013	0.114	0.013	0.114
Fired or made redundant	0.029	0.167	0.028	0.165
A weather-related disaster (flood, cyclone)	0.015	0.120	0.014	0.116
Male	0.490	0.496	0.490	0.496
Female	0.510	0.496	0.510	0.496
Age - 15-24 years	0.174	0.376	0.091	0.286
Age - 25-44 years	0.353	0.474	0.342	0.471
Age - 45-64 years	0.324	0.464	0.348	0.473
Age- 65-84 years	0.141	0.346	0.190	0.389
Age- 85+ years	0.009	0.094	0.030	0.168
HH income -Q1 0-25%	0.252	0.431	0.229	0.417
HH income-Q2 25-50%	0.279	0.445	0.235	0.421
HH income-Q3 50-75%	0.261	0.436	0.257	0.434
HH income-Q4 75-100%	0.208	0.403	0.279	0.445
Education-Year 12 or below	0.452	0.494	0.368	0.479
Education- Certificates & diploma	0.298	0.454	0.337	0.469
Education-Bachelor or honours degree	0.195	0.393	0.222	0.412
Education- Postgraduate degree	0.055	0.227	0.074	0.259
Labour force status- Employed	0.644	0.475	0.639	0.477
Labour force status -Unemployed	0.036	0.184	0.031	0.172
Labour force status -Not in the labour force	0.320	0.463	0.330	0.467
Club/community activities	0.352	0.474	0.355	0.475
Long term health condition	0.255	0.433	0.312	0.460

5.3.2 Regression results

Table 5.2 reports the individual and pooled OLS estimates. All variables, except education, are significant and have the expected signs. The results suggest that on average, ceteris paribus, women in general had about one-point lower mental health score than men, across waves. The difference in mental health score is also much higher between the younger and older populations. Older age (65-84) and (85+) groups had on average about eight and nine points higher mental health scores respectively than the reference group (15-24 years) implying a protective effect of retirement on mental health. Unsurprisingly, the results also show that higher income groups have higher mental health scores. The highest quartile income group had a 2.5 points higher mental health score than the lowest quartile income group, on average, across waves. The labour force status results report a negative relationship to mental health. An unemployed individual had lower mental health scores compared to an employed individual ranging from one to six points across waves. Individuals who are active members of sporting/community clubs received a positive effect on mental health ranging from three to four points across waves. Having long term health conditions also reduce mental health by approximately seven points, on average, across waves.

An increase in one additional life shock increases the financial hardship index by approximately 0.14 (there are seven financial hardship items) and one additional life shock increases the negative life events index by approximately 0.083 (there are twelve negative life events items). The main implications of the results are that an increase in one life shock will reduce an individuals' mental health score by approximately three points and two points for financial hardship and negative life events, respectively on average, across waves [0.14*(-20) = -2.8 ≈ -3] points and [0.083*(-18) = -1.5 ≈ 2 points). This is significant because these events have differential impacts on different socio-economic groups. For example, in wave 17, a young unemployed woman who is in the lowest quartile income group with long term health conditions and undertaking no sporting activities will have 28 points (-0.88-4.76-3.34-6.66-4.68-7.3= 27.62 ≈ 28) lower mean mental health score compared with a physically engaging middle aged working man in the richest income quartile with no long-term health conditions. Thus, exposure to just one life shock will result in a greater risk of lowering an individuals' mental health score below the cut-off score of 76, which in turn

increases the risk of developing a common mental disorder. In summary, life shocks significantly affect mental health and the impact differs by socio-economic status.

Table 5.2: Regression results

Variables	wave 12	wave 13	wave 14	wave 15	wave 16	wave 17	Pooled
SF-36 Mental Health Score: MHI-5 (Dep. variable)	n=13496 (unweighted) n=13262 (weighted) Population size: 16,699,284						
	Key objective variables						
Financial hardship score	-20.276*** (1.587)	-20.010*** (1.817)	-20.228*** (1.692)	-20.178*** (1.856)	-20.067*** (1.912)	-17.402*** (1.730)	-19.759*** (1.344)
Negative life event score	-18.766*** (2.900)	-17.080*** (3.126)	-20.979*** (3.243)	-22.079*** (3.187)	-16.242*** (3.499)	-16.045*** (3.510)	-18.259*** (2.217)
	Demographic variables						
-Male (ref.)							
-Female	-1.182*** (0.360)	-0.770** (0.334)	-1.203*** (0.359)	-1.225*** (0.341)	-0.935*** (0.364)	-0.879** (0.368)	-1.029*** (0.262)
Age							
-15-24 years (ref.)							
- 25-44 years	2.096*** (0.679)	0.904 (0.689)	0.967 (0.708)	1.080 (0.775)	1.479* (0.866)	1.200 (0.747)	1.148** (0.550)
- 45-64 years	3.306*** (0.639)	2.863*** (0.650)	2.787*** (0.691)	4.063*** (0.756)	3.732*** (0.904)	4.762*** (0.718)	3.447*** (0.567)
- 65-84 years	8.192*** (0.779)	8.175*** (0.818)	8.109*** (0.926)	9.164*** (0.937)	8.786*** (1.268)	9.923*** (1.177)	8.520*** (0.779)
- 85+ years	9.546*** (2.013)	12.330*** (1.665)	10.438*** (1.558)	8.0379*** (1.840)	9.426*** (1.779)	11.592*** (1.331)	9.547*** (1.216)
	SES variables						
Household income quartile							
-Q1 0-25% (ref.)							
-Q2 25-50%	1.498* (0.791)	2.670*** (0.9681)	1.443* (0.871)	1.522* (0.885)	2.951*** (0.955)	1.888* (1.096)	2.004*** (0.675)
-Q3 50-75%	1.5166** (0.725)	2.0803** (1.015)	0.8303 (0.753)	1.4863* (0.849)	3.2247*** (1.024)	3.2386*** (1.214)	2.027*** (0.724)
-Q4 75-100%	2.0121** (0.826)	2.9874*** (0.985)	1.9101** (0.792)	2.0144** (0.841)	3.4633*** (1.004)	3.3444*** (1.224)	2.552*** (0.751)
Education							
-Year 12 or below (ref.)							
- Certificates & diploma	0.230 (0.487)	1.126** (0.464)	0.128 (0.482)	-0.428 (0.507)	0.262 (0.567)	0.250 (0.567)	0.189 (0.398)
-Bachelor or honours degree	-0.817 (0.791)	-0.604 (0.723)	-0.783 (0.815)	-1.674** (0.816)	-0.976 (0.866)	-1.617 (1.026)	-1.132 (0.757)
- Postgraduate degree	-0.070 (1.783)	0.466 (1.356)	-0.364 (0.790)	-0.478 (1.283)	-0.692 (0.854)	-0.819 (0.814)	-0.408 (0.894)
Labour force status							
-Employed (ref.)							
-Unemployed	-2.434** (1.095)	-1.071 (1.528)	-1.227 (1.559)	-4.435*** (1.073)	-6.155*** (2.352)	-6.663** (2.785)	-3.575*** (0.978)
-Not in the labour force	-1.743*** (0.686)	-2.343*** (0.680)	-2.115*** (0.593)	-2.062*** (0.622)	-1.083* (0.593)	-2.842*** (0.636)	-2.019*** (0.440)
	Other variables						
Club/community activities	3.236*** (0.418)	3.302*** (0.488)	3.221*** (0.487)	4.082*** (0.468)	3.532*** (0.443)	4.681*** (0.534)	3.675*** (0.375)
Long term health conditions	-5.705*** (0.582)	-6.972*** (0.478)	-7.256*** (0.578)	-8.103*** (0.559)	-8.617*** (0.606)	-7.296*** (0.687)	-7.380*** (0.338)
Constant	74.142*** (0.858)	73.556*** (1.083)	74.756*** (0.803)	74.064*** (0.972)	72.067*** (1.190)	71.148*** (1.132)	73.496*** (0.750)

Notes: *** p < 0.01, ** p < 0.05, and * p < 0.1. Standard errors are in the parentheses.

5.3.3 Factor decomposition of mental health inequality

Table 5.3 presents the estimates of the factor decomposition of socio-economic mental health inequality. The first row of each variable measures the average elasticity indicating the impact of that determinant on mental health outcomes. The second row measures the CI or income related factor's inequality. The third row is a multiplicative term of the first and second rows which measures the factor 'contribution' to mental health. The sum of all factor contributions in a wave constitutes the explained part of

the total contribution of CI in mental health of that wave. For a health variable that represents better health with higher values (mental health score variable in this case), a positive (negative) contribution of a factor suggests that good mental health is concentrated among the rich (poor) by that factor and inequality is increasing leading to a pro-rich (pro-poor) distribution by that factor (O'donnell et al. 2008).

Table 3: Wagstaff - Doorslaer – Watanabe Decomposition results

Variables		wave 12	wave 13	wave 14	wave 15	wave 16	wave 17	Pooled
	η[a]	-0.017	-0.017	-0.017	-0.017	-0.017	-0.014	-0.016
Financial hardship score	CI[b]	-0.267	-0.292	-0.319	-0.291	-0.301	-0.300	-0.295
	Co[c]	**0.005**	**0.005**	**0.006**	**0.005**	**0.005**	**0.004**	**0.005**
	η	-0.013	-0.012	-0.015	-0.015	-0.011	-0.01	-0.012
Negative life event score	CI	-0.064	-0.039	-0.054	-0.045	-0.067	-0.059	-0.056
	Co	**0.001**	**0.000**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**
	η	-0.008	-0.005	-0.008	-0.009	-0.007	-0.006	-0.007
Female	CI	-0.030	-0.029	-0.029	-0.022	-0.026	-0.030	-0.027
	Co	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Age	η	0.010	0.004	0.005	0.005	0.007	0.006	0.005
- 25-44 years	CI	0.067	0.074	0.070	0.089	0.091	0.099	0.081
	Co	**0.001**	**0.000**	**0.000**	**0.001**	**0.001**	**0.001**	**0.000**
	η	0.014	0.013	0.013	0.019	0.017	0.023	0.016
- 45-64 years	CI	0.103	0.112	0.112	0.103	0.107	0.111	0.109
	Co	**0.002**	**0.001**	**0.001**	**0.002**	**0.002**	**0.003**	**0.002**
	η	0.016	0.017	0.018	0.022	0.022	0.026	0.019
- 65-84 years	CI	-0.349	-0.312	-0.288	-0.271	-0.268	-0.278	-0.289
	Co	**-0.005**	**-0.005**	**-0.005**	**-0.006**	**-0.006**	**-0.007**	**-0.006**
	η	0.001	0.002	0.002	0.002	0.003	0.005	0.002
- 85+ years	CI	-0.437	-0.472	-0.480	-0.531	-0.492	-0.531	-0.493
	Co	**-0.001**	**-0.001**	**-0.001**	**-0.001**	**-0.002**	**-0.003**	**-0.001**
Household income quartile	η	0.006	0.009	0.005	0.005	0.010	0.006	0.007
-Q2 25-50%	CI	-0.216	-0.232	-0.250	-0.282	-0.291	-0.307	-0.263
	Co	**-0.001**	**-0.002**	**-0.001**	**-0.001**	**-0.003**	**-0.002**	**-0.002**
	η	0.005	0.007	0.003	0.005	0.011	0.011	0.007
-Q3 50-75%	CI	0.324	0.276	0.247	0.221	0.209	0.185	0.244
	Co	**0.002**	**0.002**	**0.001**	**0.001**	**0.002**	**0.002**	**0.002**
	η	0.006	0.010	0.007	0.007	0.013	0.013	0.009
-Q4 75-100%	CI	0.792	0.765	0.746	0.739	0.732	0.721	0.749
	Co	**0.004**	**0.007**	**0.005**	**0.005**	**0.009**	**0.009**	**0.007**
Education	η	0.001	0.005	0.001	-0.002	0.001	0.001	0.001
- Certificates & diploma	CI	0.024	0.015	0.009	-0.001	-0.010	-0.013	0.005
	Co	**0.000**	**0.0001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	η	-0.002	-0.002	-0.002	-0.005	-0.003	-0.005	-0.003
- Bachelor or honours degree	CI	0.2307	0.2238	0.2228	0.234	0.234	0.2233	0.2292
	Co	**-0.001**	**-0.000**	**-0.001**	**-0.001**	**-0.001**	**-0.001**	**-0.001**
	η	-0.000	0.000	-0.000	-0.000	-0.001	-0.001	-0.001
- Postgraduate degree	CI	0.326	0.334	0.295	0.332	0.324	0.309	0.322
	Co	**0.000**	**0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**
Labour force status	η	-0.001	-0.001	-0.001	-0.002	-0.003	-0.003	-0.002
-Unemployed	CI	-0.169	-0.210	-0.321	-0.341	-0.252	-0.380	-0.281
	Co	**0.000**	**0.000**	**0.000**	**0.001**	**0.001**	**0.001**	**0.001**
	η	-0.008	-0.010	-0.009	-0.009	-0.005	-0.013	-0.009
-Not in the labour force	CI	-0.322	-0.313	-0.309	-0.318	-0.328	-0.341	-0.322
	Co	**0.002**	**0.003**	**0.003**	**0.003**	**0.002**	**0.005**	**0.003**
	η	0.015	0.017	0.016	0.020	0.016	0.023	0.018
Club/community activities	CI	0.050	0.047	0.066	0.046	0.054	0.049	0.052
	Co	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**
	η	-0.020	-0.027	-0.028	-0.033	-0.034	-0.031	-0.029
Long term health condition	CI	-0.202	-0.192	-0.216	-0.208	-0.236	-0.216	-0.210
	Co	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.007**	**0.006**
Total estimated Contribution		**0.014**	**0.017**	**0.016**	**0.016**	**0.020**	**0.020**	**0.017**
CI of Mental health		**0.015**	**0.017**	**0.016**	**0.017**	**0.019**	**0.019**	**0.017**

Notes: a. η represents elasticity. By definition $\eta_k = \beta_k \frac{\bar{x}_k}{\bar{h}}$, b. CI is concentration index of the row variable ranked by equivalised household income, c. Co is the contribution to mental health concentration index. Sum of all Co constitute the explained part of CI of mental health in a wave.

Over the study period, the socio-economic inequality of mental health ranged from 0.015 to 0.019 (last row in Table 5.3). Figure 5.2 shows the major factors' contribution by wave. Figure 5.2 reveals that life shocks contribute significantly to socioeconomic mental health inequality. The life shock contribution to mental health inequality ranges from 0.005 to 0.006 across waves. The contributions can be expressed as a percentage term by taking the percentage of a contribution to the actual concentration index. Life shock contributes to a pro-rich distribution and contribution to mental health inequality ranges from as low as 24.7% in wave 17 to as high as 40.5% in wave 14. From Table 5.3 it can be seen that financial hardship is the major driver of life shocks. It contributes to mental health inequality by 21% to 35% across waves. Negative life events contribute 2% to 5% of mental health inequality across waves. The demographic variables (age and gender) contribute to a pro-poor distribution because of the aging or retirement effect. Age reduces inequality by 23.6% to 32.5% across waves. However, SES variables (e.g., income, education and labour force status) explain approximately 69.6% of the pro-rich contribution to mental health inequality in wave 17. The lowest SES contribution is 43% in wave 14. Figure 5.2 shows broad category factors' contribution (see Appendix A in supplemental data for broad category factors' percentage contribution).

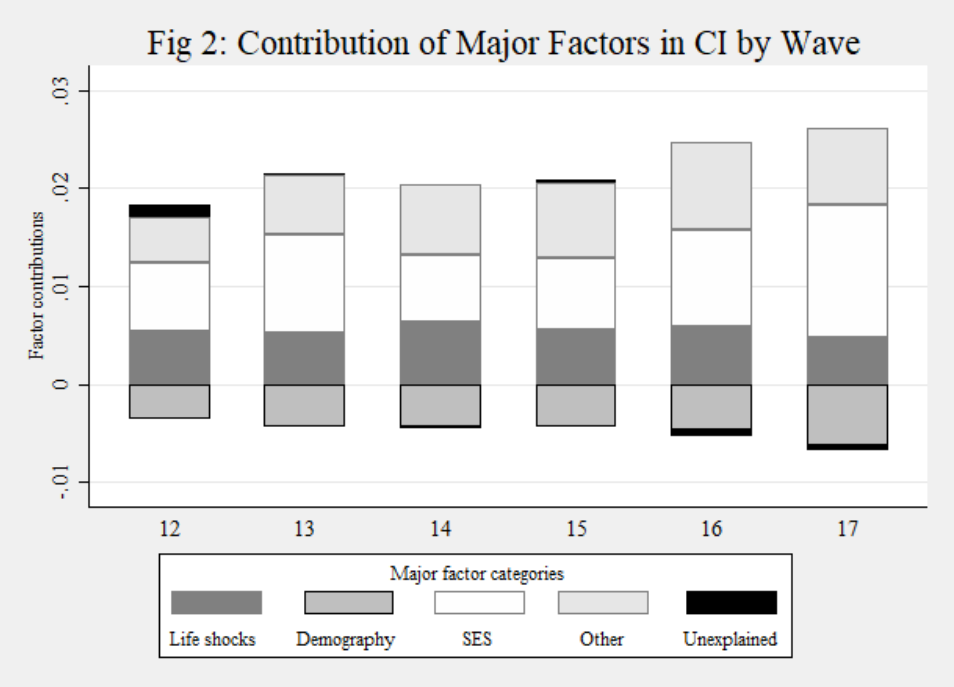

Figure 5.2: Contribution of major factors to socioeconomic mental health inequality by wave

The study also found that inequality is generated from both negative values of elasticities and concentration indices of factors from life shocks, being female, long term health conditions and labour force status for all waves. On the contrary, inequality is generated from both positive values of elasticities and concentration indices of factors from higher quartile income (Q3 and Q4), working aged population (aged 25-44 and 45-64 years) and club/community activities in all waves.

This study conducted sensitivity analyses using the mental component score (MCS) as the dependent variable. The clinical threshold score for MCS is lower than MHI-5. Thus, socioeconomic inequality is lower when the MCS is used. However, the trends and pattern of inequality are similar as can be seen in Figure 5.1 (see Appendix A in supplemental data for the sensitivity results). The results of the sensitivity analyses are provided in the appendix Table 6. The results are similar and the basic conclusion remains the same. Thus, mental health inequality arising from shocks are a major driver of socioeconomic mental health inequality in the Australian context.

5.3.4 Factor trajectories of changes in mental health inequalities

This study also investigated the factor trajectories of changes in mental health inequalities using the Oaxaca-Blinder decomposition approach (see Table 4 of Appendix A in supplemental data for the study results). This table explains how the inequality of mental health has changed overtime. The first and second row of each variable explains the contribution to changes in mental health inequality due to changes in factor inequality and changes in factor elasticity, respectively.

The results suggest that, in the study period, the highest quartile income group is still the major driver of socioeconomic mental health inequality. This group increased mental health inequality 0.003 and 0.004 in wave 12-13 and wave 15-16 respectively. “Not in the labour force” variable is another major driver that increased inequality by 0.003 in wave 16-17. Other variables that increased socioeconomic mental health inequality by at least 0.001 in at least one wave are: Q2 and Q3 income quartiles, bachelor or honours degree holders, long term health condition, financial hardship index, being unemployed and being 45-64 years of age. All these variables also had at least one wave where inequality reduced by at least 0.001 (except for the unemployed group). The older age group (65-84 and 85+ years) showed reductions in mental health

inequality in most waves. The results were also very similar when the MCS score was compared instead of MHI-5 in the sensitivity analysis (see Table 7 of Appendix A in supplemental data for the sensitivity results).

5.4 Discussion

In this study, the shocks of negative life events and financial hardship on mental health disparities among different socio-economic groups in Australia were examined. The study used the HILDA longitudinal survey which is comparable to the British Household Panel Survey (BHPS), the German Socio-Economic Panel (SOEP) and the Panel Study of Income Dynamics (PSID) of the USA. This contributes to the body of knowledge in the socioeconomic health inequality literature by addressing the effect of short-term shocks in a longitudinal setting. Although past studies have tackled socio-economic health inequality in a cross-sectional setting (Morasae, Forouzan, Majdzadeh, et al. 2012; Veisani & Delpisheh 2015) or in a longitudinal setting (Hauck & Rice 2004), no previous studies have quantitatively measured such shocks in the health inequality field.

The impact of SES and demographic variables in Australia are similar to what other country studies have found (Gundgaard & Lauridsen 2006; Morasae, Forouzan, Majdzadeh, et al. 2012; Brydsten et al. 2018). This study supports the argument of Kolodziej and García-Gómez (2019) that retirement has a protective effect on mental health. This study also showed that 65+ year groups have lower socioeconomic mental health inequality. The findings also showed the expected result that higher income groups have higher mental health status (Pickett & Wilkinson 2015). The results also found a negative relationship between unemployment and mental health status which is well documented in the literature (Burns et al. 2007; Paul & Moser 2009; Brydsten et al. 2018).

The major contribution of this study is to assess mental health inequality using a life course perspective where both life shocks and SES are considered. The results indicate that life shocks contribute significantly to socioeconomic mental health inequality. The negative concentration indices of life shock variables in Table 5.3 (i.e., the CI values in the second row of the life shock variables) indicate that the poor are exposed to more life shocks than the rich. In addition, the negative elasticity of the life shock variables (the first row in the life shock variables in Table 5.3) show that increasing life shock

exposure will reduce mental health and will contribute to mental health inequality. The above-mentioned effects are also similar to the effect of labour force status, being female and long-term health conditions variables. On the contrary, higher income quartile group, club/community activities and working age population variables are different in nature when generating inequalities. Both concentration indices and elasticities are positive for these variables, implying richer people have better resources, do more club/community activities and working aged people have higher incomes and having more of these characteristics implies better mental health (which also reflected by the positive elasticity value). Because the effects of all these variables on mental health is different for lower and higher socioeconomic groups, socioeconomic mental health inequality is increasing overtime in Australia.

Overall, the findings suggest that lower SES groups, particularly young individuals who are not employed or in the labour force and are not active in club/community activities or are disadvantaged with disabilities/long term health conditions are at risk of much lower mental health from life shocks. In particular, the effects of financial hardship shocks are found to be more pronounced in this study. Government welfare support, for example, through cash transfers, can be provided for such individuals. A regression analysis of individual shocks (see Table 8 of Appendix A in supplemental data for the regression results) found that individuals who went without meals or were unable to heat homes or asked for financial help from family and community organisations had significantly lower mental health scores. The study also found that serious personal injury, being separated from a spouse or the death of a spouse or child results in significantly lower mental health scores. Government policy could be designed such that these individuals can get adequate psychological supports especially focusing on lower SES groups.

One of the limitations of this study is that approximately nine percent of the life shock variables were missing and were imputed using the last observation carry forward method. Since, life shocks have a low probability of occurrence, this method might underestimate the true impact of life shocks in the mental health distribution. In addition, because of the group-based analysis and methodological constraints, individual heterogeneity is not accounted for in the analysis. The study also did not investigate health selection reverse causality, i.e., the impact of mental health leading to lower socioeconomic status. These issues are precisely the future research avenues this study suggest are worthy of consideration.

5.5 Conclusions

The present study adds life shocks into the analysis of the socioeconomic inequality of mental health. The study has demonstrated that the impact of life shocks on mental health status is significant for Australian adults. This study also has demonstrated that the impact of life shocks on lower SES groups creates disadvantageous mental health outcomes when compared to higher SES groups. This generates significant mental health disparities at a population level. In Australia, for example, during the study period, the study found that life shocks (financial hardship and negative life events) contribute to 24.7% to 40.5% of pro-rich socioeconomic mental health inequality. Individuals in lower socioeconomic groups are more vulnerable to life shocks than the higher socioeconomic groups and this itself is generating mental health inequality.

The study also investigated the temporal impacts of the effects of life shocks. The study found that life shocks periodically increase socioeconomic mental health inequality, although the distributional effect of these shocks is reduced in other periods. Income and employment status were still the major driver for the change in socioeconomic health inequality. The socioeconomic inequality due to the contribution of life shocks can be addressed through targeted welfare programs such as financial assistance, employment generation schemes and psychological support programs. Short term welfare targeting for groups of poor individuals who encounter such life shocks will have their mental health status improved and will reduce the burden on existing healthcare delivery system in welfare states like Australia. The current contribution explains these phenomena. To measure the progress of such programs, mental health inequality can be monitored and compared with other similar countries. Thus, lessons learned from this study can contribute to the understanding of the impact of shocks in socioeconomic inequality in mental health in other developed countries. Further research is needed to design specific interventions to address shock related mental health disparities. In conclusion, life shocks significantly contribute to mental health disparities and should be accounted for in designing policies and intervention strategies.

CHAPTER 6

A GENERALISED LONGITUDINAL FRAMEWORK FOR ANALYSING SOCIOECONOMIC HEALTH AND INCOME MOBILITY

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ABSTRACT

In recent years the literature examining socioeconomic health inequality has seen a gradual shift away from cross-sectional towards longitudinal decomposition analysis. However, there still exists a gap in the understanding of the merits of normative choice on concentration indices in longitudinal decomposition. Building on a generalised method of cross-sectional decomposition for all bi-variate rank dependent indices, we propose an umbrella framework for longitudinal decomposition. We also show that the traditional and most commonly used Oaxaca-Blinder decomposition can be explained by our proposed generalised framework. We illustrated our generalised framework by measuring and decomposing socioeconomic mental health inequality in Australia using Household, Income and Labour Dynamics in Australia (HILDA) panel survey data between 2009 and 2017. Our findings suggest that poorer individuals experience long term health conditions and exposure to life shocks more than richer individuals and that these factors are the major drivers of mental health inequality in Australia.

Key words: Concentration Index; Welfare; inequality

6.1 Introduction

The unequal distribution of health between poor people and the better off is a major concern in all countries. In recent times, the Center for Disease Control in the US and the European Commission have renewed their focus on socioeconomic health inequalities amid calls to reduce disparities in health (CDC 2013; European Commission 2013). Reducing health inequalities is germane to the health policy agenda of almost all countries. As an illustration, the Organisation for Economic Co-operation and Development's (OECD) recent framework for policy action on inclusive growth recommends investing in people's health so that it moves towards an inclusive society and creates opportunities for all (OECD 2019). To assess the magnitude of socioeconomic health inequalities between countries and to unravel the determinants of inequalities within countries, health economists have long used the concentration indices (Wagstaff et al. 1991; Wagstaff et al. 2003; Erreygers & Van Ourti 2011a). Concentration indices are a class of bi-variate rank dependent indices that have their roots in the income inequality literature. These indices capture the magnitude of health

disparities across individuals ranked by income or some other measure of socioeconomic status.

In the recent past, the literature on socioeconomic health inequality has gradually moved away from a cross-sectional towards a longitudinal perspective. Part of this renewed focus is attributable to the inability of cross-sectional analysis to depict the complete picture of the social burden of inequality in health. Cross-sectional studies are uninformative on issues of interest to policymakers such as whether the health of the poor at a particular time is improving relative to the rich or what factors explain the health and income mobility of individuals in society. This limitation can be resolved by using a longitudinal study design that involves tracking an individual over time to investigate the distributional consequences of the dynamic relationship between health and socioeconomic status. Evidence on the temporal dimensions of health and income offers valuable information on inequalities when designing social support or ill-health prevention interventions.

In the early research on health inequalities, Wagstaff et al. (2003) adapted and extended an Oaxaca-Blinder type decomposition method from the labour economics literature (Blinder 1973; Oaxaca 1973) to explain the changes in health inequalities using the standard concentration index. Gravelle and Sutton (2003) on the other hand, used cross-sectional estimates of health inequalities over time. The limitation of this type of approach is that the analyses are based on repeated cross-sections and are unable to track individual experiences. It cannot capture the dynamics of health inequality when an individual's income or health rank changes over time. Later work has explained the evolution of socioeconomic health inequalities using longitudinal data (Jones & López Nicolás 2004; Van Ourti et al. 2009; Allanson et al. 2010; Allanson & Petrie 2013b, 2013a; Baeten et al. 2013; Coveney et al. 2016, 2020). However, in many recent studies, the properties and generalisations in this class of bivariate rank dependent indices are not incorporated/reflected in the longitudinal analysis of socioeconomic health inequalities literature (Wagstaff 2005; Erreygers 2009b, 2009a; Wagstaff 2009; Erreygers & Van Ourti 2011a; Wagstaff 2011b, 2011a; Kjellsson & Gerdtham 2013; Kjellsson et al. 2015). For example, Allanson et al. (2010) chose the standard concentration index whereas Coveney et al. (2020) chose the Erreygers index in their longitudinal analysis. Clarification is required about the normative value choice of using a particular concentration index or set of indices.

In this paper, we pick up the generalisation of bivariate rank dependent indices where (Erreygers 2009b) left off and propose a generalised framework for longitudinal analysis of socioeconomic health inequalities. To this end, we posit three propositions. Our first proposition is a generalised equation for decomposing all types of concentration indices. Building on our first proposition, we next put forward a generalised method to decompose changes in socioeconomic health inequalities using longitudinal data. The longitudinal decomposition of the second proposition is not only generalised for all type of indices, the restriction on identifying the sources of changes in socioeconomic health inequalities is also minimal. In the third and last proposition, we show that the traditional Oaxaca-Blinder decomposition can be explained using our proposed generalised framework. Further clarification and identification of the implicit value judgments in the methodology is the first and main contribution of this article.

We illustrate our generalised framework by investigating the role of mental health determinants in the dynamics of income-related mental health inequality in Australia. Unlike physical health, there exists a paucity of research on the dynamics of income-related mental health inequality. The social determinants of mental health are also subtly different from physical health. The World Health Organization (WHO) calls for taking universal action on levelling the social gradient in mental health outcomes for citizens in all its member states (World Health Organization & Calouste Gulbenkian Foundation 2014). Approximately 72% of WHO member states have a standalone policy for mental health and 57% have standalone laws (World Health Organization 2018). England, Scotland, New Zealand and Australia are some of the English speaking high-income countries that have incorporated the social determinant of mental health approach into their national policy and strategy (World Health Organization & Calouste Gulbenkian Foundation 2014). We use the Household, Income and Labour Dynamics in Australia (HILDA) panel survey to investigate the evolution of income-related mental health inequality of Australia between 2009 and 2017. Unravelling the most important drivers of income-related mental health inequality in Australia is the second major contribution of this paper.

6.2 Methods

6.2.1 Bivariate rank dependent inequality indices

Suppose for a population of n individuals ($i = 1,2, \dots \dots, n$) and T time periods ($t = 1,2, \dots \dots, T$), the health outcome of interest is observed by h_{it} and socioeconomic achievement is observed by y_{it}. Given, the lower bound $l_h \geq 0$, the health outcome set is $h \in [l_h, u_h]$ if bounded and $h \in [l_h, u_h)$ if unbounded (without loss of generality, the ill health variable can be similarly defined as $H_{it} = u_h - h_{it}$). The socioeconomic achievement y_{it} for any individual i at period $t = j$, $\forall\, j \in [1, T]$, can be ranked in ascending order ranging from the least achieved ($r_{it,\ t=j} = 1$) to the most achieved ($r_{it,\ t=j} = n$). The fractional rank R_{it} for period j is defined as $R_{ij} = \frac{1}{n}(r_{ij} - \frac{1}{2})$. The relative fractional rank $\breve{R}_{ij}$ is defined as $\breve{R}_{ij} = \frac{R_{ij}}{\mu_R}$. Since, $\mu_R = \frac{\sum R_{ij}}{n} = \frac{1}{2}$, $\breve{R}_{ij} = 2R_{ij}$. Let the relative fractional rank weight z_{it} for period j is defined as $z_{ij} = \breve{R}_{ij} - 1$.

Erreygers (2009b) showed that the general class of bivariate rank dependent inequality indices for period j can be defined as:

$$I_{t=j}\left(h_{ij}\middle|y_{ij}\right) = f(\mu_h^j, l_h, u_h)\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}\, h_{ij} \tag{6.1}$$

Where, $f(\mu_h^j, l_h, u_h)$ is an index class weighting function (scaling factor). Depending upon how the function is defined, different type of inequality indices will emerge from equation (6.1). For example, if $f(\mu_h, l_h, u_h) = \frac{1}{\mu_h^j}$, where $\mu_h^j = \frac{\sum_{i=1}^{n} h_{i,j}}{n}$ at period j, equation (6.1) becomes the standard concentration index (Wagstaff et al. 1991; Kakwani et al. 1997) of period j:

$$C_j\left(h_{ij}\middle|y_{ij}\right) = \frac{1}{n\mu_h^j}\sum_{i=1,j}^{n} z_{ij}\, h_{ij} = \frac{1}{n}\sum_{i=1,j}^{n}\frac{h_{ij}(2R_{ij}-1)}{\mu_h^j} \tag{6.2}$$

The generalised concentration index (Wagstaff et al. 1991; Clarke, P. M. et al. 2002) can be derived from equation (6.1) if $f(\mu_h, l_h, u_h) = 1$:

$$V_j\left(h_{ij}\middle|y_{ij}\right) = \frac{1}{n}\sum_{i=1,j}^{n} z_{ij}\, h_{ij} = \frac{1}{n}\sum_{i=1,j}^{n} h_{ij}(2R_{ij} - 1) \tag{6.3}$$

Similarly, modified concentration index $M_j\left(h_{ij}\middle|y_{ij}\right)$ (Erreygers & Van Ourti 2011a), Erreygers concentration index $E_j\left(h_{ij}\middle|y_{ij}\right)$ (Erreygers 2009b) and Wagstaff's concentration index $W_j\left(h_{ij}\middle|y_{ij}\right)$ (Wagstaff 2005) can be derived from equation (6.1)

by setting $f(\mu_h, l_h, u_h) = \frac{1}{(\mu_h^j - l_h)}$, $f(\mu_h, l_h, u_h) = \frac{4}{(u_h - l_h)}$ and $f(\mu_h, l_h, u_h) = \frac{(u_h - l_h)}{(u_h - \mu_h^j)(\mu_h^j - l_h)}$ respectively. Thus, from equation (6.1), the indices are respectively:

$$M_j(h_{ij}|y_{ij}) = \frac{1}{n(\mu_h^j - l_h)} \sum_{i=1,j}^{n} z_{ij}\, h_{ij} = \frac{1}{n(\mu_h^j - l_h)} \sum_{i=1,j}^{n} h_{ij}(2R_{ij} - 1) \tag{6.4}$$

$$E_j(h_{ij}|y_{ij}) = \frac{4}{n(u_h - l_h)} \sum_{i=1,j}^{n} z_{ij}\, h_{ij} = \frac{4}{n(u_h - l_h)} \sum_{i=1,j}^{n} h_{ij}(2R_{ij} - 1) \tag{6.5}$$

$$W_j(h_{ij}|y_{ij}) = \frac{(u_h - l_h)}{n(u_h - \mu_h^j)(\mu_h^j - l_h)} \sum_{i=1,j}^{n} z_{ij}\, h_{ij} = \frac{(u_h - l_h)}{n(u_h - \mu_h^j)(\mu_h^j - l_h)} \sum_{i=1,j}^{n} h_{ij}(2R_{ij} - 1) \tag{6.6}$$

Thus, the class of bivariate rank dependent inequality can be generalised as $I_{t=j}^{s}(h_{ij}|y_{ij})$ where, s specifies a vector of inequality indices (C_j, V_j, M_j, E_j, W_j) with their respective scaling factor specification of $f(\mu_h^j, l_h, u_h)$. The negative value of $I_{t=j}^{s}(h_{ij}|y_{ij})$ indicates a pro-poor distribution of health outcome and vice-versa. The health outcome should be measured at least on a cardinal scale and the ranking variable on an ordinal scale. Detailed properties of measurement levels, merits, and normative value judgement about the indices have been extensively reviewed and debated in the literature (Wagstaff 2005; Erreygers 2009b, 2009a; Wagstaff 2009; Erreygers & Van Ourti 2011a, 2011b; Wagstaff 2011b, 2011a; Kjellsson & Gerdtham 2013; Kjellsson et al. 2015).

6.2.2 A general framework of cross-sectional factor decomposition

Wagstaff et al. (2003) in their seminal paper first showed the method for decomposing the standard concentration index. Erreygers (2009b) also showed that his index can be decomposed into factor contributions in a similar fashion. In this section, we propose a generalised framework for cross-sectional decomposition to build the groundwork for longitudinal decomposition[5]. To this end, we first define the health outcome determinant function. Suppose the health outcome variable at period *j* can be expressed by the following linear regression equation:

$$h_{ij} = \beta_j + \sum_{k=1}^{q} \beta_{kj} x_{ikj} + \varepsilon_{ij} \tag{6.7}$$

[5] Our generalisation of cross-sectional decomposition is similar to Wagstaff's formula rather than Erreygers. Unlike Erreygers, we do not transform the outcome variable. Erreyger's decomposition formula cannot explain anything about factor inequalities. In our proposed decomposition framework, it is possible to explain factor inequalities for all bivariate rank dependent indices.

The following proposition specifies the cross-sectional decomposition.

Proposition 1. Given the generalised framework of bivariate rank dependent inequality indices in equation (6.1) and a linear health outcome determinant function of equation (6.7), the generalised framework of cross-sectional factor decomposition for all the indices at period j can be expressed as:

$$I^{s}_{t=j}(h_{ij}|y_{ij}) = S_{hj}[\sum_{k=1}^{q}\beta_{kj}\, S_{kj}^{-1} I^{S}_{t=j}(x_{ikj}|y_{ij}) + I^{s=V_j}_{t=j}(\varepsilon_{ij}|y_{ij})] \tag{6.8}$$

Proof:

Substituting equation (6.7) into equation (6.1) yields:

$$I^{s}_{t=j}(h_{ij}|y_{ij}) = f(\mu_h^j, l_h, u_h)\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}\,(\beta_j + \sum_{k=1}^{q}\beta_{kj}x_{ikj} + \varepsilon_{ij}) \tag{6.9}$$

For notational simplicity, let the scaling factor $S_{hj} = f(\mu_h^j, l_h, u_h)$ at period j. As discussed earlier, S_{hj} is a scaler that takes different weighting values for different indices. Then equation (6.8) becomes:

$$I^{s}_{t=j}(h_{ij}|y_{ij}) = S_{hj}\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}\,(\beta_j + \sum_{k=1}^{q}\beta_{kj}x_{ikj} + \varepsilon_{ij}) \tag{6.10}$$

$$=> \underbrace{S_{hj}\beta_j\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}}_{since,\sum_{i=1,j}^{n} z_{ij}=0} + S_{hj}\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}\sum_{k=1}^{q}\beta_{kj}x_{ikj} + S_{hj}\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}\,\varepsilon_{ij}$$

$$=> S_{hj}\sum_{k=1}^{q}\beta_{kj}\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}x_{ikj} + S_{hj}\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}\,\varepsilon_{ij} \tag{6.11}$$

Now, $I^{s}_{t=j}(x_{ikj}|y_{ij}) = S_{kj}\frac{1}{n}\sum_{i=1,j}^{n} z_{ij}x_{ikj} => \frac{1}{n}\sum_{i=1,j}^{n} z_{ij}x_{ikj} = S_{kj}^{-1} I^{s}_{t=j}(x_{ikj}|y_{ij})$, thus equation (6.11) becomes:

$$= S_{hj}[\sum_{k=1}^{q}\beta_{kj}\, S_{kj}^{-1} I^{s}_{t=j}(x_{ikj}|y_{ij}) + I^{s=V_j}_{t=j}(\varepsilon_{ij}|y_{ij})] \tag{6.12}$$

Equation (6.12) is thus the generalised version of the cross-sectional factor decomposition formula for concentration indices. □

6.2.3 A general framework of longitudinal factor decomposition

Allanson et al. (2010), in their influential work, proposed health and income mobility measures based on the assumption that any change in the standard concentration index over time arises from the combination of change in the individual's health outcomes and their position in the income distribution. They decomposed the difference in the standard concentration index between two periods by adding and subtracting a counterfactual concentration index (CI) measure. The counterfactual CI was constructed such that the health outcome was chosen in the final period but income

was ranked by the initial period. They defined "income-related health mobility" measure as the difference between initial CI and counterfactual CI. Similarly, they defined their "health-related income mobility" measure as the difference between the final CI and the counterfactual CI. Using Erreygers index, Baeten et al. (2013) and Coveney et al. (2016, 2020) showed similar decomposition by either constructing multiple counterfactual CIs using various hypothetical health states (for example predicted health state with proportionate/ average income growth and no income growth) or changing the ranking criteria by defining various sources of income.

Given a health determinant function in equation (6.7), the hypothetical health state is defined as:

$$\tilde{h}_{i\tilde{J}} = \tilde{\beta}_{\tilde{J}} + \sum_{k=1}^{q} \tilde{\beta}_{k\tilde{J}} \tilde{x}_{ik\tilde{J}} + \tilde{\varepsilon}_{i\tilde{J}} \tag{6.13}$$

Now, equation (6.13) is a very generalised linear function, and there are no restrictions on how it can be defined. For example, following the formulation of Allanson et al. (2010), $\tilde{h}_{i\tilde{J}}$ is just the final or initial period health outcome. The final period health outcome equation (6.13) becomes:

$$h_{iT} = \beta_T + \sum_{k=1}^{q} \beta_{kT} x_{ikT} + \varepsilon_{iT} \tag{6.14}$$

Similarly, following Baeten et al. (2013) or Coveney et al. (2016, 2020), and without loss of generality, if there is a nonlinear component in the health outcome function, $\tilde{h}_{i\tilde{J}}$ is the hypothesised health state constructed from assuming either average growth, proportionate growth or no growth of the non-linear component $\phi(.)$. $\tilde{h}_{i\tilde{J}}$ in (6.13) can then be expressed as (shown proportionate growth case as an example):

$$h_{ij}^{PG} = \beta_j + \phi\left(y_{it}^{PG}\right) + \sum_{k=1}^{q} \beta_{kj} x_{ikj} + \varepsilon_{ij} \tag{6.15}$$

Where, $y_{it}^{PG} = y_{it}(\frac{\bar{y}_t}{\bar{y}_1})$.

For, ease of exposition, this study would rule out non-linear components specified in (6.15) since the concept of generalisation framework will not change much.

Given, equation (6.13) and equation (6.1), a generalised counterfactual CI can be constructed as:

$$\tilde{I}_{t=\tilde{J}}^{s}(\tilde{h}_{i\tilde{J}}|\tilde{y}) \tag{6.16}$$

For example, the simplest case of $\tilde{y}$ would be either initial period (y_{i1}) or final period (y_{iT}) income. The formulation of $\tilde{I}_{t=\tilde{J}}^{s}(\tilde{h}_{i\tilde{J}}|\tilde{y})$ is very generalizable since for both $\tilde{h}_{i\tilde{J}}$ and $\tilde{y}$, there are no restrictions on how it can be defined. For instance, following Coveney et al. (2020), the $\tilde{y}$ can be additively separable by various sources of income

(i.e., $\tilde{y} = \tilde{y}^1 + \tilde{y}^2$) and thereby can have additively separated ranking weights (i.e., $\tilde{z} = \tilde{z}^1 + \tilde{z}^2$).

Proposition 2. Given the generalised framework of bivariate rank dependent inequality indices in equation (6.1), linear health determinant function of equation (6.7), hypothetical health state in equation (6.13) and generalised counterfactual CI in equation (6.16), the longitudinal decomposition between period one and period T is given by:

$$\Delta \mathrm{I}^{s}(h_{it}|y_{it}) = \underbrace{S_{hT}\left[\sum_{k=1}^{q}\beta_{kT}\,S_{kT}^{-1}I_{t=T}^{s}(x_{ikT}|y_{iT})\right] - S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y})\right]}_{Term\ 1} +$$

$$\underbrace{S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y})\right] - S_{h1}\left[\sum_{k=1}^{q}\beta_{k1}\,S_{k1}^{-1}I_{t=1}^{s}(x_{ik1}|y_{i1})\right]}_{Term\ 2} +$$

$$\underbrace{\left[S_{hT}I_{t=T}^{s=V_T}(\varepsilon_{iT}|y_{iT}) - S_{h1}I_{t=1}^{s=V_1}(\varepsilon_{i1}|y_{i1})\right]}_{residual} \qquad (17)$$

Proof:

$$\Delta \mathrm{I}^{s}(h_{it}|y_{it}) = I(h_{iT}|y_{iT}) - I(h_{i1}|y_{i1}) \qquad (18)$$

Now adding and subtracting counterfactual CI: $\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{h}_{i\tilde{\jmath}}|\tilde{y})$ in equation (6.18) yields

$$\Delta \mathrm{I}^{s}(h_{it}|y_{it}) = I_{t=T}^{s}(h_{iT}|y_{iT}) - \tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{h}_{i\tilde{\jmath}}|\tilde{y}) + \tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{h}_{i\tilde{\jmath}}|\tilde{y}) - I(h_{i1}|y_{i1}) \qquad (19)$$

Substituting the generalised factor decomposition formula of equation (6.12) into equation (6.18) yields

$$\Delta \mathrm{I}^{s}(h_{it}|y_{it}) = S_{hT}\left[\sum_{k=1}^{q}\beta_{kT}\,S_{kT}^{-1}I_{t=T}^{s}(x_{ikT}|y_{iT}) + I_{t=T}^{s=V_T}(\varepsilon_{iT}|y_{iT})\right] -$$

$$S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y}) + \tilde{I}_{t=\tilde{\jmath}}^{s=V_{\tilde{\jmath}}}(\tilde{\varepsilon}_{i\tilde{\jmath}}|\tilde{y})\right] + S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y}) +\right.$$

$$\left.\tilde{I}_{t=\tilde{\jmath}}^{s=V_{\tilde{\jmath}}}(\tilde{\varepsilon}_{i\tilde{\jmath}}|\tilde{y})\right] - S_{h1}\left[\sum_{k=1}^{q}\beta_{k1}\,S_{k1}^{-1}I_{t=1}^{s}(x_{ik1}|y_{i1}) + I_{t=1}^{s=V_1}(\varepsilon_{i1}|y_{i1})\right] \qquad (6.20)$$

Now, collecting terms and rearranging

$$\Delta \mathrm{I}^{s}(h_{it}|y_{it}) = \underbrace{S_{hT}\left[\sum_{k=1}^{q}\beta_{kT}\,S_{kT}^{-1}I_{t=T}^{s}(x_{ikT}|y_{iT})\right] - S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y})\right]}_{Term\ 1} +$$

$$\underbrace{S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y})\right] - S_{h1}\left[\sum_{k=1}^{q}\beta_{k1}\,S_{k1}^{-1}I_{t=1}^{s}(x_{ik1}|y_{i1})\right]}_{Term\ 2} +$$

$$\underbrace{\left[S_{hT}I_{t=T}^{s=V_T}(\varepsilon_{iT}|y_{iT}) - S_{\tilde{h}}\tilde{I}_{t=\tilde{\jmath}}^{s=V_{\tilde{\jmath}}}(\tilde{\varepsilon}_{i\tilde{\jmath}}|\tilde{y})\right]}_{Term\ 1\ residual} + \underbrace{S_{\tilde{h}}\tilde{I}_{t=\tilde{\jmath}}^{s=V_{\tilde{\jmath}}}(\tilde{\varepsilon}_{i\tilde{\jmath}}|\tilde{y}) - S_{h1}I_{t=1}^{s=V_1}(\varepsilon_{i1}|y_{i1})]}_{Term\ 2\ residual} \qquad (6.21)$$

$$\Delta \mathrm{I}^{s}(h_{it}|y_{it}) = \underbrace{S_{hT}\left[\sum_{k=1}^{q}\beta_{kT}\,S_{kT}^{-1}I_{t=T}^{s}(x_{ikT}|y_{iT})\right] - S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y})\right]}_{Term\ 1} +$$

$$\underbrace{S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{\jmath}}\,S_{k\tilde{\jmath}}^{-1}\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{x}_{ik\tilde{\jmath}}|\tilde{y})\right] - S_{h1}\left[\sum_{k=1}^{q}\beta_{k1}\,S_{k1}^{-1}I_{t=1}^{s}(x_{ik1}|y_{i1})\right]}_{Term\ 2} +$$

$$\underbrace{\left[S_{hT}I_{t=T}^{s=V_T}(\varepsilon_{iT}|y_{iT}) - S_{h1}I_{t=1}^{s=V_1}(\varepsilon_{i1}|y_{i1})\right]}_{residual} \qquad (6.22)$$

Equation (6.22) is thus the generalised version of the longitudinal factor decomposition formula for concentration indices. □

Equation (6.22) generalises longitudinal factor decomposition in two ways. First, it generalises the decomposition for all classes of bivariate rank dependent inequality indices. Second, it generalises the counterfactual CI: $\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{h}_{i\tilde{\jmath}}|\tilde{y})$. Depending on the specification of $\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{h}_{i\tilde{\jmath}}|\tilde{y})$, equation (6.22) can be either reduced or expanded. For example, it can be shown that if $\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{h}_{i\tilde{\jmath}}|\tilde{y}) = I_{t=T}^{s=C_T}(h_{iT}|y_{i1})$ equations (6.21) and (6.22) are reduced to "health-related income mobility" (Term 1+ Term 1 residual) and "income-related health mobility" (Term 2 + term 2 residual) longitudinal decomposition indices respectively as proposed by Allanson et al. (2010). In the next section, it is proposed that the Oaxaca-Blinder decomposition can also be explained by equation (6.22).

6.2.4 Oaxaca Blinder- decomposition: explained in the longitudinal framework

Given the generalised longitudinal decomposition of equation 6.3, it can be shown that Oaxaca-Blinder decomposition (Wagstaff et al. 2003) for bivariate rank dependent health inequality is a special case of the longitudinal framework when scaling factor is $S_{t=j}^{C_j}$, counterfactual health determinant function is:

$\tilde{h}_i = \tilde{\beta} + \sum_{k=1}^{q}\beta_{kT}x_{ik1} + \tilde{\varepsilon}_i$ and

counterfactual CI is $\tilde{I}_{t=\tilde{\jmath}}^{s}(\tilde{h}_{i\tilde{\jmath}}|\tilde{y}) = \frac{1}{\mu_h^T}\left[\sum_{k=1}^{q}\beta_{kT}\,\bar{x}_{kT}C_{K,1}(x_{ik1}|y_{i1})\right]$. The proposition is as follows.

Proposition 3. Given equation (22), and the following values, $S_{hT} = \frac{1}{\mu_h^T}$, $S_{h1} = \frac{1}{\mu_h^1}$, $S_{kT}^{-1} = \bar{x}_{kT}$, $S_{k1}^{-1} = \bar{x}_{k1}$, $I_{t=T}^{s=C_T}(x_{ikT}|y_{iT}) = C_{K,T}(x_{ikT}|y_{iT})$, $I_{t=1}^{s=C_1}(x_{ik1}|y_{i1}) = C_{K,1}(x_{ik1}|y_{i1})$, $S_{hT}I_{t=T}^{s=V_T}(\varepsilon_{iT}|y_{iT}) = \frac{1}{\mu_h^T}V_T(\varepsilon_{iT}|y_{iT})$, $S_{h1}I_{t=1}^{s=V_1}(\varepsilon_{i1}|y_{i1}) = \frac{1}{\mu_h^1}V_1(\varepsilon_{i1}|y_{i1})$, and

$\tilde{I}^{s}_{t=\tilde{j}}(\tilde{h}_{i\tilde{j}}|\tilde{y}) = S_{\tilde{h}}\left[\sum_{k=1}^{q}\tilde{\beta}_{k\tilde{j}}\, S^{-1}_{k\tilde{j}}\tilde{I}^{s}_{t=\tilde{j}}(\tilde{x}_{ik\tilde{j}}|\tilde{y})\right] = \frac{1}{\mu_h^T}\left[\sum_{k=1}^{q}\beta_{kT}\,\bar{x}_{kT}C_{K,1}(x_{ik1}|y_{i1})\right]$

equation (6.22) becomes the Oaxaca-Blinder decomposition formula:[6]

$$\Delta \mathrm{I}^{s=C}(h_{it}|y_{it}) = \sum_{k=1}^{q}\eta_{KT}\left(C_{K,T}(x_{ikT}|y_{iT}) - C_{K,1}(x_{ik1}|y_{i1})\right) + \sum_{k=1}^{q}C_{K,1}(x_{ik1}|y_{i1})(\eta_{KT}-\eta_{K1}) + \Delta\frac{1}{\mu_h^{\Delta}}V(\varepsilon_{\mathrm{it}}|y_{\mathrm{it}}) \quad (6.23)$$

Proof:

Substituting the given values of proposition 3 in equation (6.22) we have-

$$\Rightarrow \Delta \mathrm{I}^{s=C}(h_{it}|y_{it}) = \frac{1}{\mu_h^T}\left[\sum_{k=1}^{q}\beta_{kT}\,\bar{x}_{kT}C_{K,T}(x_{ikT}|y_{iT})\right] - \frac{1}{\mu_h^T}\left[\sum_{k=1}^{q}\beta_{kT}\,\bar{x}_{kT}C_{K,1}(x_{ik1}|y_{i1})\right] + \frac{1}{\mu_h^T}\left[\sum_{k=1}^{q}\beta_{kT}\,\bar{x}_{kT}C_{K,1}(x_{ik1}|y_{i1})\right] - \frac{1}{\mu_h^1}\left[\sum_{k=1}^{q}\beta_{k1}\,\bar{x}_{k1}C_{K,1}(x_{ik1}|y_{i1})\right] + \Delta\frac{1}{\mu_h^{\Delta}}V(\varepsilon_{\mathrm{it}}|y_{\mathrm{it}}) \quad (6.24)$$

$$\Rightarrow \left[\sum_{k=1}^{q}\underbrace{\beta_{kT}\bar{x}_{kT}\frac{1}{\mu_h^T}}_{\eta_{KT}}C_{K,T}(x_{ikT}|y_{iT})\right] - \left[\sum_{k=1}^{q}\underbrace{\beta_{kT}\bar{x}_{kT}\frac{1}{\mu_h^T}}_{\eta_{KT}}C_{K,1}(x_{ik1}|y_{i1})\right] + \left[\sum_{k=1}^{q}\underbrace{\beta_{kT}\bar{x}_{kT}\frac{1}{\mu_h^T}}_{\eta_{KT}}C_{K,1}(x_{ik1}|y_{i1})\right] - \left[\sum_{k=1}^{q}\underbrace{\beta_{k1}\bar{x}_{k1}\frac{1}{\mu_h^1}}_{\eta_{K1}}C_{K,1}(x_{ik1}|y_{i1})\right] + \Delta\frac{1}{\mu_h^{\Delta}}V(\varepsilon_{\mathrm{it}}|y_{\mathrm{it}})$$

$$\Rightarrow \left[\sum_{k=1}^{q}\eta_{KT}C_{K,T}(x_{ikT}|y_{iT})\right] - \left[\sum_{k=1}^{q}\eta_{KT}C_{K,1}(x_{ik1}|y_{i1})\right] + \left[\sum_{k=1}^{q}\eta_{KT}C_{K,1}(x_{ik1}|y_{i1})\right] - \left[\sum_{k=1}^{q}\eta_{K1}C_{K,1}(x_{ik1}|y_{i1})\right] + \Delta\frac{1}{\mu_h^{\Delta}}V(\varepsilon_{\mathrm{it}}|y_{\mathrm{it}})$$

$$\Rightarrow \sum_{k=1}^{q}\eta_{KT}\left(C_{K,T}(x_{ikT}|y_{iT}) - C_{K,1}(x_{ik1}|y_{i1})\right) + \sum_{k=1}^{q}C_{K,1}(x_{ik1}|y_{i1})(\eta_{KT}-\eta_{K1}) + \Delta\frac{1}{\mu_h^{\Delta}}V(\varepsilon_{\mathrm{it}}|y_{\mathrm{it}}) \quad (6.25)$$

[6] The alternative Oaxaca-Blinder formula $\Delta \mathrm{I}^{s=C}(h_{it}|y_{it}) = \sum_{k=1}^{q}\eta_{K1}\left(C_{K,T}(x_{ikT}|y_{iT}) - C_{K,1}(x_{ik1}|y_{i1})\right) + \sum_{k=1}^{q}C_{K,T}(x_{ikT}|y_{iT})(\eta_{KT}-\eta_{K1}) + \Delta\frac{1}{\mu_h^{\Delta}}V(\varepsilon_{\mathrm{it}}|y_{\mathrm{it}})$ can similarly be proven with counterfactual CI $\tilde{I}^{s}_{t=\tilde{j}}(\tilde{h}_{ij}|\tilde{y}) = \frac{1}{\mu_h^1}\left[\sum_{k=1}^{q}\beta_{k1}\,\bar{x}_{k1}C_{K,T}(x_{ikT}|y_{iT})\right]$.

Equation (6.25) is thus the Oaxaca-Blinder decomposition formula, which is a special case of the generalised version of the longitudinal factor decomposition for concentration indices. □

6.3 Empirical illustration

6.3.1. The HILDA dataset

To illustrate the application of the generalised framework, this study uses the restricted release version 17 of the Household, Income and Labour Dynamics in Australia (HILDA), a nationally representative, longitudinal survey dataset focusing on social and economic issues. Apart from the general module, which is conducted in every year, the survey also includes rotating contents (major modules include: wealth, retirement, health, fertility and education) that are administered every 4 years. The health module started with wave 9 (in 2009) of the survey and has so far been administered in three waves of the survey (wave 9, 13 and 17). Based on data availability of the variables specified in our model, we use wave 9 and 17 of HILDA data for analysing socioeconomic health and income mobility. We constructed a balanced panel of 9,277 individuals for analysis. We use longitudinal weights available through the HILDA to maintain national representativeness. Detailed information about the HILDA survey can be found elsewhere (Summerfield et al. 2018).

6.3.2 Health outcome measurement

We use mental health as a health outcome for our empirical illustration. A paucity of research on socioeconomic mental health inequality and mobility exists in the current literature. We use the Kessler Psychological Distress Scale (K10) to measure mental health outcomes (Kessler et al. 2002). The K10 scale is a screening tool to monitor mental disorder prevalence and trends and has been applied throughout the world (Kessler et al. 2009). The score ranges from a minimum score of 10, indicating no distress to a maximum score of 50, referring to severe distress (Andrews & Slade 2001). The scale is used in clinical practice to assess the likelihood of having a mental disorder (Kessler et al. 2003; Wooden 2009).

6.3.3 Income measurement

We use equivalised household annual disposable total income as a measure of socioeconomic achievement and rank it in ascending order to construct all of our bivariate inequality indices. Detailed information on how the HILDA survey

constructs household annual disposable total income can be found elsewhere (Wilkins 2014; Summerfield et al. 2018). We equivalised the household disposable income variable using the 'modified OECD' equivalence scale formula as follows (ABS 2006):

$$\ddot{y}_{Hit} = \frac{Y_{Hit}}{1\times a+0.5\times b+0.3\times c} \tag{6.26}$$

Where, $\ddot{y}_{Hit}$= equivalised household annual disposable total income for household H, individual i at period t, Y_{Hit}= household annual disposable total income for household H, individual i at period t, a = 1 (first adult), b = number of additional adult members of the household, c = number of child members of the household.

6.3.4 Trends of socioeconomic mental health inequality in Australia

The trends of income-related mental health inequality from 2009 to 2017 in Australia using all five types of rank dependent bi-variate inequality indices are presented in Figure 6.1. The figure depicts all indices in the negative Y axes domain. This is because the K10 score is an ill-health outcome measurement and a negative concentration index refers to a pro-poor inequality of ill health outcome, i.e., ill health outcome is concentrated in individuals with low incomes. Initial inspection of Figure 6.1 reveals that the generalised concentration index has a declining trend with a cyclical pattern. A similar trend, albeit to a lesser degree, can also be seen in the modified concentration index. Other concentration indices show almost a stagnant scenario compared to the generalised concentration index. However, in the generalised framework, it has been shown that all indices are derived by some form of scaling of the generalised concentration index and thus all indices should follow similar patterns. This will be evident if we just plot two indices instead of five in the same figure. Figure 6.2 presents the trends of the standard concentration index and Erreygers index. Similar to the pattern of generalised concentration indices in Figure 6.1, we observe a cyclical declining trend for standard and Erreygers concentration indices in Figure 6.2. The magnitude of changes of the generalised concentration index is masking the changes of all other indices in Figure 6.1. In summary, the socioeconomic inequality in mental health is gradually worsening in Australia, i.e., the distribution of mental disorder is gradually shifting towards poorer individuals.

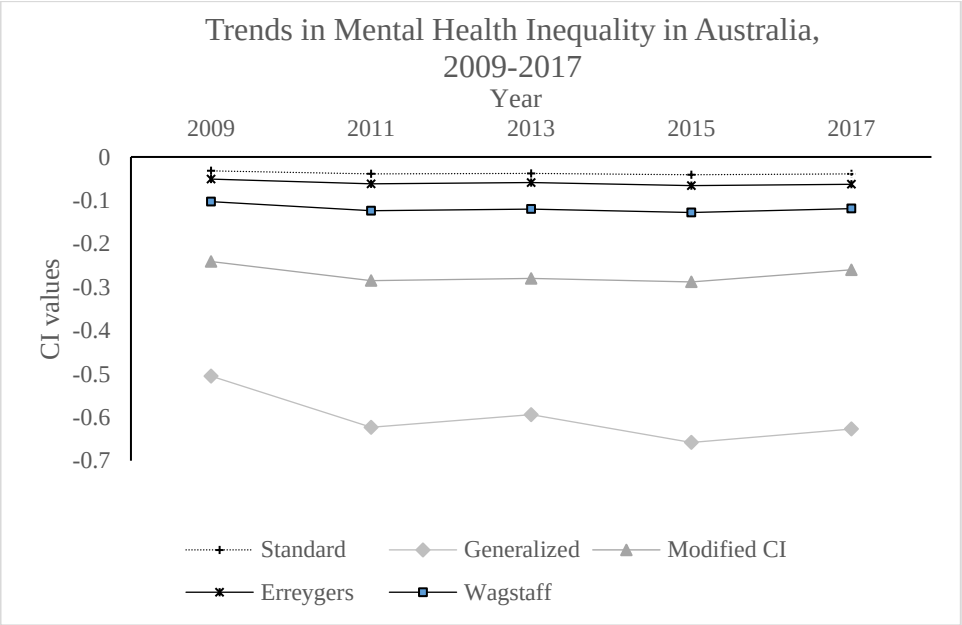

Figure 6.1: Trends in five types of concentration indices in Australia, 2009-2017

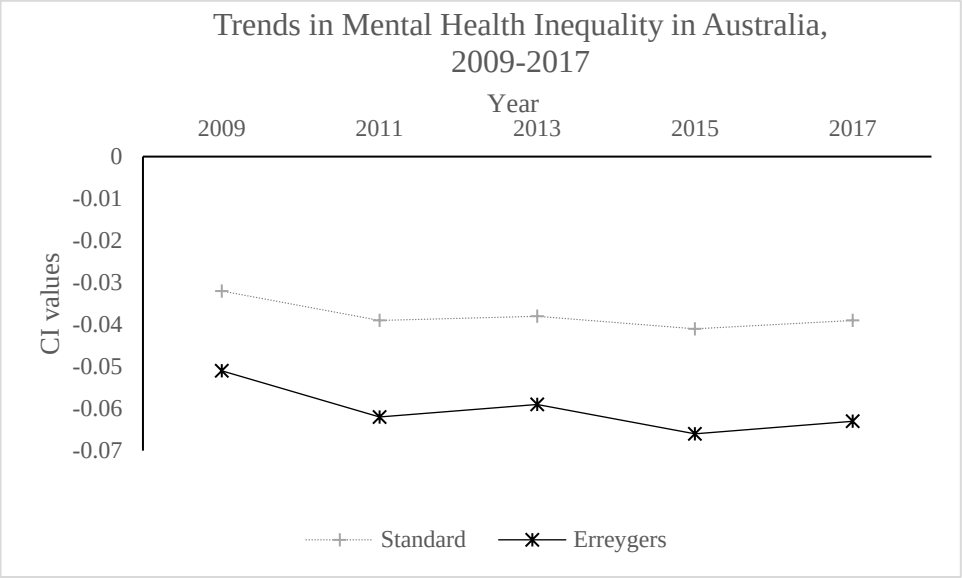

Figure 6.2: Trends of standard concentration index and Erreygers index

What are the major factors that have been driving this change in inequality? Are some factors structural in nature? Do some factors change inequality in the opposite direction, i.e., counteractive effects? If a policy framework were to be developed to tackle such health inequality issues, answering these questions is crucial. Traditionally, the Oaxaca-Blinder decomposition method has been used to analyse changes in health inequality. Although, the Oaxaca-Blinder decomposition analysis can give some insight on the changes in factor inequalities and elasticities, it is limited, however, when trying to capture the dynamics of health inequality, during which an individual's

income or health rank changes over time. To overcome this limitation, Allanson et al. (2010) proposed an alternative decomposition approach. Using standard concentration indices, they constructed 'income-related health mobility' (that can measure whether health changes are progressive (regressive) i.e., poor individuals are gaining larger (smaller) share of health gains or smaller (larger) share of health loss) and 'health-related income mobility' (that can measure the effect of reshuffling the ranking of individuals in the income distribution) indices. Even though Allanson et al. (2010) measure changes in health improvement and effects of changes in income redistribution, their approach does not decompose the sources that drive the changes in income-related health inequality. Allanson and Petrie (2013b) did explore the issue of health determinants on 'income-related health mobility'. However, since, they did not explore 'health-related income mobility', their investigation on the role of health determinants on changes in health inequality was inadequate. Further, they only analysed the issue from a standard concentration indices perspective. This creates an avenue to present a generalised framework to analyse the role of health determinants in the dynamics of income-related health inequality.

6.3.5 The mental health determinant function

An individual's mental health is shaped by various social, economic, environmental and demographic factors (Allen et al. 2014). Some determinants of mental health are also shared by physical health such as demographic factors like age and gender. However, there are some differences among the factors as well. For example, exposure to life shocks in a person's life course have considerable impacts on mental health (Williams et al. 1981; Hashmi et al. 2020). Further, physical health has an interaction effect on mental health. For instance, studies have found that long term health conditions are associated with mental wellbeing (Cassileth et al. 1984; Scott et al. 2007). Other factors that influence psychological wellbeing are a person's attitude towards risk, their health and social behaviours, specifically smoking/drinking, their community/club or sporting activities and having private health insurance coverage (Lasser et al. 2000; Scott et al. 2007; Doiron et al. 2008). Thus, the mental health determinant function requires careful consideration. In this article, we devise the following reduced form of mental health determinant function:

$$h_{it} = \alpha_t + X_{it}\beta_t + Y_{it}\delta_t + Z_{it}\theta_t + W_{it}\lambda_t + \varepsilon_{it} \tag{6.27}$$

Where the dependent variable h_{it} = K10 score (mental health outcome measure), X_{it} = vector of demographic factors, Y_{it} = vector of socioeconomic factors, Z_{it} = vector of behavioural factors, W_{it} = vector of circumstance factors, $\beta, \delta, \theta \; and \; \lambda$ are parameters to be estimated, α = constant term, ε = residual term, i = individual i and t = period t.

The descriptive statistics of the variables included in equation (6.27) for both wave 9 and wave 17 are presented in Table 6.1.

Table 6.1: Background characteristics

	2009 (Wave-9)				2017 (Wave-17)			
	Unweighted			Weighted	Unweighted			Weighted
Variable description	**n**	**Mean**	**95% CI**	**mean**	**n**	**Mean**	**95% CI**	**mean**
Dependent variable								
Kessler 10 score	9277	15.512	(15.386-15.637)	15.738	9277	15.965	(15.829-16.101)	16.262
Demographic factors								
Age								
-15-24 years	1552	0.167	(0.16-0.175)	0.178	316	0.034	(0.031-0.038)	0.043
-25-54 years	5043	0.544	(0.533-0.554)	0.548	4803	0.518	(0.508-0.528)	0.536
-55-64 years	1472	0.159	(0.151-0.166)	0.148	1882	0.196	(0.188-0.205)	0.182
-65+ years	1210	0.13	(0.124-0.137)	0.126	2336	0.252	(0.243-0.261)	0.239
Gender								
-Male	4287	0.462	(0.452-0.472)	0.492	4287	0.462	(0.452-0.472)	0.492
-Female	4990	0.538	(0.528-0.548)	0.508	4990	0.537	(0.528-0.548)	0.508
Socioeconomic status factors								
Education								
-Year 12 or below	4413	0.476	(0.466-0.486)	0.499	3463	0.373	(0.363-0.383)	0.384
-Certificate level	1900	0.205	(0.197-0.213)	0.202	2202	0.237	(0.229-0.246)	0.237
-Undergraduate level	2052	0.221	(0.213-0.23)	0.213	2410	0.26	(0.251-0.269)	0.258
-Post-graduate level	912	0.098	(0.092-0.105)	0.087	1202	0.13	(0.123-0.137)	0.122
Labour force status								
-Employed	6229	0.671	(0.662-0.681)	0.66	5734	0.618	(0.608-0.628)	0.624
-Unemployed	300	0.032	(0.029-0.036)	0.036	205	0.022	(0.019-0.025)	0.025
-Not in the labour force	2748	0.296	(0.287-0.306)	0.304	3338	0.36	(0.35-0.37)	0.351
Behavioural factors								
Covered by private health insurance	5200	0.561	(0.55-0.571)	0.556	5442	0.587	(0.577-0.597)	0.58
Life style: Active membership of club	3341	0.36	(0.35-0.37)	0.339	3312	0.357	(0.347-0.367)	0.335
Life style: Daily smoker	1277	0.138	(0.131-0.145)	0.131	1063	0.115	(0.108-0.121)	0.113
Life style: Drinks ≥ 4 standard drinks/day	1452	0.157	(0.149-0.164)	0.149	1243	0.134	(0.127-0.141)	0.136
Circumstance factors								
Have long term health condition	2507	0.27	(0.261-0.279)	0.269	3178	0.343	(0.333-0.352)	0.343
Number of life shocks	9277	0.932	(0.903-0.961)	0.877	9277	0.862	(0.835-0.889)	0.826

6.3.6 Statistical analysis

We used Stata 15 statistical software for our analysis. To account for survey weights and sample design, we used the SVY command. We used the longitudinal weights (responding person - balanced wave 9 to 17) supplied by HILDA data in our analysis. To estimate all bi-variate rank dependent indices, we used the CONINDEX command (O'Donnell et al. 2016). To implement the generalised framework the following steps are taken:

Step 1: To ease the calculation of factor decomposition, we construct a data matrix and present the matrix in Table 6.2. Our analysis only illustrates factor decomposition analysis using the standard concentration index (a relative bivariate rank dependent

inequality index) and Erreygers index (an absolute bivariate rank dependent inequality index). Because of redundancy, the other rank dependent inequality indices are not illustrated in this study. However, factor decomposition can be analysed using these indices with a similar procedure. Columns (i) and (ii) of Table 6.2 represent scaling factors of standard CI at period 1 and period T respectively. The scaling factors of Erreygers index is the same for all periods and it is provided in column (iii). Columns (iv) and (v) provide regression coefficients β_k at period T and period 1 respectively. Columns (vi) and (vii) provide factor inequalities using the standard concentration index at period T and period 1 respectively. Columns (viii) and (ix) provide factor inequalities at period T and period 1 using the Erreygers index. Columns (x) and (xi) provides counterfactual CIs constructed from standard CI and Erreygers index respectively. We constructed the counterfactual CI using the final period health outcome with the initial period income ranking[7]. This method of counterfactual construction is chosen because our objective is to analyse health and income mobility. There are many other ways to construct the counterfactual CI which has been discussed earlier. Since the procedure is similar, those counterfactual examples are not illustrated here.

Step 2: Using Table 6.2, we estimate the cross-sectional factor decomposition and report it in Table 6.3. For example, the factor contribution corresponding to 2009 standard CI in column (i) of Table 6.3 is derived by multiplying columns (ii), (v) and (vii) of Table 6.2. Similarly, factor contribution corresponding to 2017 Erreygers index in column (iv) of Table 6.3 is derived by multiplying column (iii), (iv) and (viii) and so on. The percentage contribution columns are derived from the respective factor contribution column as a percentage of the actual index provided in the last row.

Step 3: Using Table 6.2, we estimate longitudinal factor decomposition and report it in Table 6.4. The Health-Related Income Mobility (HRIM) of Erreygers index in column (i) of Table 6.4 is derived by subtracting column (xi) from column (viii) and multiplying the subtracted result subsequently with column (iii) and (iv) of Table 6.2. The income related health mobility (IRHM) of Erreygers index in column (ii) of Table 6.4 is derived by first multiplying columns (iii), (iv), (xi) and second, multiplying columns (iii), (v), (ix) in Table 6.2. Subtracting the later multiplications from the first produces column (ii) of Table 6.4. Adding columns (i) and (ii) produces column (iii)

[7] An alternative counterfactual CI could be derived using the initial period health outcome with final period income ranking.

Table 6.2: Data matrix for estimation of factor decomposition analysis [a]

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)
Variables	S^C_{hT}/S^C_{kT}	S^C_{h1}/S^C_{k1}	S^E_h/S^E_k	β_{kT}	β_{k1}	$I^C_T(x_{ikT}\|y_{iT})$	$I^C_1(x_{ik1}\|y_{i1})$	$I^E_T(x_{ikT}\|y_{iT})$	$I^E_1(x_{ik1}\|y_{i1})\|$	$\bar{I}^C(x_{ikT}\|y_{i1})$	$\bar{I}^E(x_{ikT}\|y_{i1})$
Age (Ref :15-24 years)											
-25-54 years	0.033	0.035	0.025	-1.987***	-0.836**	0.105	0.085	0.225	0.187	0.057	0.123
-55-64 years	0.011	0.009	0.025	-3.376***	-1.939***	0.097	0.067	0.071	0.04	0.107	0.077
-65+ years	0.015	0.008	0.025	-5.591***	-3.690***	-0.312	-0.397	-0.298	-0.199	-0.191	-0.183
Gender (Ref: Male)											
-Female	0.031	0.032	0.025	0.411*	0.428**	-0.033	-0.027	-0.067	-0.054	-0.027	-0.054
Education (Ref: ≤Year 12)											
-Certificate level	0.015	0.013	0.025	-0.316	-0.305	-0.054	-0.004	-0.051	-0.003	-0.044	-0.041
-Undergraduate level	0.016	0.014	0.025	-0.187	-0.438*	0.181	0.197	0.186	0.168	0.163	0.168
-Post-graduate level	0.008	0.006	0.025	-0.388	-0.192	0.335	0.335	0.163	0.116	0.272	0.132
Labour force status (Ref: Employed)											
-Unemployed	0.002	0.002	0.025	2.37**	1.981***	-0.378	-0.268	-0.038	-0.038	-0.209	-0.021
-Not in the labour force (NLF)	0.022	0.019	0.025	1.357***	1.247***	-0.338	-0.326	-0.473	-0.397	-0.209	-0.293
Covered by private health insurance	0.036	0.035	0.025	-1.073***	-0.896***	0.187	0.19	0.435	0.422	0.18	0.418
Active membership of club	0.021	0.022	0.025	-1.423***	-1.579***	0.046	0.051	0.061	0.07	0.075	0.101
Daily Smoker	0.007	0.008	0.025	1.184*	0.687*	-0.109	-0.109	-0.049	-0.057	-0.157	-0.071
Drink ≥ 4 standard drinks/day	0.008	0.01	0.025	-0.085	0.288	0.077	0.033	0.042	0.02	0.016	0.009
Have long term health condition	0.021	0.017	0.025	3.346***	2.961***	-0.208	-0.201	-0.285	-0.216	-0.175	-0.24
Number of life shocks	0.051	0.056	0.475	0.895***	0.729***	-0.149	-0.131	-0.026	-0.024	-0.132	-0.023
Constant				17.796***	15.916***						

[a] *** $p < 0.001$, ** $p < 0.01$, and * $p < 0.5$

in Table 6.4. Similar procedures using standard CI columns in Table 6.2 produce the decomposition of standard CI in Table 6.4 (columns iv, v and vi). The Oaxaca-Blinder decomposition (columns vii, viii and ix of Table 6.4) are also self-explanatory and derived from Table 6.2.

Table 6.3: Cross-sectional income related health inequality decomposition for 2009 (Wave -9) and 2017 (Wave-17)

	Factor contributions to CI				% of factor contributions to CI			
	Standard CI		Erreygers		Standard CI		Erreygers	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Variables	2009	2017	2009	2017	2009	2017	2009	2017
Age (Ref :15-24 years)								
-25-54 years	-0.003	-0.007	-0.004	-0.011	7.74%	17.84%	7.74%	17.84%
-55-64 years	-0.001	-0.004	-0.002	-0.006	3.81%	9.51%	3.81%	9.51%
-65+ years	0.012	0.026	0.018	0.042	-36.42%	-66.51%	-36.42%	-66.51
Gender (Ref: Male)								
-Female	-0.000	-0.000	-0.001	-0.001	1.14%	1.09%	1.14%	1.09%
Education (Ref: ≤Year 12)								
-Certificate level	0.000	0.000	0.000	0.000	-0.05%	-0.65%	-0.05%	-0.65%
-Undergraduate level	-0.001	-0.001	-0.002	-0.001	3.63%	1.39%	3.63%	1.39%
-Post-graduate level	-0.000	-0.001	-0.001	-0.002	1.10%	2.52%	1.10%	2.52%
Labour force status (Ref: Employed)								
-Unemployed	-0.001	-0.001	-0.002	-0.002	3.75%	3.61%	3.75%	3.61%
-Not in the labour force (NLF)	-0.008	-0.010	-0.012	-0.016	24.5%	25.59%	24.5%	25.59%
Covered by private health insurance	-0.006	-0.007	-0.010	-0.012	18.74%	18.62%	18.74%	18.62%
Active membership of club	-0.002	-0.001	-0.003	-0.002	5.44%	3.47%	5.44%	3.47%
Daily Smoker	-0.001	-0.001	-0.001	-0.002	1.93%	2.33%	1.93%	2.33%
Drink ≥ 4 standard drinks/day	0.000	-0.000	0.000	-0.000	-0.28%	0.14%	-0.28%	0.14%
Have long term health condition	-0.010	-0.015	-0.016	-0.024	31.74%	38.1%	31.74%	38.1%
Number of life shocks	-0.005	-0.007	-0.008	-0.011	16.61%	17.54%	16.61%	17.54%
Residual	-0.005	-0.01	-0.008	-0.016	16.62%	25.41%	16.62%	25.41%
Explained	-0.027	-0.029	-0.042	-0.047	83.38%	74.59%	83.38%	74.59%
Actual	-0.032	-0.039	-0.050	-0.063	100.00%	100.00%	100.00%	100.00%

6.4 Results and Discussion

Earlier we showed that the socioeconomic inequality in mental health has gradually worsened in Australia between 2009 and 2017. In this section, we separately study the cross-sectional and longitudinal decomposition. First, we study the role of mental health determinants in mental health inequality. Second, we discuss the changes to the socio-economic mental health inequality.

6.4.1 Cross-sectional decomposition of socioeconomic mental health inequality

The estimates of cross-sectional factor contributions and their respective percentages to standard CI and Erreygers indices for 2009 and 2017 are reported in Table 6.3. The model explains socioeconomic mental health inequality approximately 83% and 75% respectively in 2009 and 2017. From the generalised decomposition equation (6.12) of proposition 1, we know that factor contribution to socioeconomic inequality can arise from two sources. The first source is the regression coefficients of the health determinant function, and the second source is the socioeconomic inequality of the factor itself. Understanding this relationship has important implications in our analysis. For example, education level contributes to socioeconomic inequality in

mental health by 4.68% (certificate: -0.05%, undergraduate: 3.63% and post-graduate 1.1%) and 3.26% (certificate: -0.65%, undergraduate: 1.39% and post-graduate 2.52%) respectively in 2009 and 2017. However, if we inspect the regression coefficients of columns (iv) and (v) in Table 6.2, we see that, except for undergraduate education in 2009, all coefficients are insignificant. Thus, inspecting the factor inequalities columns (columns vi-ix) in Table 6.2 reveal that, education contribution to socioeconomic inequality of mental health in Table 6.3 is coming from socioeconomic inequalities in education. In summary, our results suggest that education level does not have impacts on mental health but socioeconomic inequality in education is contributing to socioeconomic mental health inequality.

Table 6.4: Longitudinal decomposition of income-related health inequality for 2009 (Wave -9) and 2017 (Wave-17)

	Erreygers			Standard CI (AGP)			Oaxaca-Blinder		
	(i) Term 1	(ii) Term 2	(iii)	(iv) Term 1	(v) Term 2	(vi)	(vii) Term 1	(viii) Term 2	(ix)
Variables	HRIM	IRHM	T	HRIM	IRHM	T	ΔCE	ΔEC	T
Age (Ref :15-24 years)									
-25-54 years	-0.0051	-0.0022	-0.0073	-0.0031	-0.0013	-0.0044	-0.0013	-0.0031	-0.0044
-55-64 years	0.0006	-0.0046	-0.0040	0.0004	-0.0028	-0.0024	-0.0011	-0.0013	-0.0024
-65+ years	0.0161	0.0072	0.0233	0.0099	0.0041	0.0139	-0.0070	0.0209	0.0139
Gender (Ref: Male)									
-Female	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Education (Ref: ≤Year 12)									
-Certificate level	0.0001	0.0003	0.0004	0.0000	0.0002	0.0002	0.0002	0.0000	0.0002
-Undergraduate level	-0.0001	0.0010	0.0010	-0.0001	0.0007	0.0006	0.0000	0.0006	0.0006
-Post-graduate level	-0.0003	-0.0007	-0.0010	-0.0002	-0.0004	-0.0006	0.0000	-0.0006	-0.0006
Labour force status (Ref: Employed)									
-Unemployed	-0.0010	0.0006	-0.0004	-0.0006	0.0004	-0.0002	-0.0004	0.0002	-0.0002
-Not in the labour force (NLF)	-0.0061	0.0024	-0.0037	-0.0038	0.0018	-0.0020	-0.0003	-0.0017	-0.0020
Covered by private health insurance	-0.0004	-0.0018	-0.0022	-0.0003	-0.0009	-0.0012	0.0001	-0.0013	-0.0012
Active membership of club	0.0014	-0.0008	0.0006	0.0009	-0.0005	0.0004	0.0002	0.0002	0.0004
Daily Smoker	0.0006	-0.0011	-0.0005	0.0004	-0.0007	-0.0003	0.0000	-0.0003	-0.0003
Drink ≥ 4 standard drinks/day	-0.0001	-0.0002	-0.0002	0.0000	-0.0001	-0.0001	0.0000	-0.0001	-0.0001
Have long term health condition	-0.0038	-0.0040	-0.0078	-0.0023	-0.0022	-0.0045	-0.0005	-0.0040	-0.0045
Number of life shocks	-0.0012	-0.0014	-0.0026	-0.0007	-0.0007	-0.0014	-0.0008	-0.0006	-0.0014
Total explained	0.0005	-0.0052	-0.0046	0.0003	-0.0023	-0.0020	-0.0110	0.0090	-0.0020
Residual	-0.0057	-0.0018	-0.0075	-0.0035	-0.0010	-0.0045	-0.0076	0.0031	-0.0045
Actual	-0.0052	-0.0070	-0.0122	-0.0032	-0.0033	-0.0065	-0.0185	0.0121	-0.0065
% Explained	-10.61%	73.92%	38.15%	-10.61%	70.95%	30.90%	59.23%	74.35%	30.90%

If both the regression coefficient and socioeconomic factor inequality are large, the factor contribution will be large. However, if either or both of the sources are low, the

factor contribution will be small. Thus, a larger factor contribution implies a large impact from both sources. Table 6.3 reports that the major factor contributors are long term health conditions (31.74% and 38.1% respectively in 2009 and 2017), not in the labour force (NLF) (24.5% and 25.59% respectively in 2009 and 2017), private health insurance (18.74% and 18.62% respectively in 2009 and 2017) and frequency of life shocks (16.61% and 17.54% respectively in 2009 and 2017). All of these factors have significant regression coefficients. Table 6.2 shows that long term health conditions increase the K10 score (i.e., reduces mental health) and also has a pro-poor distribution of the condition (i.e., a greater number of poor than rich people have long term conditions).

Similar effects are also observed for NLF and frequency of life shocks. In the case of private health insurance coverage, the regression coefficient reduces the K10 score (improves mental health) and the factor distribution is pro-rich (positive values). Thus, these factors add large negative values to concentration indices, i.e., higher K10 scores are distributed more in the poorer segments of society (more psychological distress and concentration of mental disorders).

The mental health behaviour variables add minor contributions to the socioeconomic mental health inequality. For example, Table 6.2 reports that club and sporting activity reduces K10 scores and has a pro-rich distribution (Table 6.3 reports 5.44% and 3.47% respectively in 2009 and 2017). Similarly, smoking also increases K10 scores and has a pro-poor distribution (Table 6.3 reports 1.93% and 2.33% respectively in 2009 and 2017). Alcohol consumption does not have significant regression coefficients and does not contribute to the socioeconomic mental health inequality in our estimates. Being female also makes a minor contribution to socioeconomic mental health inequality (Table 6.3 reports 1.14% and 1.09% respectively in 2009 and 2017). However, the demographic factor age makes a large contribution to socioeconomic mental health inequality (Table 6.3). Table 6.2 reports regression coefficients that are more negative in higher age groups. The working-age groups (age 25-54 and 55-64) have pro-rich socioeconomic inequality and the retirement age group (65+ years) has pro-poor socio-economic inequality. Thus, being of retirement age reduces socioeconomic inequality by a large margin.

6.4.2 Longitudinal decomposition of socioeconomic mental health inequality

Table 6.4 presents the longitudinal decomposition analysis of socioeconomic mental health inequality. In this analysis, we constructed our counterfactual socioeconomic inequality index using the final period's (wave 17/ year 2017) health outcome with the initial period's income ranking (wave 9/ year 2009). The first column shows factor contributions of health-related income mobility (HRIM) or term 1 of equation 22. Since the health outcome is fixed in this column and the income ranking is changing between the periods, this column shows the effect of income reshuffling. The next column shows factor contributions of income-related health mobility (IRHM) or term 2 of equation 22. The income ranking is fixed with the initial ranking in this column so that the factor contributions of health outcome change are reflected here. Through this column, we can understand whether health changes are progressive (regressive) in favour of poor (rich) people, which is a matter of principal interest to this illustration. The third column is derived by adding the first two columns and thus depicts the total changes contributed by the factor. The first three columns are derived using the Erreygers index (an absolute concentration index). A similar exercise is reported in the next three columns also using standard concentration index (a relative concentration index) for comparing normative value judgments. Finally, the last three columns report the Oaxaca-Blinder decomposition for comparison purpose. A careful inspection will reveal that the factor contributions of total changes in the Oaxaca-Blinder decomposition (last column) is exactly the same as the factor contribution of total changes in the standard concentration index (column vi). However, terms 1 and term 2 are different. This reflects the different uses of counterfactuals as well as interpretations under the common framework.

Our model performs well in understanding Income-Related Health Mobility (IRHM) as it explains approximately 74% and 71% respectively for the Erreygers and standard concentration indexes. The major factors that negatively affect the poor in health mobility index are long term health conditions, private health insurance coverage and the number of life shocks (-0.004, -0.0018 and -0.0014 respectively in the Erreygers index, and -0.0022, -0.0009 and -0.0007 respectively in the standard CI). Poorer individuals' circumstances play a major role in mental health mobility. Health behaviour such as smoking, drinking and club membership plays a relatively smaller role. The major factors that positively affect the poor in IRHM are labour force status and retirement age. Since, Australia is a welfare state country, benefits at retirement

age have a positive impact on society. Better economic conditions also have positive impacts on the poor's mental health. The negative aspects played a stronger role in this period.

The HRIM effects for labour force status is much stronger than income-related health mobility effects. The stronger negative effect in the HRIM counteracts the weaker positive effects in IRHM, resulting in a net negative effect from labour force status in this period. The overall changes in factor contribution are explained by 38% and 31% respectively for Erreygers and standard concentration indices. Similar to the cross-sectional analysis, factors such as long-term health conditions, number of life shocks, and NLF are the major drivers of the changes in socioeconomic inequality in mental health. There was no change in socioeconomic inequality for females. Socioeconomic inequality in the mental health of being female is thus structural in nature. The Oaxaca-Blinder decomposition also revealed that long term health conditions, private insurance and NLF contributes to socioeconomic inequality through the change in elasticities. In summary, circumstance factors are the major driving force of socioeconomic mental health inequality. To account for this, Australian governments should emphasise developing cost-effective intervention policies targeting vulnerable groups, so that health system resources are optimised as well as addressing the social determinants of health to reduce inequality in mental health.

6.5 Conclusions

Health inequalities due to a citizens' socioeconomic position are unfair. Social and economic conditions define peoples' health opportunities and thereby determine their risk of illness. On equity grounds, most developed and developing countries thus want to reduce such inequalities so that people can have equal opportunities regardless of socio-economic status. Understanding the measurement and examination of the key sources that drives socioeconomic health inequalities over time is thus essential to design policy interventions for their reduction. This paper makes contributions both in terms of methods and empirical results in the socioeconomic health inequality literature.

First, this study extends the literature by proposing a framework for analysing socioeconomic health and income mobility. We generalised the cross-sectional decomposition of all bivariate rank dependent indices and building on this method we

propose a generalised method of longitudinal decomposition for all classes of concentration indices. We also show that the traditional Oaxaca-Blinder type decomposition method can also be explained using our framework. Our proposed framework provides greater clarity and understanding on using different concentration indices for decomposition analysis and offers informed normative choices under a single umbrella framework.

Second, an illustrative application of our proposed framework enables us to analyse the sources and the recent evolution of socioeconomic mental health inequality in Australia. Using HILDA longitudinal survey data from waves 9 and 17, we deduce that factors like long term health conditions and life shock exposure are the major drivers of socioeconomic mental health inequality. SES factors like labour force status, and behavioural factors like private health insurance and community/club activities also play a significant role in individual outcomes. Our analysis also reveals that the elderly age group contributes to a large reduction in socioeconomic mental health inequality. Our hypothesis in this regard is that the elderly creates a positive externality in reducing socioeconomic mental health inequality. Opportunities exist in future research to explore the impact of the elderly on socioeconomic mental health inequality.

CHAPTER 7

INEQUITY IN PSYCHIATRIC HEALTHCARE USE IN AUSTRALIA

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ABSTRACT

Background

Despite recent substantial mental healthcare reforms to increase the supply of healthcare, mental health inequality in Australia is rising. Understanding of the level of inequity (unmet need gap) in psychiatric service use in Australia's mixed public-private health care system is lacking.

Objective

To present a novel method to measure inequity in the delivery of psychiatric care.

Methods

Data came from wave 9 (year 2009, n=11563) and wave 17 (year 2017, n=16194) of the Household, Income and Labour Dynamics in Australia (HILDA) survey. Multiple logistic regression was employed to estimate the psychiatric care utilisation compared to its need and the Gini index was used to estimate the standardised distribution of utilisation to measure the extent of inequity.

Results

The results show the inequity indices (need-standardised Gini) in psychiatric care utilisation were significant and found to be 0.066 and 0.096 in 2009 and 2017,

respectively for all individuals. In 2009, the inequity indices were found to be 0.051 and 0.078 for males and females, respectively, and 0.045 and 0.068 for rural and urban residents, respectively. In 2017, the indices were calculated to be 0.081 and 0.109 for males and females, respectively, and 0.086 and 0.097 for rural and urban residents, respectively.

Conclusions

This study showed a marked increase in unmet needs in psychiatric care utilisation since 2009. There is a greater need to develop policies to improve equity in psychiatric care utilisation in Australia.

Keywords: Inequity, GINI, mental health, need factors

7.1 Introduction

Promoting equity in mental health through needs-based provision of psychiatric care is seen as a key objective for many governments. To foster the aim of health equity, the Australian government has introduced the Better Access to Mental Health Care (Better Access) Initiative and the UK government has introduced the Improving Access to Psychological Therapies initiative in recent times (Littlefield & Giese 2008; Clark et al. 2009) In Australia's Better Access scheme, a range of mental health services is offered through Medicare (Australia's national universal health insurance system) and allowed patients in rural and remote areas to access psychological treatment through video conferencing (Harris et al. 2011). The scheme has grown in reputation and is initiating interest in the method in countries such as the UK, Canada and New Zealand with similar goals (Richards & Bower 2011). However, despite the success and increased provision of psychological treatment through the programs, the prevalence of mental disorders had not decreased for many countries and in Australia's case, recent evidence suggested that mental health inequality had increased (Jorm et al. 2017; Hashmi et al. 2020).

Since 1992, under the guidance of the National Mental Health Strategy, there has been substantial reform in mental health service delivery in Australia (Whiteford & Buckingham 2005). In 2018-19 Australia spent $10.6 billion on mental health-related services, a 234% increase in real terms since 1992-93 (Australian Institute of Health and Welfare 2021). Despite these reforms, there has been much debate as to whether

they have been effective (Griffiths et al. 2015). Further, questions were raised as to whether the Basaglian de-hospitalised model that Australian policy makers adopted was effective (Allison et al. 2020; Waters 2020). However, comparative research on such a topic requires a means of measuring inequity that will assess the health systems' role in generating inequity. To clarify uncertainties on understanding the Australian mental health system, the current study seeks to present new evidence that could be used to assess the equity impacts of these policy reforms.

While the term inequality and inequity are sometimes confused, they are not interchangeable. Inequity in healthcare refers to unfair and avoidable differences in utilisation of health resources arising from poor governance (Kawachi et al. 2002). On the contrary, inequality in healthcare simply refers to the uneven distribution of utilisation of health resources (Kawachi et al. 2002). Those covered by the national health insurance scheme have access to health services more or less equally once they are in the system. However, achieving equity in the utilisation of such resources is difficult and requires monitoring of resources for just allocation.

The Australian health system performance with respect to achieving equity in mental health provision is thus not clear. To be exact, questions have been raised as to whether recent policy reforms have improved access to services with respect to need, i.e., whether the unmet need is reduced. And if so, to what extent? This paper aims to estimate the level of overall inequity (unmet need gap) in mental health care service utilisation in Australia. We use Wagstaff and colleagues (Wagstaff & van Doorslaer 2000) method to estimate inequity. However, instead of concentration index (CI) to measure socioeconomic inequity (disparities in healthcare use adjusted for need), we propose using the Gini index to measure overall inequity to better understand the shortfall of service delivery. We will use data from a nationally representative annual survey and investigate whether mental health utilisation has improved since the inception of the Better Access scheme in 2006. Further, to shed more light on equity in utilisation, our study examines inequities by gender types and regions.

There are several key areas that this study seeks to contribute to the literature. First, past studies such as that by Meadows and colleagues (Meadows et al. 2015) handled such research questions by estimating the inequality of service utilisation. Although Meadows and colleagues' work captured some form of disparities through measuring inequalities, it was unable to measure unfairness that stemmed from the need of the

patients (i.e., measuring inequality does not capture inequity) (Kawachi et al. 2002). Recent studies clearly revealed that the poor had an 11% higher prevalence of mental disorders than the rich in Australia (Hashmi et al. 2021) and thus needs are different among socio-economic strata. Therefore, it is important for research to examine the needs of patients in mental health services utilisation across socioeconomic classes, which this study will do. Second, apart from the Better Access scheme, Australia currently operates more than 30 other mental health programs (The Department of Health 2019). Thus, any analysis (for example, Harris et al. (Harris et al. 2011) and Jorm's (Jorm 2018) work) that assesses the performance of only the Better Access scheme can be considered partial, compared to the equity perspective of the overall mental health system. Our study will assign Gini index values for the system as a whole and considers the unmet need gap from the overall health system perspective so that it has no such shortcomings.

Further, the recent work of Bartram and Stewarts (Bartram & Stewart 2019) that compared income inequities of mental health services of Canada and Australia was closest in terms of methodology to this work. However, two aspects distinguish this work from Bartram and Stewarts. Primarily, they used a Concentration Index (CI) approach to estimate income inequities in mental health services utilisation. Although socioeconomic inequities would indicate the level of inequity, it will not be able to accurately indicate overall unmet needs as it only considers disparity in service utilisation in different social classes and not the overall shortfall that is unjust as a whole. This issue is important when the health system aims to provide universal health coverage. In such healthcare systems, the expectation of socioeconomic inequities would indeed be lower by definition. It is argued here that, instead of using CI for the need for standardised distribution of mental health services, the Gini index would better capture the unmet needs in the mental health system from an overall perspective. Further, Bartram and Stewart used Australian National Mental Health and Wellbeing 2007 survey data which was much older data compared with current circumstances. This was especially true, when considered that the Better Access scheme came into operation in November 2006. In this paper we addressed such methodological shortcomings and details are in the next section.

7.2 Materials and methods

7.2.1 Data source and sample selection

The analysis of this study is based on the data from the Household, Income and Labour Dynamics in Australia (HILDA) survey (Department of Social Services et al. 2020). HILDA is a nationally representative household-level longitudinal survey in Australia conducted annually since 2001. HILDA collects data from all individual members of the household who are aged 15 years and older. The questionnaire consists of the main module and a few major and minor sub-modules. The main module of the survey focuses on the socio-demographic characteristics of an individual. This data is obtained through face-to-face interviews and reinterviews of the same selected household members that occurs each year. The annual number of survey participants ranges from 12,500 to 17,500 individuals. Over the years, more than 30,000 individuals have participated in face-to-face interviews. On the contrary, the data for major and minor sub-modules are collected from individuals through self-completed questionnaires in different years. Annually, the major and minor sub-modules usually cover a specific theme (for example, wealth, retirement, fertility, health or education) and each theme usually recurs every 3 to 5 years.

The major module covering health appears every four years: starting with wave 9 (year 2009), wave 13 (year 2013) and wave 17 (year 2017). For this study, we used the waves that contained the earliest (2009) and latest (2017) health modules for our analysis. The principal reason for choosing wave 9 was to use the closest year to the inception of the Better Access scheme and compare it to the most distant year where data is available (wave 17). Only individuals who participated in at least one of wave 9 or 17 were included in the analysis. The final sample contained 19,130 individuals and 27,757 observations (11,563 observations in wave 9 and 16,194 observations for wave 17). Of the 19,130 individuals, 8,627 individuals participated in both waves. To account for sample attrition and characteristics of the population, the survey supplied responding person Self-Completion Questionnaire (SCQ) weights have been used for the analysis. In addition, albeit in a very small percentage, non-responses to particular items were imputed using the last observation carried forward method. Detailed information about sampling procedure, wave-on-wave survey response and attrition rates can be found elsewhere (Summerfield et al. 2019).

7.2.2 Measures

7.2.2.1 Outcome variable

The main outcome of interest for this study is psychiatric care utilisation. HILDA collects psychiatric care utilisation data by showing a prompt card on types of health care providers and asking the respondent "During the last 12 months, have you seen any of these types of health care providers about your health?" and if the respondent had a positive response, then the respondent was asked, "Which ones?" The response of the respondent who had seen a mental health professional such as a psychiatrist or psychologist was recorded in the HILDA survey as variable "_ hecpmhp". This binary variable is used as a measure of psychiatric care utilisation in this study.

7.2.2.2 Need and non-need variables

The literature on inequity measurement has mainly developed from Wagstaff and Van Doorslaers' work (Wagstaff & van Doorslaer 2000), based on the horizontal equity principle (that states equal use for equal need). To measure the degree of inequity they standardised the healthcare delivery variable through need and non-need factors. Further empirical work interpreted care delivery as equitable if medical care resources were allocated strictly in accordance with the medical needs of patients and not allocated subjectively to non-need factors such as patient status, income, education or geographic area (O'donnell et al. 2008; Pulok, van Gool, Hajizadeh, et al. 2020). Following recent developments in the literature, we have classified and selected the need and non-need variables of psychiatric care utilisation for our analysis (Pulok, van Gool, et al. 2020c; Pulok, van Gool, et al. 2020b, 2020a). Medical need in household surveys is not estimable and in practice researchers use demographic and health status/morbidity variables as a proxy of need (O'donnell et al. 2008). This study included the following variables to measure the need for psychiatric services: age, gender, general health condition and mental health condition. The general health condition of the respondents was assessed using the five-point Self-Assessed Health (SAH) measure included in the SF36 instrument of the HILDA health module. The mental health condition of a participant was measured using the Kessler Psychological Distress Scale (K10) (Kessler et al. 2002). The K10 score ranges from 10 to 50 and is used to assess the likelihood of having a mental disorder. For example, a threshold score of 20 or greater indicates the likelihood of developing a mild or above mental disorder depending on how high a person has scored on the K10 scale (Andrews &

Slade 2001). Thus, we have defined the binary mental health variable (K10>=20) as a measure for psychiatric care need.

Non-need characteristics such as socio-economic indicators could also have an impact on psychiatric care utilisation (Bartram & Stewart 2019). Non-need indicators were: income, education, labour force status, the socio-economic rank of living area and urbanisation type. The study used equivalised household disposable yearly income in quintiles (poorest, poorer, middle, richer and richest categories) as a measure of income. The 'modified OECD' equivalence scale formula was, used to calculate equivalence (ABS 2006). The education level was measured high if the participants had an education level above the Australian Qualification Framework (AQF) level 6 (bachelor's degree and above), measured medium if AQF level 3-6 (certificate III-IV, diploma etc.) and measured low if AQF level below 3 (year 11-12 etc.) (Australian Qualification Framework Council 2013). Labour force status was categorised as employed, unemployed and participants who were not in the labour force (NLF) in the survey period. The socio-economic rank of an area is measured by the 2011 version of Socio-Economic Indexes for Areas (SEIFA) from the Australian Bureau of Statistics (ABS) (Pink 2011). This study used SEIFA in quintiles that rank areas of Australia according to relative socio-economic advantage and disadvantage (most disadvantaged areas, disadvantaged areas, median ranked areas, advantaged areas and most advantaged areas). Lastly, the study measured urbanisation type by the 2011 version of the Australian Statistical Geography Standard (ASGS) definition of Section of State (SOS) (Australian Bureau of Statistics 2011).). If the person lived in a 'major urban area' (population greater than 100,000) or 'other urban area' (population in between 1,000-99,999) then the groups were categorised as a person living in an urban area in this study. The rest of the population are categorised as a person living in a rural area.

7.2.3 Statistical analyses

In assessing equity in psychiatric care, our attention focused on assessing the existence of horizontal inequity (Van Ourti et al. 2014). The method is fundamentally different from analysing inequality in the utilisation of health care, as equity analysis for health care must account for differences in the need for health care. Thus, according to the horizontal equity principle, variations of utilisation due to need factors are equitable and all other variations are treated as inequitable (O'donnell et al. 2008). A cross-

tabulation comparison of psychiatric care need and utilisation distribution by socio-demographic factors would give a general indication of the value judgement of the health care system. However, to assess the extent of inequity, the need for standardised distribution of health care utilisation is required to be estimated so that any residual inequality in utilisation can be interpreted as the degree of inequity in the utilisation of health care resources.

This study used the indirect standardisation method to measure inequity, which is currently the dominant technique in measuring inequity from household survey data (Van Ourti et al. 2014). The steps for estimating need standardised distribution were as follows (O'donnell et al. 2008; Pulok, van Gool, Hajizadeh, et al. 2020):

Step 1: The psychiatric care use model that specifies the relationship between psychiatric care use and need/non-need variables is estimated. Since, our outcome of interest is a binary variable (psychiatric care utilisation in the last 12 months — yes/no), we estimate a logistic regression model of the following functional form:

$$p_i = \Phi\left(\alpha_0 + \sum_j \beta_j X_j + \sum_k \gamma_k Z_k\right) + \varepsilon_i \qquad (7.1)$$

Where, p_i is the indicator for psychiatric care use by individual i; α, β & γ are vectors of parameters to be estimated; X is a vector of need variables that we want to standardise (age, gender, general health condition and mental health condition); Z is a vector of non-need variables that we want to control for (income, education, labour force status, socio-economic rank of area and urbanisation types for this study); and ε_i is the residual for individual i .

Step 2: From the estimated parameters ($\hat{\alpha}_0, \hat{\beta}_j$ & $\hat{\gamma}_k$) of equation 7.1, individual values of need variables (X_j) and sample means of non-need variables ($\bar{Z}_k$), we can predict the need-expected utilisation of psychiatric care $\hat{p}_i$:

$$\hat{p}_i = \Phi\left(\hat{\alpha}_0 + \sum_j \hat{\beta}_j X_j + \sum_k \hat{\gamma}_k \bar{Z}_k\right) \qquad (7.2)$$

The need-expected utilisation (equation 2) predicts the ideal level of psychiatric care an individual would use on average given the same need level, through neutralising the influence of the non-need factors by setting then to their average (Pulok, van Gool, Hajizadeh, et al. 2020).

Step 3: Need-standardised psychiatric utilisation then is derived by subtracting need-expected utilisation from actual psychiatric use and adding the mean of need-expected utilisation. The mean is added so that the mean of the standardised utilisation remains

equal to the actual utilisation (O'donnell et al. 2008). Thus, the need-standardised utilisation is as follows:

$$\hat{p}_i^{IS} = p_i - \hat{p}_i + \frac{1}{n}\sum_{i=1}^{n}\hat{p}_i \quad (7.3)$$

Step 4: After the estimation of need-standardised utilisation, as in the standard literature, the concentration index is used to measure socioeconomic inequity. We propose that inequity can also be tested by estimating the Gini index of the need standardised utilisation to measure overall inequity (unmet need gap).

Using the above procedure, we can also extend our analysis to compare subgroups (i.e., gender, urbanisation type and states) for two time periods in Australia. Stata MP Version 15 software and Excel 2016 were used to perform all analyses of this study.

7.3 Results

7.3.1 Distribution and correlates of psychiatric care use

The distribution of mental illness (individuals who had K10 score 20 or greater) and psychiatric care use by need and non-need factors for 2009 and 2017 are presented in Table 7.1. Comparing the rates of mental illness and service utilisation enables an estimate of the shortfall in the healthcare system. Varying degree of service utilisation shortfall exists across all need and non-need factors (i.e., compared with the level of mental illness, service utilisation is low). For example, in 2009, the mental illness rate (as indicated by the proportion of participants reaching the K10 cut-off) for males was 19.13% (95% CI: 17.57-20.78), whereas service utilisation was 4.23% (95% CI: 3.58-5.00). Similarly, for females in the same period, the mental illness rate was 22.88% (95% CI: 21.28-24.56) compared with the service utilisation rate of 6.82 % (6.06-7.66). In general, if the mental illness rates were higher for the need factors, the table showed an increase in service utilisation for that factor, although there might still exist a varying degree of shortfall.

The same is not true for some non-need factors such as income, education and socioeconomic rank by area. Whereas, the mental illness rates between groups were significantly different for these factors, the service utilisation rates were not significantly different. For example, in 2017, the poorest income group had 32.23% (95% CI: 30.10-34.44) mental illness rate and the richest income group had a rate of 17.56% (95% CI: 15.72-19.62). Clearly, the data show that individuals belonging to higher income groups had significantly lower mental illness rates. However, the

Table 7.1: Percentage distribution of mental illness and health service utilisation by key socio-demographic characteristics

	2009			2017		
Characteristics	**Observations**	**Mental Illness**	**Service Utilisation**	**Observations**	**Mental Illness**	**Service Utilisation**
	(N)	(%) (95% CI)	(%) (95% CI)	(N)	(%) (95% CI)	(%) (95% CI)
Need factors						
Age						
15-24 years	2137	25.54 (23.16-28.07)	5.54 (4.40-6.94)	2588	34.87 (32.40-37.43)	12.44 (10.80-14.28)
25-39 years	2735	22.05 (19.60-24.70)	6.59 (5.55-7.82)	4217	28.43 (25.92-31.09)	11.26 (9.79-12.92)
40-64 years	4791	20.15 (18.35-22.08)	6.19 (5.38-7.10)	6289	23.24 (21.54-25.03)	8.51 (7.59-9.54)
65+ years	1900	16.38 (13.79-19.35)	2.08 (1.42-3.03)	3100	15.59 (13.11-18.45)	2.72 (2.15-3.42)
Gender						
Male	5400	19.13 (17.57-20.78)	4.23 (3.58-5.00)	7601	22.85 (21.37-24.41)	7.16 (6.39-8.02)
Female	6163	22.88 (21.28-24.56)	6.82 (6.06-7.66)	8593	27.36 (25.82-28.97)	10.46 (9.50-11.49)
Self-Assessed Health						
Excellent	1505	6.61 (4.93-8.82)	2.95 (1.97-4.39)	1825	9.7 (7.73-12.11)	4.66 (3.58-6.03)
Very good	4285	12.64 (10.92-14.59)	3.90 (3.19-4.76)	5633	15.74 (14.39-17.21)	6.49 (5.56-7.56)
Good	3980	23.32 (21.51-25.23)	5.41 (4.58-6.38)	5817	28.01 (25.99-30.13)	9.29 (8.19-10.52)
Fair	1439	41.15 (37.52-44.87)	11.09 (9.19-13.33)	2375	43.34 (40.41-46.32)	13.30 (11.68-15.11)
Poor	354	63.43 (54.65-71.40)	12.39 (8.83-17.13)	544	68.03 (63.12-72.58)	23.87 (19.77-28.51)
Non-need factors						
Income						
Poorest	2314	31.54 (28.22-35.05)	6.90 (5.62-8.44)	3239	32.23 (30.10-34.44)	10.16 (8.82-11.69)
Poorer	2313	22.85 (20.41-25.49)	6.25 (5.05-7.71)	3239	29.13 (25.21-33.39)	9.05 (7.67-10.64)
Middle	2311	20.38 (18.12-22.84)	5.38 (4.35-6.65)	3239	26.97 (24.01-30.09)	8.53 (7.38-9.85)
Richer	2313	17.74 (15.41-20.35)	4.60 (3.62-5.83)	3239	20.66 (18.66-22.81)	8.13 (6.71-9.81)
Richest	2312	13.59 (11.64-15.82)	4.69 (3.75-5.85)	3239	17.56 (15.72-19.62)	8.48 (7.25-9.89)
Education						
Low	5646	24.76 (22.89-26.73)	5.38 (4.66-6.21)	6501	30.18 (28.32-32.1)	9.81 (8.82-10.90)
Medium	3307	19.06 (17.08-21.21)	5.46 (4.57-6.50)	5357	24.89 (23.08-26.79)	8.43 (7.58-9.39)
High	2570	14.70 (12.97-16.62)	6.03 (4.91-7.39)	4336	17.99 (16.02-20.14)	7.84 (6.68-9.17)
Labour force status						
Employed	7435	17.15 (15.87-18.51)	4.68 (4.08-5.37)	10254	22.35 (21.21-23.54)	8.04 (7.24-8.92)
Unemployed	395	38.41 (32.12-45.11)	13.43 (9.29-19.01)	628	47.42 (38.09-56.94)	16.13 (12.17-21.08)
Not in Labour Force (NLF)	3733	26.60 (24.17-29.18)	6.33 (5.42-7.39)	5312	28.12 (26.11-30.23)	9.58 (8.56-10.71)
SEIFA						
Most disadvantaged	2315	30.07 (26.62-33.77)	6.08 (4.82-7.64)	3239	31.26 (28.48-34.18)	8.80 (7.22-10.70)
Disadvantaged	2312	21.89 (19.45-24.53)	4.66 (3.64-5.95)	3252	26.26 (24.37-28.25)	8.70 (7.51-10.06)
Median	2317	20.41 (18.02-23.02)	5.69 (4.67-6.91)	3242	25.71 (23.10-28.50)	9.45 (8.20-10.86)
Advantaged	2308	16.89 (14.85-19.15)	5.55 (4.51-6.81)	3223	21.88 (19.74-24.18)	9.50 (8.11-11.09)
Most advantaged	2311	16.08 (14.26-18.10)	5.67 (4.55-7.04)	3238	21.53 (17.94-25.61)	7.85 (6.56-9.36)
Urbanisation types						
Urban	10056	21.29 (19.90-22.74)	5.84 (5.26-6.48)	14095	25.48 (24.09-26.92)	9.06 (8.35-9.81)
Rural	1507	18.73 (16.30-21.43)	2.88 (1.99-4.16)	2099	22.54 (19.72-25.63)	7.10 (5.81-8.64)

poorest income group had 10.16% (95% CI: 8.82-11.69) utilisation rate and the richest income group had 8.48% (95% CI: 7.25-9.89) despite the large difference in mental illness rates.

Table 7.2: Correlates of healthcare service utilisation (Logistic regression models)

	2009				2017			
Characteristics	**Unadjusted OR**	**95% CI**	**Adjusted OR**	**95% CI**	**Unadjusted OR**	**95% CI**	**Adjusted OR**	**95% CI**
Age								
15-24 years (ref.)								
25-39 years	1.204	(0.894-1.622)	1.2	(0.861-1.673)	0.893	(0.723-1.104)	1.006	(0.794-1.274)
40-64 years	1.125	(0.857-1.477)	1.028	(0.740-1.430)	0.655***	(0.542-0.791)	0.668***	(0.539-0.826)
65+ years	0.362***	(0.234-0.561)	0.247***	(0.143-0.427)	0.197***	(0.148-0.261)	0.158***	(0.113-0.220)
Gender								
Male (ref.)								
Female	1.655***	(1.343-2.039)	1.546***	(1.236-1.935)	1.514***	(1.298-1.766)	1.387***	(1.175-1.639)
Self-Assessed Health								
Excellent (ref.)								
Very good	1.335	(0.85-2.097)	1.247	(0.776-2.004)	1.421*	(1.042-1.939)	1.347	(0.983-1.847)
Good	1.880**	(1.200-2.945)	1.498	(0.934-2.401)	2.098***	(1.582-2.782)	1.779***	(1.336-2.370)
Fair	4.105***	(2.614-6.446)	2.984***	(1.834-4.854)	3.142***	(2.318-4.260)	2.481***	(1.797- 3.427)
Poor	4.653***	(2.668-8.114)	2.707**	(1.44- 5.090)	6.42***	(4.484-9.193)	3.933***	(2.666- 5.800)
Mental Illness (K10>=20)								
No (ref.)								
Yes	5.330***	(4.273-6.649)	3.883***	(3.076-4.903)	6.128***	(5.136-7.311)	4.321***	(3.596- 5.191)
Income								
Poorest (ref.)								
Poorer	0.9	(0.655-1.236)	1.044	(0.715-1.524)	0.879	(0.697-1.108)	0.859	(0.672- 1.098)
Middle	0.768	(0.556-1.059)	0.868	(0.584-1.289)	0.825	(0.666-1.022)	0.868	(0.668-1.129)
Richer	0.651**	(0.470-0.902)	0.756	(0.515-1.110)	0.782	(0.604-1.013)	0.966	(0.721-1.295)
Richest	0.664**	(0.487-0.906)	0.781	(0.527-1.158)	0.819	(0.646-1.037)	1.135	(0.863-1.493)
Education								
Low (ref.)								
Medium	1.015	(0.803-1.283)	1.259	(0.969-1.637)	0.847*	(0.732-0.980)	0.946	(0.804-1.112)
High	1.129	(0.864-1.476)	1.441*	(1.073-1.935)	0.781*	(0.638-0.956)	0.983	(0.754-1.283)
Labour Force Status								
Employed (ref.)								
Unemployed	3.155***	(2.030-4.903)	2.461***	(1.492-4.059)	2.199***	(1.558-3.105)	1.452	(0.969- 2.175)
Not in Labour Force (NLF)	1.376**	(1.106-1.712)	1.379*	(1.051-1.811)	1.212*	(1.027-1.430)	1.49***	(1.226-1.812)
SEIFA								
Most Disadvantaged (ref.)								
Disadvantaged	0.755	(0.529-1.078)	0.945	(0.641-1.395)	0.987	(0.749-1.301)	1.197	(0.861-1.663)
Median	0.931	(0.674-1.286)	1.397	(0.970-0.012)	1.081	(0.834-1.4)	1.338	(0.976-1.834)
Advantaged	0.907	(0.655-1.255)	1.534*	(1.060-2.219)	1.087	(0.829-1.425)	1.532**	(1.107-2.121)
Most advantaged	0.928	(0.664-1.297)	1.565*	(1.059-2.314)	0.882	(0.669-1.162)	1.201	(0.836-1.725)
Urbanisation types								
Urban (ref.)								
Rural	0.479***	(0.322-0.712)	0.491***	(0.324-0.744)	0.767***	(0.612-0.962)	0.772*	(0.603-0.988)
Constant			0.013***	(0.007-0.025)			0.028***	(0.018-0.044)

*** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$

In summary, Table 7.1 showed that higher mental illness is matched with higher utilisation rates across all need factors and some non-need factors. In addition, both illness and utilisation rates were higher in 2017 than in 2009. However, a service utilisation shortfall exists in all factors in both years. Table 7.1 indicates the existence of inequity in psychiatric care utilisation, but fails to confirm and measure the extent

of inequity in psychiatric care. To understand the level of inequity we need to investigate the estimates of the logistic regression model.

Table 7.2 reports the need-expected correlates of psychiatric care utilisation for 2009 and 2017. Unsurprisingly, people who were more likely to be mentally ill (K10 score 20 or greater), had the highest odds of psychiatric care utilisation among all factors (adjusted odds ratio [AOR]: 3.883 and 4.321 for years 2009 and 2017, respectively). Similarly, individuals who reported their health (Self-Assessed Health) as 'fair' or 'poor' had higher odds to use psychiatric services compared to individuals who reported their health as 'excellent' (AOR: 2.984 and 2.707 in 2009 and 2.481 and 3.933 in 2017, respectively for 'fair' and 'poor'). In addition, the results showed that women had higher odds (AOR: 1.55 and 1.39) than men in using psychiatric care in 2009 and 2017, respectively. The results also showed that the older age group (65+ years) had significantly lower odds (AOR: 0.247 and 0.158 respectively in 2009 and 2017) of psychiatric care utilisation than the reference age group (15-24 years). Thus, the need type variables showed expected patterns in the logistic regression model results.

This study did not find any evidence that non-need factors such as income or socio-economic area ranks (SEIFA) had any significant association with psychiatric care utilisation. This is understandable since patients are supported through Medicare, the national health insurance scheme. However, the study found that individuals with high levels of education used significantly more psychiatric care (AOR: 1.441) compared to individuals who had lower levels of education in 2009. Similarly, individuals who were unemployed or not in the labour force (NLF) used significantly higher levels of psychiatric care (AOR: 2.461 and 1.379 respectively for unemployed and NLF in 2009 and 1.49 for NLF in 2017) than employed individuals, although, the education and unemployed groups were not significant in 2017. The results also show that non-need factors such as urbanisation types were significant in both years. Individuals who reside in a rural area had lower odds of psychiatric care utilisation than individuals who lived in urban areas (AOR: 0.013 and 0.028 in 2009 and 2017 respectively for rural areas). While regression estimates showed the relative importance of each factor, they did not show the extent of inequity in psychiatric care utilisation in Australia. For that, we have to use the regression estimates to generate a need-standardised distribution and use the inequality indices of the distribution to measure inequity.

7.3.2 Inequity in Psychiatric care utilisation

The levels of inequity and inequality of psychiatric care service utilisation in Australia are presented in Table 7.3. The socioeconomic inequality and inequity indices (measured by concentration index) are bounded between -1 and 1. A negative value indicates pro-poor inequity/inequality and a positive value indicates pro-rich inequity/inequality of utilisation of healthcare. Conversely, overall inequality and inequity indices (measured by the Gini index) are bounded between 0 and 1. In one extreme, a zero value indicates equal distribution to all and on the other extreme, a value of one indicates the highest levels of unequal distribution of healthcare utilisation (all psychiatric care is utilised by only one person). Table 7.3 showed that there exists a significant level of pro-poor socioeconomic inequality of -0.087 in 2009. However, this inequality was lower but not significant in 2017. Furthermore, socioeconomic inequity (when need was standardised) in both 2009 and 2017 was not significant, implying there was no socioeconomic inequity in the study period.

Table 7.3: Inequity and inequality of psychiatric healthcare service utilisation

	2009	**2017**
Socioeconomic inequality	-0.087**	-0.034
Socioeconomic inequity	-0.002	0.001
Overall inequality	0.945***	0.912***
Overall inequity	0.066***	0.096***

*** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$

To understand the inequity level further, we also studied overall inequality and inequity. Overall inequality and inequity were significant in both years. The overall inequality for psychiatric care utilisation was 0.945 and 0.912 in 2009 and 2017, respectively. By 2017, the level of inequality was reduced, i.e., more individuals had used psychiatric care in 2017. However, the simple inequality measurement does not account for the need for health care. Individuals with greater need will, obviously, use higher levels of healthcare if available. Inequity measurement takes into account an individuals' need/non-need factors and indicates the level of unfairness in healthcare utilisation. Table 7.3 showed that overall inequity in psychiatric care utilisation were 0.066 and 0.096 in 2009 and 2017 respectively (statistically significant in both years). Contrary to overall inequality, the inequity level in psychiatric care utilisation in Australia had risen by 2017.

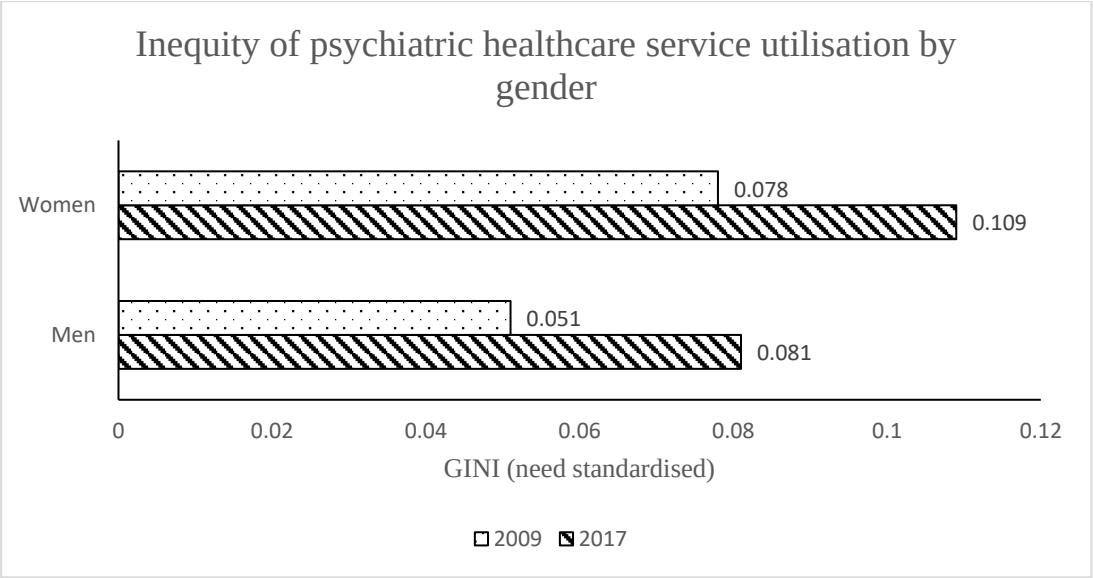

Figure 7.1: Inequity of psychiatric healthcare service utilisation by gender in 2009 and 2017

Figure 7.1 shows the gender specific inequity level of psychiatric services in 2009 and 2017. The inequity levels of psychiatric care utilisation for women are 0.078 and 0.109 in 2009 and 2017, respectively. Conversely, the levels for men are 0.051 and 0.081 in 2009 and 2017, respectively. Women experience a higher level of inequity in psychiatric care utilisation than men in Australia. The inequity level also increased for both genders by 2017.

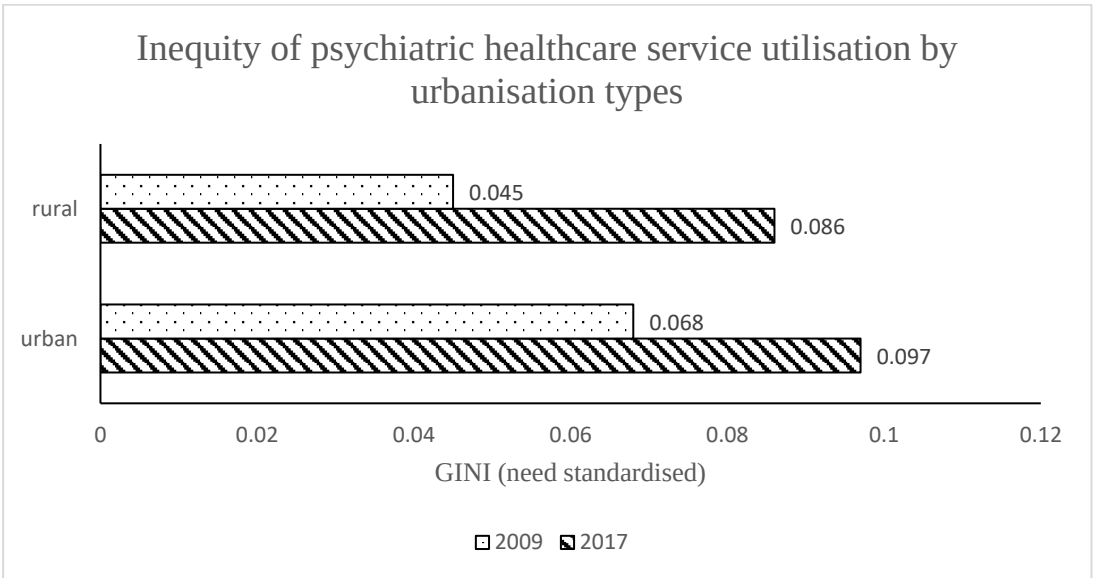

Figure 7.2: Inequity of psychiatric healthcare service utilisation by urbanisation types in 2009 and 2017

The inequity level also varies by area. Figure 7.2 shows the inequity level by urbanisation. Individuals who lived in rural areas encountered a lower level of inequity in psychiatric care utilisation than individuals who lived in urban areas (0.045 and

0.086 respectively in 2009 and 2017 for rural residents and 0.068 and 0.097 respectively in 2009 and 2017 for urban residents). The inequity level had increased for both types of residents in 2017 and the inequity gap between these two groups reduced. A similar picture is also portrayed in states and territories in Australia. The levels of inequity are presented in Figure 7.3. Inequity has increased by 2017 in all states and territories. South Australia had the highest level of inequity in 2009. However other states caught up and the highest level of inequity in 2017 was in Tasmania.

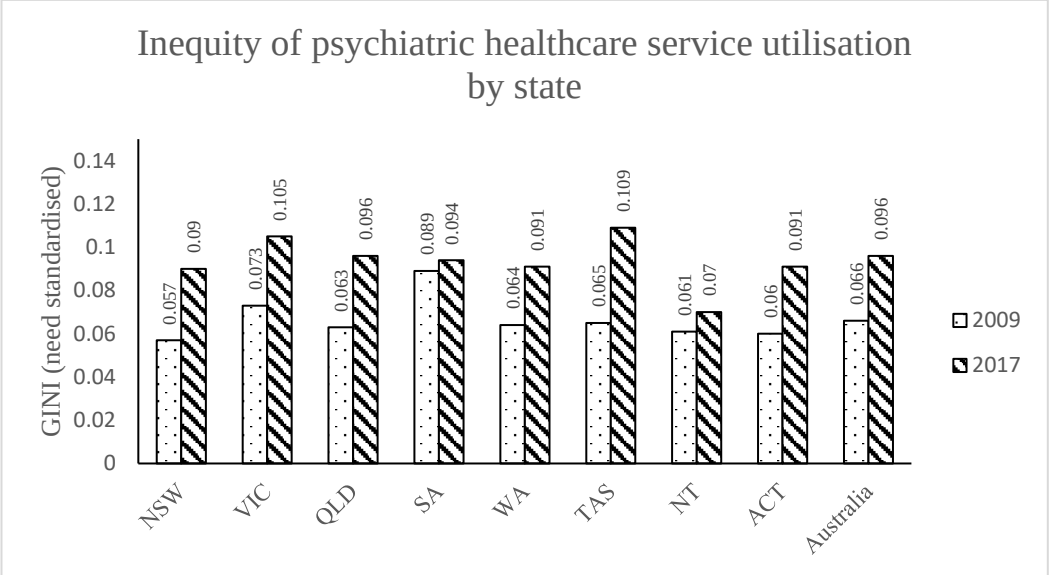

Figure 7.3: Inequity of psychiatric healthcare service utilisation by State in 2009 and 2017

7.4 Discussion

Gaps continue to exist in the literature when estimating the degree of unmet needs in the mental healthcare system. Although most studies report correlates of unmet need of mental healthcare utilisation, it is difficult to draw precise comparison across health systems because such studies lack a standardised measure of unmet need (Mansbach-Kleinfeld et al. 2010; Roll et al. 2013; Page, I. S. et al. 2021). However, in the health inequity literature, the CI approach has been used to measure the extent of disparity in mental health need and its utilisation in different socioeconomic strata through the use of an inequity index (Mangalore et al. 2007). Similar to the CI approach, we proposed that the Gini index could be used to measure the degree of unmet mental health needs. The study findings demonstrated marked inequity in mental healthcare service provision even after the introduction of the Better Access scheme in Australia.

Contrary to previous studies, our study found that there was no significant socioeconomic inequity in mental health care use, i.e., we did not find any significant disparity in mental healthcare use among different socioeconomic groups after we adjusted for needs and non-need factors (Meadows et al. 2015; Bartram & Stewart 2019). First, this contradiction likely arose because Meadows et al (Meadows et al. 2015) did not adjust for need-factors in their work. Second, Bartram and Stewart (Bartram & Stewart 2019) used old data that did not correspond to current healthcare provision in Australia. Further, Bartram and Stewart investigated mental health service providers (psychiatrist, psychologist etc.) separately and as patients can avail themselves of services with different providers, the result could very well be different if their analyses were conducted in an aggregate system level.

However, our results are consistent with the findings of Harris et al. (Harris et al. 2011) and Jorm (Jorm 2018) that confirm that there exists a marked unmet need in Australia's mental health delivery system. However, unlike Harris et al and Jorm's works which evaluated the Better Access scheme specifically, our work evaluated the mental health system as a whole and found that there was a 45% increase in index score (unmet need gap) in recent times despite the introduction of the Better Access scheme.

Previous research suggested that women have higher needs and are more likely to use mental health care than men (Kessler et al. 1981). This situation is also confirmed in our study. The findings showed that at a population level, females' unmet need is higher than males even after adjusting for need and non-need factors and holds in both periods. Thus, policymakers might need to design and implement strategies focusing higher levels of service delivery to female populations so that such unmet need is reduced. Our study findings also suggest that unmet need is higher in urban areas than rural areas in Australia. The Australian government should be commended for mental health service delivery in rural areas. However, the rate of increase in unmet need in rural areas was higher when compared to urban areas. The Australian government should formulate policy targets that cost-effectively increase need-based psychiatric care access in the rural areas.

It is important to consider certain limitations of our study findings. First, instead of the perceived needs of an individual, this study used K10 self-report surveys and self-assessed health to measure the need for psychiatric utilisation. Thus, it is possible that it excludes those who need care but do not fulfil the clinical cut off criteria, for example, those with sub-clinical symptoms or those seeking early intervention or

assistance with wellbeing. However, at the population level, the clinical cut-offs associated with the K10 provide a good indication of the proportion of people who would indicate a need for some type of psychiatric assistance.

Second, if data were available before 2007 then it would be possible to investigate the health reform effect of programs like Better Access scheme more accurately. Further, data unavailability limits our analysis to only two years (2009 and 2017) which fails to capture the within-year effects that a trend analysis would have allowed. Finally, it might also be beneficial to examine service utilisation in a more detailed manner, for example, how many times participants had utilised psychiatric services rather than simply whether these services had been accessed during the time period. This could explain finer details of socio-economic inequity. However, we could not perform such analysis, because of data unavailability. Given these limitations, this study calls for prospective research and future surveys that capture changes in the level of unmet need over time for countries that have similar equity objectives.

7.5 Conclusions

Service equity across socio-demographic characteristics, regions and communities is one of the primary goals of Australia's National Mental Health Strategic Plan. Despite recent mental healthcare reforms, our results showed that equity has not been fully achieved in psychiatric care delivery in Australia. Although our results did not find any significant socioeconomic inequity in mental healthcare use, they suggest that there is an unmet need gap that is increasing across all communities in Australia. Further, there is a need for policies to address the unmet needs of psychiatric care for women. Although Australia's health care system performs well compared to the rest of the world, there is a need to focus on improving equity and efficiency performance of existing policies and help develop targeted strategies that improve the equity of psychiatric care for all Australians.

CHAPTER 8

DISCUSSION AND CONCLUSIONS

8.1 Introduction

One of the most defining aspects of Australia's mental health system performance assessment is its commitment to equity. However, equity is essentially a normative term, and applying it to any process necessitates the use of positive economics concepts. Therefore, the overarching objective of this thesis was to apply positive economics approaches to identify several strategies for mental health policy, practice, and research that promote mental health improvements in accordance with normative ideals of equity.

To meet such an objective, this thesis set out to explore equity issues in the mental health sector in Australia by:

i) Determining the prevalence of mental disorders in socioeconomic groups (Chapter 3);

ii) Investigating the effect of mothers' background on mental health inequalities among Australian youth (Chapter 4);

iii) Examining the severity of life shocks' influence on socioeconomic disparities in mental health among Australian adults (Chapter 5);

iv) Establishing a methodological framework on socioeconomic health mobility and applying the framework to mental health (Chapter 6);

v) Assessing inequity in mental health service use (Chapter 7).

The following sections summarise the findings of each study, which were discussed in depth in Chapters 3–7.

8.2 Discussion of key findings

To understand equity issues in Australian mental health, I first examined the current state of mental health by socioeconomic group (Chapter 3), and then investigated the origin of mental health inequality (Chapters 4-6) and lastly assessed inequity in healthcare use (Chapter 7). The goal was to identify the challenges that would highlight potential solutions to key equity challenges in the Australian mental health and care systems. The key study findings are as follows.

8.2.1 Prevalence of mental disorders in socioeconomic groups

The cost of mental illnesses is rising in Australia (Productivity Commission 2020). In Chapter 3, it has been outlined that the prevalence of mental illnesses varies significantly across social strata, and thus the expense associated with mental disorders varies correspondingly. For example, 30.97% of the poorest individuals had a mental disorder, compared to just 19.59% of the richest. When compared to the overall prevalence rate of mental illnesses of 23.9%, the discrepancy in prevalence rate between the wealthiest and poorest is troubling. The average rate fails to capture the severity of prevalence for people in the disadvantaged classes. Therefore, chapter 3 studied the prevalence of three main types of mental illnesses (anxiety-related, affective, and other disorders) across socioeconomic classes and the underlying socioeconomic correlates of mental illnesses (income level, educational attainment, and labour force status) using Australian National Health Survey, 2017-18 data.

Anxiety-related disorders were the most prevalent, with a weighted prevalence rate of 20.04% among the poorest, 13.85% among the richest, and 16.34% overall. The weighted prevalence rate of mood/affective disorders was 20.19% for the poorest, 9.96% for the richest, and 13.57% for the entire population. Other mental illnesses had a prevalence of 9.07% among the poorest, 3.83% among the richest, and 5.93% among all. In all 14 types of mental disorders, it has been determined that lower socioeconomic groups consistently have a greater prevalence rate than higher socioeconomic groups.

The logistic regression model indicated that children from the medium (AOR: 0.75, $p < 0.1$), affluent (AOR: 0.71, $p < 0.05$), and highest (AOR: 0.6, $p < 0.01$) income categories had significantly reduced odds. Similarly, there were significantly decreased odds for adults in the intermediate income group (AOR: 0.84, $p < 0.05$), the high-income group (AOR: 0.73, $p < 0.01$), and the wealthiest income group (AOR: 0.76, $p < 0.01$). When education level was considered, those with a bachelor's degree (AOR: 0.71, $p < 0.01$) or a postgraduate degree (AOR: 0.79, $p < 0.01$) had significantly lower odds than those with a 12 year or less education level. Unemployed (AOR: 1.66, $p < 0.01$) and not in the labour force (AOR: 1.92, $p < 0.01$) groups similarly had significantly greater odds of experiencing mental illnesses than the employed group. Additionally, the analysis revealed significantly reduced odds for the 3rd, 4th, and 5th quintiles of advantaged locations (3rd: 0.84, $p < 0.05$; 4th: 0.87, $p < 0.1$; and 5th: 0.73, $p < 0.01$).

In summary, consistent with current research, the regression analysis's findings indicate that people from poorer socioeconomic origins, those who are unemployed, those who live in disadvantaged places, or those with less education are more likely to suffer from mental illness. This is the first research of its sort to quantify the present magnitude of mental illness across Australia's various socioeconomic strata. The use of such data for intervention techniques and health promotion in mental healthcare has significant consequences.

8.2.2 Impact of mothers' background on mental health inequalities among Australian youths

Identifying socioeconomic factors that contribute to mental health inequalities is crucial for policymakers in formulating strategies for improving mental health and reducing such inequalities. Therefore, the fourth chapter analyses the impact of opportunity deprivation, namely poor maternal background and adverse individual circumstances, on the mental health condition of youth. The study constructed a follow-up of 975 individuals aged 15-19 years for ten years using data from the HILDA (Household, Income and Labour Dynamics in Australia) longitudinal study and utilised multi-level regression to explore the causal relationship between opportunity deprivation and youth mental health.

To model the mental health outcome as a multi-level regression function, this study employed a three-level nested data structure in which repeated individual responses were treated as level 1, individuals as level 2, and individuals' backgrounds as level 3. In contrast to the bulk of research in the literature, the study findings show that multi-level regression intercepts do not differ according to background history types. Moreover, maternal background dimensions (i.e., maternal education and employment) had no influence on young people’s mental health. However, the study discovered that low household income (AOR: 1.572, $p < 0.05$) and adverse living arrangements (AOR: 1.586, $p < 0.05$) significantly increase the likelihood of developing a mental condition. Furthermore, the study revealed that individual circumstances have a considerable influence on the mental health of youth: financial shock (AOR: 1.412, $p < 0.001$), life event shock (AOR: 1.157, $p < 0.05$), long term health conditions (AOR: 2.855, $p < 0.001$), smoking (AOR: 1.676, $p < 0.01$), drinking (AOR: 1.649, $p < 0.001$) and being female (AOR: 2.021, $p < 0.001$) all had negative influences on youth mental health.

The study findings confirm West (1997) hypothesis that, in contrast to childhood, youth exhibit a mechanism of adjustment that eliminates the effects of specific aspects of family background variations on their mental health. Thus, as youth gain independence, it is probable that the effect of mothers' education and work diminishes and the function of social ties with individuals outside of families becomes increasingly significant in promoting mental health. In contrast to the maternal background, the research showed that individual circumstances such as financial struggles and adverse life events, long-term health issues, and health behaviour-related activities (smoking and drinking habits) had a significantly bigger influence on mental health. In summary, whereas maternal background may influence mental health in early life, its influence on youth mental health is less clear. On the contrary, a number of individual-level determinants are strongly linked with youth mental health.

8.2.3 Life shocks' influence on socioeconomic disparities in mental health among Australian adults

Recent research has established that life shocks (especially those associated with financial difficulty and adverse life experiences) are significant socioeconomic determinants affecting adult mental health (Dalgard et al. 1995; Kornblith et al. 2001; Volanen et al. 2007; Butterworth et al. 2009; Bradshaw & Ellison 2010; Selenko & Batinic 2011). Accordingly, chapter 5 conducts a distributional investigation of the influence of financial hardship and negative life event on adult mental health. The study used data from the HILDA survey on 13,496 adult individuals to explore the impacts of life shocks on socioeconomic inequalities in mental health and changes in inequalities in mental health over a six-year period using the concentration index and Blinder-Oaxaca decomposition methodologies.

The study discovered that over a six-year period, socioeconomic disparity in mental health climbed gradually from 0.015 to 0.019. Additionally, the study discovered that life shocks account for 24.7%–40.5% of the pro-rich mental health inequalities. Financial hardship shocks account for 21.6%–35.4% of these inequalities across waves, whereas negative life event shocks explain for 2.3%–5.4% of disparities between waves. Since the study also found that poorer socioeconomic groups face more life shocks than more affluent socioeconomic groups, the findings indicate that life shocks are the major drivers of socioeconomic inequalities in mental health over the period 2012 to 2017.

In general, the findings indicate that lower SES groups, particularly young people who are unemployed or not working, who are not involved in club/community activities, or are disadvantaged due to disabilities or long-term health conditions, are at risk of experiencing significantly worse mental health as a result of life shocks. The impacts of financial hardship shocks, in particular, are found to be stronger. The study also discovered that catastrophic physical injury, divorce, or the death of a spouse or child result in considerably worse mental health. Although the distributional effect of these shocks diminishes over time, they periodically exacerbate socioeconomic mental health disparities.

8.2.4 Longitudinal decomposition of socioeconomic mental health inequality

The concentration index has become the de facto method for quantifying socioeconomic inequality in health and healthcare (Van Ourti et al. 2014). Despite recent progress in understanding the properties and characteristics of this class of bivariate rank dependent indices, the merits of the normative choices on various concentration indices in longitudinal decomposition as well as its longitudinal properties are not evident (Allanson et al. 2010; Kjellsson et al. 2015; Coveney et al. 2020). Hence, a generalised paradigm for the longitudinal investigation of socioeconomic health inequities is proposed in Chapter 6.

Three propositions are established in this paper, and the framework is then illustrated by measuring and decomposing socioeconomic mental health inequalities in Australia between 2009 and 2017 using HILDA panel survey data. The first proposition of the generalised framework establishes a generic equation for decomposing all forms of bivariate rank-dependent indices. The second proposition applied a generalised strategy to deconstruct changes in socioeconomic health inequality for longitudinal data. Finally, it was demonstrated that the standard Oaxaca-Blinder decomposition method can be described using the suggested generalised framework.

The suggested generalised framework was utilised in the study to analyse the dynamics of mental health inequality using data from the HILDA survey of 9,277 adult participants. The study illustrated the framework of longitudinal decomposition by utilising Erreygers index (an absolute concentration index) and standard concentration index (CI) (a relative concentration index). Furthermore, classic Oaxaca-Blinder decomposition was also illustrated to show the similarities and differences between

this and other techniques. The primary determinants affecting the poor in the Health-Related Income Mobility index are chronic health issues, private health insurance coverage, and the frequency of life shocks (-0.004, -0.002 and -0.001 respectively in the Erreygers index, and -0.002, -0.001 and -0.001 respectively in the standard CI). The key factors favourable to the poor in the Income Related Health Mobility index are unemployment, non-labour force participation and retirement age (0.001, 0.002 and 0.007 respectively in the Erreygers index and 0.001, 0.002 and 0.004 respectively in the standard concentration index).

For Erreygers and standard concentration indices, the overall variations in factor contribution are explained by 38% and 31%, respectively. As with the cross-sectional study, variables such as long-term health problems, the number of life shocks, and labour force non-participation are the primary drivers of changes in socioeconomic inequality in mental health. Female socioeconomic inequality remained unchanged. Thus, socioeconomic inequality in female mental health is structural in nature. Additionally, the Oaxaca-Blinder decomposition demonstrated that long-term health issues, private insurance, and non-participation in the labour force contribute to socioeconomic inequality through a change in their elasticities. In summary, unfavourable circumstances account for the majority of the changes in socioeconomic inequality in mental health.

8.2.5 Inequity in psychiatric service use

An essential element of achieving mental health equity is the adequate provision of need-based psychiatric care. Based on the methodology of Wagstaff and van Doorslaer (2000), chapter 7 proposed a novel approach to examine the performance of the need-based psychiatric care delivery in Australia. Inequity in the health system is defined by which a need is unmet and is quantified using the GINI inequality index. The approach is simple and can be compared with many other health systems and across time through the GINI inequality index. Data from the HILDA survey of 19,130 adults was used to estimate inequity in psychiatric care in Australia and compared for the years 2009 and 2017.

The findings of the study revealed that socioeconomic inequity in psychiatric care (Wagstaff and van Doorslaer's approach where inequity is measured through concentration index and explores whether there exist systematic socioeconomic

differences in need-based psychiatric care utilisation) was not significant in both years. However, in the earlier chapters of this thesis, it has been found that there exist significant socioeconomic inequalities in mental health in Australia, i.e., there is no significant socioeconomic inequity on the supply side, but there exists significant socioeconomic inequality on the demand side. This paradox led to the development of a novel approach in chapter 7 where instead of measuring socioeconomic inequity through the concentration index, and overall inequity is measured through the GINI index. Instead of checking systematic socioeconomic differences in need-based psychiatric care, this novel approach checks as to whether there exist any systematic differences in unmet need in psychiatric care utilisation.

The results indicate that the inequity indices (need-standardised Gini) for psychiatric care utilisation were substantial and were 0.066 and 0.096 for all persons in 2009 and 2017, respectively. In 2009, inequality indices for males and females were determined to be 0.051 and 0.078, respectively, and 0.045 and 0.068 for rural and urban people, respectively. In 2017, males and females had indices of 0.081 and 0.109, respectively, and rural and urban people had indices of 0.086 and 0.097, respectively. According to the study findings, there was a significant rise in unmet requirements in mental care utilisation over the period 2009 to 2017.

Despite significant advances in mental healthcare, the study findings indicated that equity in the delivery of psychiatric treatment in Australia has not been entirely reached. While the findings indicate that there is no major socioeconomic disparity in mental healthcare utilisation, they do indicate that a considerable amount of unmet need exists across all Australian populations. Additionally, policy emphasis is required to meet the unmet demands of women's mental treatment. There is an urgent need to adopt precise strategies to enhance the delivery of psychiatric treatment to all Australians.

8.3 Thesis recommendations

From the findings of this thesis several key recommendations can be drawn and suggested to policy makers, researchers and mental health practitioners. They are as follows.

First, findings suggested that vulnerable and disadvantaged groups (those who live in economic adversity, who are unemployed, who reside in locations with a

disadvantaged population, who are physically ill or disabled, with lower levels of education, or who are female or younger) are at higher risk of poor mental health. This reinforces the importance of systemic support and government-led strategies for this group to prevent the development of mental illness and ensure access to care when needed. For example, intervention measures such as target-based psychological support, community engagement, vocational support, social and financial barrier reduction, and increased access to care would be important strategies to implement. Increased provision of institutional and cultural interventions to minimise risk, prevent mental illness, and enhance access to mental health treatment will lower the health system's long-term care costs and assist in reducing inequity/inequality for this group. Vulnerable groups may become more impacted by disaster events such as pandemics, bushfire and drought, which can exacerbate their financial status and subsequent mental health. This may provide specific opportunities for government intervention such as financial assistance and psychological support interventions to reduce such impacts. In particular, the size of such vulnerable groups is likely to increase in the aftermath of COVID-19 pandemic. An immediate response plan could be government assistance, such as financial transfers, offered to such groups.

Second, mental health interventions should take into account the diverse factors and contexts that may influence youth behaviours and mental health. Therefore, policymakers may be interested in introducing health-related behavioural interventions aimed at promoting both physical and youth mental health as health behaviours (i.e., smoking, drinking, club/sporting activities) were shown to be associated with mental health. Additionally, the government could consider providing continuous financial, care coordination, and emotional assistance to youth in order to help them handle the short-term repercussions of traumatic experiences and provide trauma-informed psychiatric care for long-term complications given that youth circumstances were shown to be important factors of mental health.

Third, to manage rising health expenditures efficiently, it is necessary to develop health policies that target certain socioeconomic groups where a mental disorder has a high prevalence. Understanding the differences in mental health needs across socioeconomic groups can help design evidence-based health promotion efforts and enhance the targeting of health resource allocation strategies. As a result, the government needs to collect up-to-date data quickly and encourage evidence-based

research. Rapid data collection will aid in monitoring changing environments, enable service deployment where it is most required, and enable successful service delivery responses.

Finally, the thesis findings indicate that psychiatric services with respect to need in psychiatric care are significantly deficient. There are simply too many people with significant problems who do not receive assistance. Furthermore, specific policies are necessary to meet the substantial unmet needs of women in need of psychiatric care. In addition, it is essential to increase need-based psychiatric care access in rural areas. To address psychiatric services inequity, the Australian government could increase the number of psychiatric care sessions under the Better Access Scheme. To extend psychiatric services cost-effectively, the government could extend services provided following natural disasters or other community stressors (i.e., 2019-20 bushfires, 2010-11 Brisbane/QLD flood, Millennium Drought or COVID-19 pandemic). Where clinically appropriate, the government could also encourage telehealth to increase service access, especially to disadvantaged populations. The number of telehealth items on the Medicare Benefit Schedule (MBS) could be increased and the government could allow practitioners and patients to arrange group therapy sessions via telehealth, beyond the parameters of COVID-19 items.

8.4 Contribution of the thesis

This thesis produces new knowledge, contributes to theory and methodology and has policy implications for the Australian mental health sector. They are discussed as follows.

8.4.1 Contribution to knowledge

This thesis contributes to the existing body of knowledge by offering deeper insights into the magnitude of mental health and healthcare inequities, their nature and underlying determinants. In chapter 3, this thesis revealed that the prevalence of mental illnesses varies significantly in Australia. This was the first study to puts an emphasis on tracking prevalence rates according to disadvantaged groups in order to optimise resource allocation methods through target-based interventions. Additionally, in chapter 4, this research extends previous work on the inequality of opportunity with new findings on the influence of youths' physical and behavioural environments on their mental health. Due to the fact that prior research has concentrated on either

‘children or adolescents' (1-17 year) or ‘adults’ (18+ years), this study established a paradigm for the impact of maternal background throughout the transitional phase (15-29 years) on a youth's mental health outcome.

In chapter 5, this research adds to the knowledge of life shocks' effects on socioeconomic mental health inequalities. Prior to this study, our knowledge of life shock in relation to mental health in the Australian setting was unclear, and this study clarified the severity of this issue. Additionally, the thesis advanced our knowledge of socioeconomic inequality and inequity at the population level in the Australian mental health and healthcare sectors.

8.4.2 Contribution to theory and methods

Distributive justice theories are founded on normative concepts that, in theory, prescribe the policies, structures, and institutions that should be implemented. This thesis contributes to theories of distributive justice by bringing a positive approach to the theories' normative value judgments. The research advanced empirical applications of egalitarian ideas in Chapters 3 to 7. Additionally, these studies enhanced the empirical acceptability of distributive justice theories by incorporating moral concepts in to positive economics. Furthermore, the thesis makes a contribution to current approaches by suggesting two innovative methods. First, in Chapter 6, for all types of concentration indices, the thesis proposed a generalised framework of longitudinal decomposition. The suggested framework can be used in future research related to the dynamics of socioeconomic inequality. Second, in Chapter 7, the thesis proposed a unique method for evaluating inequity in mental healthcare utilisation in the Australian context. The proposed technique has wider applications and may be used to track the equity performance of the health system across time and place.

8.4.3 Contribution to policy implications/development

As previously noted in the thesis recommendation section, the thesis findings have significant policy implications. First, in Chapter 3, the findings suggested that understanding the unique mental health requirements of different socioeconomic groups has substantial policy implications. For example, vulnerable and disadvantaged groups require special attention with respect to managing mental health. Additionally, the outcomes of this study are applicable to developing response plans following natural catastrophes, i.e., post-COVID-19 recovery plans. Second, in Chapter 4,

findings suggested that mental health policies should take into account the diversity of adverse youth circumstances and health-related behaviours. Early and appropriate policy initiatives might considerably lower the burden of mental illness on individuals and the health system through preventative measures.

Third, in Chapter 5, the findings indicated that persons from disadvantaged and lower socioeconomic groups face considerably more life shocks than those from higher socioeconomic groups, making them more susceptible to mental illnesses. Thus, policies aimed at eliminating socioeconomic disparities in mental health should develop interventions that account for these shocks. Fourth, in Chapter 6, findings suggested that long term health conditions, private health insurance coverage and the number of life shocks play a major role in driving mental health mobility. Australian governments should emphasise developing cost-effective intervention policies that address such factors. Lastly, in Chapter 7, the findings of this research can be used as a benchmark to further improve mental health delivery systems in Australia.

8.5 Thesis limitations and avenues for future research

The topic of mental health equity, both from a normative and a positive perspective, is so compelling that the more I looked into it, the more I realised there was still more work to be done. Consequently, Sir Isaac Newton's final words were very enlightening in this regard, as he said (Gleick 2003, p. 4):

"… I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."

Thus, the thesis's primary shortcoming was the lack of several critical topics. This also suggests, then, that these topics are pathways for future research. For example, this research only addresses research questions as national estimates and considers the population as a whole. However, special attention is required for various minority sub-population groups such as Aboriginal and Torres Strait Islander communities, LGBTQI groups, people with disabilities and others. Additional research is necessary on these study populations utilising culturally appropriate methodologies. In addition, to conduct an effective evaluation of mental health equity, interventions would require nationwide baseline data and equivalent control groups to assess their efficacy. Given

the scarcity of quantitative research in this field, this thesis paves the way for future research in this field.

This thesis also only addressed issues related to adverse life shocks on mental health disparities and avoided intervention-specific study topics. Additional study is required to develop targeted therapies to alleviate shock-related inequities in mental health. Furthermore, it is critical that future studies explore the relationship between parental background and younger and older age cohorts in more detail. Future studies should also examine the effect on the elderly of socioeconomic mental health disparities. Finally, this study recommends conducting prospective research and subsequent surveys to track changes in the amount of unmet need over time in other OECD countries with comparable equity objectives.

8.6 Concluding remarks

Many countries' policy frameworks increasingly recognise the need to establish an equitable mental health system. However, achieving mental health equity is primarily a normative policy objective for policymakers that is embodied in moral values. To achieve distributive justice, policymakers need the direction of positive economics in order to make sound policy decisions. This thesis is intended to bring this positive economic perspective to address important issues empirically and methodologically, in the quest for Australian mental health equity.

This thesis highlights the need for, and importance of special attention to individuals who experience unfavourable circumstances in their life and consequently have high risks of suffering from mental disorders. The thesis outlines that such individuals or groups are concentrated disproportionately in lower socioeconomic classes and require systematic interventions to enhance mental health outcomes. In this aspect, the thesis observes that the existing Australian mental health treatment delivery system falls short of achieving equity.

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APPENDIX

Chapter 4:

Variable description in HILDA for financial shock and life event shock

Variables used to construct financial shock		
Sl	Variable name	Variable description
1.	_fiprbeg	Could not pay electricity, gas or telephone bills on time
2.	_fiprbmr	Could not pay the mortgage or rent on time
3.	_fiprbps	Pawned or sold something
4.	_fiprbwm	Went without meals
5.	_fiprbuh	Was unable to heat home
6.	_fiprbfh	Asked for financial help from friends or family
7.	_fiprbwo	Asked for help from welfare/community organisations
Variables used to construct life event shock		
1.	_leins	Serious personal injury/illness
2.	_leinf	Serious injury/illness to family member
3.	_ledsc	Death of spouse or child
4.	_ledrl	Death of close relative/family member
5.	_ledfr	Death of a close friend
6.	_levio	Victim of physical violence
7.	_lepcm	Victim of a property crime
8.	_lejls	Detained in jail
9.	_lejlf	Close family member detained in jail
10.	_lefrd	Fired or made redundant
11.	_ledhm	A weather related disaster (flood, bushfire, cyclone) damaged or destroyed your home

Chapter 5:

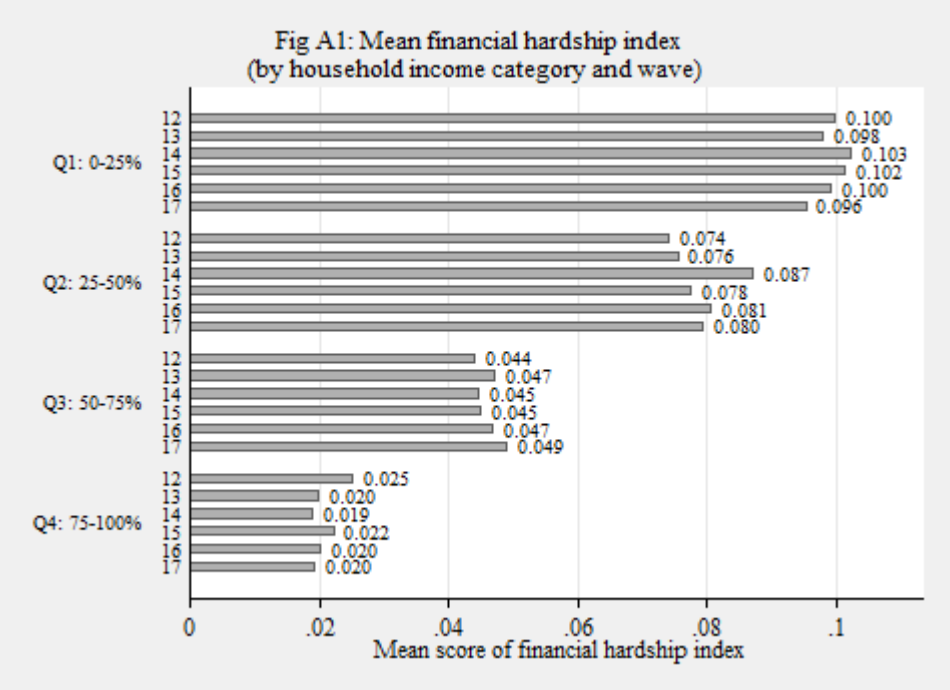

Figure A1: Bar graph for mean score of financial hardship index by income quartile category

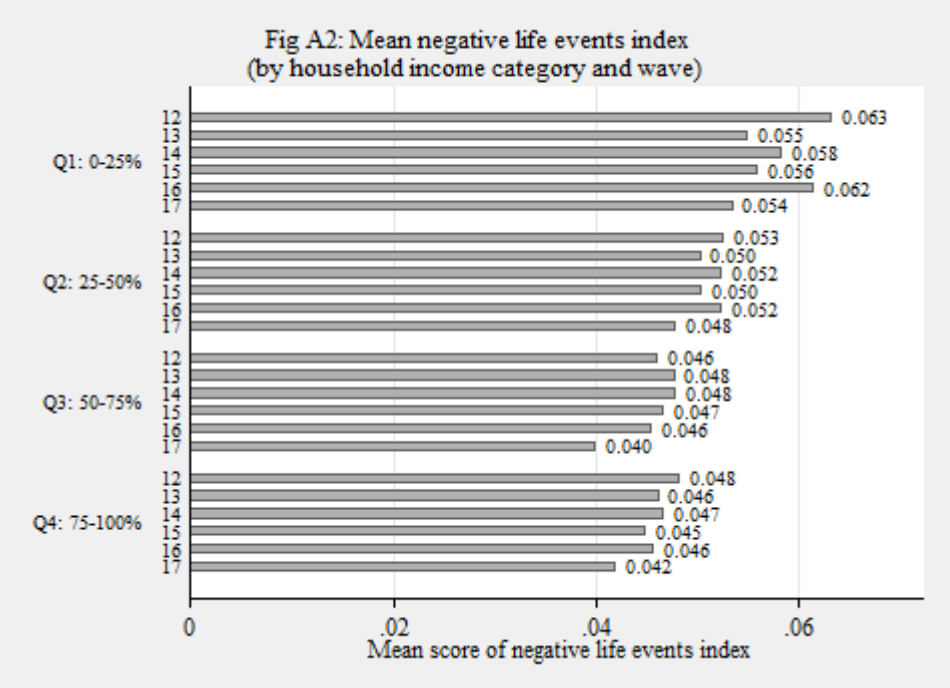

Figure A2: Bar graph for mean score of negative life events index by income quartile category

Table 4: Oaxaca-Blinder decomposition results[a]

Variables		wave 12-13	wave 13-14	wave 14-15	wave 15-16	wave 16-17
Financial hardship score	ΔCη[b]	0.0004	0.0005	-0.0005	0.0002	0
	ΔηC[c]	-0.0002	0.0003	-0.0002	0	-0.0008
	T[d]	**0.0002**	**0.0007**	**-0.0007**	**0.0001**	**-0.0008**
Negative life event score	ΔCη	-0.0003	0.0002	-0.0001	0.0003	-0.0001
	ΔηC	-0.0001	0.0001	0	-0.0002	-0.0001
	T	**-0.0004**	**0.0003**	**-0.0001**	**0.0001**	**-0.0002**
Female	ΔCη	0	0	-0.0001	0	0
	ΔηC	-0.0001	0.0001	0	0	0
	T	**-0.0001**	**0.0001**	**-0.0001**	**0**	**0**
Age	ΔCη	0	0	0.0001	0	0
- 25-44 years	ΔηC	-0.0004	0	0	0.0002	-0.0001
	T	**-0.0004**	**0**	**0.0001**	**0.0002**	**-0.0001**
- 45-64 years	ΔCη	0.0001	0	-0.0002	0.0001	0.0001
	ΔηC	-0.0002	0	0.0007	-0.0001	0.0005
	T	**-0.0001**	**0**	**0.0005**	**0**	**0.0006**
- 65-84 years	ΔCη	0.0006	0.0004	0.0004	0.0001	-0.0003
	ΔηC	-0.0005	-0.0003	-0.001	0	-0.0011
	T	**0.0001**	**0.0001**	**-0.0006**	**0**	**-0.0013**
- 85+ years	ΔCη	-0.0001	0	-0.0001	0.0001	-0.0002
	ΔηC	-0.0003	-0.0001	0	-0.0005	-0.0008
	T	**-0.0004**	**-0.0001**	**-0.0001**	**-0.0004**	**-0.0009**
Household income quartile	ΔCη	-0.0001	-0.0001	-0.0002	-0.0001	-0.0001
-Q2 25-50%	ΔηC	-0.0008	0.001	0	-0.0013	0.0011
	T	**-0.0009**	**0.0009**	**-0.0002**	**-0.0014**	**0.001**
-Q3 50-75%	ΔCη	-0.0003	-0.0001	-0.0001	-0.0001	-0.0003
	ΔηC	0.0006	-0.0012	0.0006	0.0013	0
	T	**0.0002**	**-0.0013**	**0.0005**	**0.0012**	**-0.0002**
-Q4 75-100%	ΔCη	-0.0003	-0.0001	-0.0001	-0.0001	-0.0001
	ΔηC	0.0031	-0.0022	0.0004	0.0041	0.0001
	T	**0.0028**	**-0.0023**	**0.0004**	**0.004**	**-0.0001**
Education	ΔCη	0	0	0	0	0
- Certificates & diploma	ΔηC	0.0001	-0.0001	0	0	0
	T	**0**	**-0.0001**	**0**	**0**	**0**
-Bachelor or honours degree	ΔCη	0	0	-0.0001	0	0.0001
	ΔηC	0.0001	-0.0001	-0.0006	0.0005	-0.0005
	T	**0.0001**	**-0.0001**	**-0.0006**	**0.0005**	**-0.0004**
- Postgraduate degree	ΔCη	0	0	0	0	0
	ΔηC	0.0001	-0.0002	0	-0.0001	-0.0001
	T	**0.0001**	**-0.0002**	**-0.0001**	**-0.0001**	**0**
Labour force status	ΔCη	0	0.0001	0	-0.0003	0.0004
-Unemployed	ΔηC	-0.0001	0	0.0005	0.0002	0
	T	**-0.0001**	**0.0001**	**0.0006**	**-0.0001**	**0.0003**
-Not in the labour force	ΔCη	-0.0001	0	0.0001	0	0.0002
	ΔηC	0.0008	-0.0003	-0.0001	-0.0013	0.0026
	T	**0.0007**	**-0.0003**	**0**	**-0.0013**	**0.0028**
Club/community activities	ΔCη	0	0.0003	-0.0004	0.0001	-0.0001
	ΔηC	0.0001	0	0.0003	-0.0002	0.0004
	T	**0**	**0.0003**	**-0.0001**	**-0.0001**	**0.0002**
Long term health condition	ΔCη	-0.0003	0.0007	-0.0002	0.001	-0.0006
	ΔηC	0.0015	0.0002	0.0009	0.0003	-0.0007
	T	**0.0013**	**0.0009**	**0.0007**	**0.0013**	**-0.0013**
Explained changes		0.0031	-0.001	0.0002	0.004	-0.0004
Unexplained changes		-0.0007	-0.0004	0.0006	-0.0013	0.0005
Total actual changes		**0.0024**	**-0.0014**	**0.0008**	**0.0027**	**0.0001**

Notes: a. The 0 values don't indicate actual zeros. These values are approximately zero, b. ΔCη represents health changes due to changes in inequality, c. ΔηC represents health changes due to changes in elasticity d. T represents the total changes explained by variable. Large contributions were colored.

Sensitivity analysis (MCS)

Table 5: Regression results

Variables	wave 12	wave 13	wave 14	wave 15	wave 16	wave 17	Pooled
SF-36 Mental Health Score: MCS (Dep. variable)	n=13496 (unweighted) n=13262 (weighted) Population size: 16,699,284						
Key objective variables							
Financial hardship score	-13.479*** (0.9564)	-13.7818*** (1.0086)	-13.9779*** (0.9297)	-13.3859*** (0.9605)	-14.0612*** (0.994)	-12.1382*** (0.8831)	-13.5229*** (0.6574)
Negative life event score	-14.9535*** (1.6723)	-13.2141*** (1.7784)	-15.6536*** (2.0132)	-15.7048*** (1.7183)	-12.9396*** (1.7391)	-12.8184*** (1.9077)	-14.0078*** (1.0279)
Demographic variables							
-Male (ref.)							
-Female	-0.8275*** (0.2034)	-0.6318*** (0.1956)	-0.88*** (0.2253)	-0.6493*** (0.1966)	-0.7727*** (0.2085)	-0.6042*** (0.2392)	-0.7278*** (0.1541)
Age							
-15-24 years (ref.)							
- 25-44 years	1.0975*** (0.3884)	0.9194** (0.3815)	0.9832** (0.4355)	0.7531 (0.5267)	1.2719** (0.5171)	1.0166** (0.4219)	0.9014*** (0.3322)
- 45-64 years	2.4904*** (0.3876)	2.4351*** (0.3952)	2.7924*** (0.4129)	2.9551*** (0.4773)	3.0607*** (0.5394)	3.5005*** (0.4581)	2.7617*** (0.3444)
- 65-84 years	5.686*** (0.4821)	5.7715*** (0.499)	6.3745*** (0.5189)	6.4928*** (0.5783)	6.3197*** (0.6892)	7.1848*** (0.5989)	6.125*** (0.4402)
- 85+ years	5.6364*** (1.2365)	7.699*** (0.9121)	7.6755*** (0.8463)	4.9875*** (1.0933)	6.4102*** (1.0634)	7.3513*** (0.837)	6.1096*** (0.6758)
SES variables							
Household income quartile							
-Q1 0-25% (ref.)							
-Q2 25-50%	0.5873 (0.4232)	1.1769** (0.4909)	0.592 (0.4787)	0.4274 (0.4335)	1.2209*** (0.4177)	0.5633 (0.4817)	0.7658*** (0.2478)
-Q3 50-75%	0.3549 (0.3705)	0.8358* (0.4805)	0.0853 (0.4407)	0.1478*** (0.409)	1.0304** (0.4466)	1.2105** (0.5284)	0.5834** (0.2925)
-Q4 75-100%	0.3182 (0.4144)	0.918* (0.4909)	0.3719 (0.4698)	0.4367 (0.4107)	1.0568** (0.4508)	1.0194* (0.5382)	0.6413** (0.3091)
Education							
-Year 12 or below (ref.)							
- Certificates & diploma	-0.0842 (0.2798)	0.6034** (0.2603)	-0.1028 (0.2659)	-0.2217 (0.2627)	0.3159 (0.2676)	0.03 (0.2761)	0.0341 (0.2028)
-Bachelor or honours degree	-0.6222* (0.3691)	-0.6305 (0.3845)	-0.7333* (0.3729)	-1.1776*** (0.3682)	-0.732* (0.4051)	-1.0142** (0.4193)	-0.8627*** (0.3129)
- Postgraduate degree	-0.174 (1.1244)	0.3971 (0.83)	-0.1754 (0.639)	0.0994 (0.7823)	-0.2053 (0.5822)	-0.5916 (0.4264)	-0.1769 (0.6166)
Labour force status							
-Employed (ref.)							
-Unemployed	-1.0401 (0.7326)	-0.0833 (0.797)	-0.155 (0.8697)	-2.4289*** (0.7176)	-2.5774*** (0.7093)	-2.5655*** (0.9816)	-1.448*** (0.3586)
-Not in the labour force	-0.9457*** (0.3703)	-0.8999*** (0.3376)	-1.3327*** (0.3467)	-1.3628*** (0.3444)	-0.7397** (0.3295)	-1.7395*** (0.3995)	-1.1414*** (0.2326)
Other variables							
Club/community activities	1.9007*** (0.2305)	1.9234*** (0.2455)	1.7675*** (0.2623)	2.2716*** (0.2564)	2.1764*** (0.2378)	2.6344*** (0.2527)	2.1222*** (0.1824)
Long term health conditions	-3.0361*** (0.3358)	-4.0276*** (0.2936)	-4.2113*** (0.3243)	-4.6889*** (0.3283)	-4.9609*** (0.334)	-4.45*** (0.3154)	-4.2778*** (0.2029)
Constant	49.4069*** (0.4699)	48.7632*** (0.5307)	49.2675*** (0.5071)	49.006*** (0.5989)	47.8212*** (0.668)	47.3618*** (0.5832)	48.7625*** (0.3895)

Notes: *** p < 0.01, ** p < 0.05, and * p < 0.1. Standard errors are in the parentheses.

Table 6: Wagstaff - Doorslaer –Watanabe Decomposition results (MCS)

Variables		wave 12	wave 13	wave 14	wave 15	wave 16	wave 17	Pooled
	η[a]	-0.0173	-0.0172	-0.0183	-0.0168	-0.0175	-0.0148	-0.017
Financial hardship score	CI[b]	-0.2671	-0.2916	-0.3191	-0.2914	-0.3011	-0.2996	-0.2951
	Co[c]	**0.0046**	**0.005**	**0.0058**	**0.0049**	**0.0053**	**0.0044**	**0.005**
	η	-0.0161	-0.0135	-0.0165	-0.016	-0.0136	-0.0121	-0.0144
Negative life event score	CI	-0.0637	-0.0389	-0.0539	-0.0446	-0.0674	-0.0594	-0.0556
	Co	**0.001**	**0.0005**	**0.0009**	**0.0007**	**0.0009**	**0.0007**	**0.0008**
	η	-0.0086	-0.0066	-0.0092	-0.0068	-0.0081	-0.0064	-0.0076
Female	CI	-0.0295	-0.0288	-0.0294	-0.022	-0.0255	-0.0296	-0.0273
	Co	**0.0003**	**0.0002**	**0.0003**	**0.0002**	**0.0002**	**0.0002**	**0.0002**
Age	η	0.0079	0.0066	0.0071	0.0054	0.009	0.0072	0.0064
- 25-44 years	CI	0.0674	0.0744	0.069	0.0892	0.0911	0.0989	0.0814
	Co	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0008**	**0.0007**	**0.0005**
	η	0.0164	0.0161	0.019	0.0205	0.0217	0.0252	0.019
- 45-64 years	CI	0.1031	0.1117	0.1117	0.1032	0.107	0.1111	0.1088
	Co	**0.0017**	**0.0018**	**0.0021**	**0.0021**	**0.0023**	**0.0028**	**0.0021**
	η	0.0163	0.0182	0.0214	0.0232	0.0236	0.0282	0.021
- 65-84 years	CI	-0.3491	-0.3115	-0.2884	-0.2711	-0.2681	-0.2784	-0.289
	Co	**-0.0057**	**-0.0057**	**-0.0062**	**-0.0063**	**-0.0063**	**-0.0079**	**-0.0061**
	η	0.001	0.0018	0.0024	0.002	0.0033	0.0045	0.0023
- 85+ years	CI	-0.4373	-0.4722	-0.4796	-0.5307	-0.4916	-0.5313	-0.4927
	Co	**-0.0005**	**-0.0008**	**-0.0011**	**-0.0011**	**-0.0016**	**-0.0024**	**-0.0011**
Household income quartile	η	0.0033	0.0061	0.0031	0.0022	0.0062	0.0027	0.004
-Q2 25-50%	CI	-0.2164	-0.2319	-0.2504	-0.2817	-0.2908	-0.3066	-0.263
	Co	**-0.0007**	**-0.0014**	**-0.0008**	**-0.0006**	**-0.0018**	**-0.0008**	**-0.001**
	η	0.0019	0.0043	0.0004	0.0008	0.0054	0.0064	0.0031
-Q3 50-75%	CI	0.3238	0.2755	0.2469	0.2207	0.209	0.1852	0.2435
	Co	**0.0006**	**0.0012**	**0.0001**	**0.0002**	**0.0011**	**0.0012**	**0.0007**
	η	0.0013	0.0044	0.0019	0.0024	0.0058	0.0059	0.0033
-Q4 75-100%	CI	0.7923	0.7645	0.7464	0.7392	0.7318	0.721	0.7492
	Co	**0.0011**	**0.0034**	**0.0014**	**0.0017**	**0.0043**	**0.0042**	**0.0025**
Education	η	-0.0005	0.0038	-0.0007	-0.0015	0.0022	0.0002	0.0002
- Certificates & diploma	CI	0.0237	0.0145	0.0088	-0.0007	-0.0095	-0.0132	0.0046
	Co	**0**	**0.0001**	**0**	**0**	**0**	**0**	**0**
	η	-0.0025	-0.0026	-0.0031	-0.0051	-0.0032	-0.0047	-0.0037
-Bachelor or honours degree	CI	0.2307	0.2238	0.2228	0.234	0.234	0.2233	0.2292
	Co	**-0.0006**	**-0.0006**	**-0.0007**	**-0.0012**	**-0.0008**	**-0.001**	**-0.0008**
	η	-0.0002	0.0005	-0.0002	0.0001	-0.0003	-0.0009	-0.0002
- Postgraduate degree	CI	0.326	0.3342	0.2952	0.3324	0.3242	0.3094	0.3224
	Co	**-0.0001**	**0.0002**	**-0.0001**	**0**	**-0.0001**	**-0.0003**	**-0.0001**
Labour force status	η	-0.0008	-0.0001	-0.0001	-0.002	-0.0018	-0.0016	-0.0011
-Unemployed	CI	-0.1688	-0.2102	-0.3206	-0.3407	-0.2516	-0.3802	-0.2807
	Co	**0.0001**	**0**	**0**	**0.0007**	**0.0005**	**0.0006**	**0.0003**
	η	-0.0062	-0.0058	-0.0087	-0.0089	-0.005	-0.0119	-0.0076
-Not in the labour force	CI	-0.3223	-0.3129	-0.3088	-0.3183	-0.3279	-0.3408	-0.3215
	Co	**0.002**	**0.0018**	**0.0027**	**0.0028**	**0.0016**	**0.0041**	**0.0024**
	η	0.0136	0.0145	0.013	0.0171	0.015	0.0194	0.0155
Club/community activities	CI	0.05	0.047	0.0661	0.0458	0.0541	0.049	0.0515
	Co	**0.0007**	**0.0007**	**0.0009**	**0.0008**	**0.0008**	**0.001**	**0.0008**
	η	-0.0157	-0.0237	-0.0248	-0.0286	-0.0297	-0.0288	-0.0253
Long term health condition	CI	-0.2023	-0.1918	-0.2157	-0.2081	-0.2361	-0.2159	-0.2104
	Co	**0.0032**	**0.0046**	**0.0054**	**0.006**	**0.007**	**0.0062**	**0.0053**
Total Contribution		**0.0082**	**0.0113**	**0.0112**	**0.0114**	**0.0143**	**0.0137**	**0.0115**
CI of Mental health		**0.0089**	**0.0116**	**0.0112**	**0.0117**	**0.0139**	**0.0135**	**0.0116**

Notes: a. η represents elasticity. By definition $\eta_k = \beta_k \frac{\bar{x}_k}{\bar{h}}$, b. CI is concentration index of the row variable ranked by equivalised household income, c. Co is the contribution to mental health concentration index. Sum of all Co constitute the explained part of CI of mental health in a wave.

Table 7: Oaxaca-Blinder decomposition results[a] (MCS)

Variables		wave 12-13	wave 13-14	wave 14-15	wave 15-16	wave 16-17
	$\Delta C\eta$[b]	0.0004	0.0005	-0.0005	0.0002	0
Financial hardship score	$\Delta\eta C$[c]	0	0.0003	-0.0005	0.0002	-0.0008
	T[d]	**0.0004**	**0.0008**	**-0.0009**	**0.0004**	**-0.0009**
	$\Delta C\eta$	-0.0003	0.0002	-0.0001	0.0003	-0.0001
Negative life event score	$\Delta\eta C$	-0.0002	0.0001	0	-0.0001	-0.0001
	T	**-0.0005**	**0.0004**	**-0.0002**	**0.0002**	**-0.0002**
	$\Delta C\eta$	0	0	-0.0001	0	0
Female	$\Delta\eta C$	-0.0001	0.0001	-0.0001	0	0
	T	**-0.0001**	**0.0001**	**-0.0001**	**0.0001**	**0**
Age	$\Delta C\eta$	0	0	0.0001	0	0.0001
- 25-44 years	$\Delta\eta C$	-0.0001	0	-0.0001	0.0003	-0.0002
	T	**0**	**0**	**0**	**0.0003**	**-0.0001**
	$\Delta C\eta$	0.0001	0	-0.0002	0.0001	0.0001
- 45-64 years	$\Delta\eta C$	0	0.0003	0.0002	0.0001	0.0004
	T	**0.0001**	**0.0003**	**0**	**0.0002**	**0.0005**
	$\Delta C\eta$	0.0007	0.0005	0.0004	0.0001	-0.0003
- 65-84 years	$\Delta\eta C$	-0.0006	-0.001	-0.0005	-0.0001	-0.0012
	T	**0**	**-0.0005**	**-0.0001**	**0**	**-0.0015**
	$\Delta C\eta$	-0.0001	0	-0.0001	0.0001	-0.0002
- 85+ years	$\Delta\eta C$	-0.0003	-0.0003	0.0002	-0.0007	-0.0006
	T	**-0.0004**	**-0.0003**	**0.0001**	**-0.0005**	**-0.0008**
Household income quartile	$\Delta C\eta$	-0.0001	-0.0001	-0.0001	-0.0001	0
-Q2 25-50%	$\Delta\eta C$	-0.0006	0.0007	0.0002	-0.0011	0.001
	T	**-0.0007**	**0.0006**	**0.0002**	**-0.0012**	**0.001**
	$\Delta C\eta$	-0.0002	0	0	-0.0001	-0.0002
-Q3 50-75%	$\Delta\eta C$	0.0008	-0.0011	0.0001	0.001	0.0002
	T	**0.0006**	**-0.0011**	**0.0001**	**0.001**	**0.0001**
	$\Delta C\eta$	-0.0001	0	0	0	-0.0001
-Q4 75-100%	$\Delta\eta C$	0.0024	-0.0019	0.0003	0.0026	0
	T	**0.0023**	**-0.0019**	**0.0003**	**0.0025**	**0**
Education	$\Delta C\eta$	0	0	0	0	0
- Certificates & diploma	$\Delta\eta C$	0.0001	-0.0001	0	0	0
	T	**0.0001**	**-0.0001**	**0**	**0**	**0**
	$\Delta C\eta$	0	0	-0.0001	0	0.0001
-Bachelor or honours degree	$\Delta\eta C$	0	-0.0001	-0.0004	0.0004	-0.0003
	T	**0**	**-0.0001**	**-0.0005**	**0.0004**	**-0.0003**
	$\Delta C\eta$	0	0	0	0	0
- Postgraduate degree	$\Delta\eta C$	0.0002	-0.0002	0.0001	-0.0001	-0.0002
	T	**0.0002**	**-0.0002**	**0.0001**	**-0.0001**	**-0.0002**
Labour force status	$\Delta C\eta$	0	0	0	-0.0002	0.0002
-Unemployed	$\Delta\eta C$	-0.0001	0	0.0006	0	0
	T	**-0.0001**	**0**	**0.0006**	**-0.0002**	**0.0002**
	$\Delta C\eta$	-0.0001	0	0.0001	0	0.0002
-Not in the labour force	$\Delta\eta C$	-0.0001	0.0009	0.0001	-0.0013	0.0023
	T	**-0.0002**	**0.0009**	**0.0002**	**-0.0012**	**0.0024**
	$\Delta C\eta$	0	0.0002	-0.0003	0.0001	-0.0001
Club/community activities	$\Delta\eta C$	0	-0.0001	0.0003	-0.0001	0.0002
	T	**0**	**0.0002**	**-0.0001**	**0**	**0.0001**
	$\Delta C\eta$	-0.0002	0.0006	-0.0002	0.0008	-0.0006
Long term health condition	$\Delta\eta C$	0.0016	0.0002	0.0008	0.0002	-0.0002
	T	**0.0014**	**0.0008**	**0.0006**	**0.0011**	**-0.0008**

Notes: a. The 0 values don't indicate actual zeros. These values are approximately zero, b. $\Delta C\eta$ represents health changes due to changes in inequality, c. $\Delta\eta C$ represents health changes due to changes in elasticity d. T represents the total changes explained by variable.

Table 8: Complete and partial regression model (OLS) of disentangled life shock variables for wave 12 and wave 17

	Wave 12		Wave 17	
Variables	Complete model	Partial Model	Complete Model	Partial Model
Could not pay electricity, gas or telephone bills on time	-1.234	-1.728**	-1.233	-2.263***
Could not pay the mortgage or rent on time	0.111	0.32	0.478	1.39
Pawned or sold something	-2.758***	-3.654***	-1.519	-2.694***
Went without meals	-7.371***	-7.787***	-8.144***	-9.987***
Was unable to heat home	-5.876***	-7.109***	-3.658***	-4.772***
Asked for financial help from friends or family	-3.289***	-4.103***	-2.982***	-4.815***
Asked for help from welfare/community organisations	-3.581***	-4.919***	-2.603*	-5.341***
Separated from spouse	-3.588*	-4.64**	-5.87***	-5.823***
Serious personal injury/illness	-5.201***	-6.005***	-4.924***	-6.114***
Serious injury/illness to family member	-0.442	-0.562	-1.183**	-0.893
Death of spouse or child	-4.245**	-4.153*	-7.558***	-7.932***
Death of close relative/family member	-0.389	-0.69	0.494	0.348
Death of a close friend	1.018*	1.666***	1.15*	1.938***
Victim of physical violence	-2.832	-4.114	-0.165	-1.422
Victim of a property crime	-3.365***	-3.028***	-1.47	-1.633
Detained in jail	-8.39***	-8.247**	5.904*	4.904*
Close family member detained in jail	-2.021	-3.034*	-2.792**	-4.116***
Fired or made redundant	-2.429**	-2.691**	-0.457	-1.046
A weather related disaster (flood, cyclone)	-2.672**	-3.105**	-1.862	-1.425
Gender	-1.243***		-0.94***	
Age- 25-44 years	1.822***		0.855	
Age- 45-64 years	2.872***		4.341***	
Age- 65-84 years	7.556***		9.305***	
Age- 85+ years	8.76***		10.934***	
Household Income: Q2: 25-50%	1.25		1.746*	
Household Income: Q3: 50-75%	1.356**		3.134***	
Household Income: Q4: 75-100%	1.966**		3.285***	
Education: Certificates & diploma	0.41		0.287	
Education: Bachelor or honours degree	-0.545		-1.366	
Education: Postgraduate degree	0.225		-0.566	
Labour force status: Unemployed	-2.055**		-6.753**	
Labour force status: Not in the labour force	-1.643***		-2.586***	
Club/community activities	3.062***		4.551***	
Long term health condition	-5.325***		-6.939***	
constant	74.224***	76.963***	71.32***	75.536***

Table 9: Major factors contribution and by percentage by wave

	Wave 12	Wave 13	Wave 14	Wave 15	Wave 16	Wave 17
Financial hardship (fh)	0.0046	0.0048	0.0056	0.0048	0.005	0.0042
Negative life event (nl)	0.0008	0.0004	0.0008	0.0007	0.0008	0.0006
Life shocks (fh+nl)	0.0054	0.0052	0.0064	0.0055	0.0058	0.0048
Demography	-0.0035	-0.0043	-0.0043	-0.0043	-0.0047	-0.0063
SES	0.007	0.0101	0.0068	0.0074	0.01	0.0135
Other	0.0047	0.006	0.0071	0.0077	0.0089	0.0078
Unexplained	0.0012	0.0002	-0.0002	0.0003	-0.0007	-0.0004

	Wave 12	Wave 13	Wave 14	Wave 15	Wave 16	Wave 17
Financial hardship (fh)	31.1%	27.9%	35.4%	28.9%	25.9%	21.6%
Negative life event (nl)	5.4%	2.3%	5.1%	4.2%	4.1%	3.1%
Life shocks (fh+nl)	36.5%	30.2%	40.5%	33.1%	30.1%	24.7%
Demography	-23.6%	-25.0%	-27.2%	-25.9%	-24.4%	-32.5%
SES	47.3%	58.7%	43.0%	44.6%	51.8%	69.6%
Other	31.8%	34.9%	44.9%	46.4%	46.1%	40.2%
Unexplained	8.1%	1.2%	-1.3%	1.8%	-3.6%	-2.1%
Total %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 10: Missing observation analysis

Variable	Variable Description	Missing	Available	Missing %
helth	Long term health condition	15	80961	0.02%
lsclub	Club/community activities	7241	73735	8.94%
fiprbeg	Could not pay electricity, gas or telephone bills on time	8839	72137	10.92%
fiprbmr	Could not pay the mortgage or rent on time	9105	71871	11.24%
fiprbps	Pawned or sold something	8985	71991	11.10%
fiprbwm	Went without meals	8958	72018	11.06%
fiprbuh	Was unable to heat home	8994	71982	11.11%
fiprbfh	Asked for financial help from friends or family	8866	72110	10.95%
fiprbwo	Asked for help from welfare/community organisations	8966	72010	11.07%
ghmh	SF-36 mental health score(MHI5)	6881	74095	8.50%
lesep	Separated from spouse	7196	73780	8.89%
leins	Serious personal injury/illness	7257	73719	8.96%
leinf	Serious injury/illness to family member	7290	73686	9.00%
ledsc	Death of spouse or child	7218	73758	8.91%
ledrl	Death of close relative/family member	7186	73790	8.87%
ledfr	Death of a close friend	7209	73767	8.90%
levio	Victim of physical violence	7266	73710	8.97%
lepcm	Victim of a property crime	7133	73843	8.81%
lejls	Detained in jail	7133	73843	8.81%
lejlf	Close family member detained in jail	7134	73842	8.81%
lefrd	Fired or made redundant	7201	73775	8.89%
ledhm	A weather related disaster (flood, cyclone)	7163	73813	8.85%
			Average	9.16%

--------- End of Thesis----------