UNDERSTANDING THE DETERMINANTS AND SOCIOECONOMIC INEQUALITY OF BEHAVIOURAL AND MENTAL HEALTH PROBLEMS, AND SERVICES UTILIZATION AMONG AUSTRALIAN ADOLESCENTS

A Thesis submitted by

MD IRTEJA ISLAM

Bachelor of Medicine and Surgery (MBBS)
MSc Public Health (MPH)

For the award of

Doctor of Philosophy (PhD)

2021

ABSTRACT

Behavioural and mental health problems are considered to be among the most important global public health concerns in the 21st century. Worldwide, the burden of behavioural and mental health issues is rapidly escalating, and this burden is part of the global burden of disease (GBD), including Australia. The responses to the growing burden of behavioural and mental health have been scarce, particularly among adolescents, owing to inadequate knowledge of the long-term effects of behavioural and mental health, and their consequences. Moreover, empirical evidence is lacking about how the social determinants (including inequality) of behavioural and mental health interact and bring about the utilization of mental health services in adolescents. Hence, the overarching aim of this thesis by publication is to investigate the burden of behavioural (bullying victimization) and mental health problems (mental disorders, self-harm, and suicidality) among adolescents aged 12-17 years of Australia. Moreover, the thesis aims to identify key social determinants of behavioural and mental health issues (bullying, victimization, mental disorders, self-harm, and suicidality), and mental health services. This thesis also investigates how the social determinants interact within the behavioural and mental health issues, and to what extent social determinants contribute to the inequity associated with bullying, victimization, mental disorder, self-harm, and suicidality, and in the utilization of mental health services for adolescents of Australia.

To achieve the research goal, this PhD thesis by publication followed a typical format: eight empirical papers (which are to be published in peer-reviewed journals) bookended by substantial introductory and concluding chapters. This thesis is formulated on the basis of Erikson's theory of psychosocial development, Andersen's Behavioural Model of Service Utilization, ecosocial theory, and the World Health Organization (WHO) recommended Commission on Social Determinants of Health (CSDH) conceptual framework. It is based on a quantitative approach, using a nationally representative cross-sectional dataset from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing: Young Minds Matter (YMM).

This thesis is constructed using three main research themes: (I) Identifying the indicators of behavioural and mental health problems in adolescents (*Studies 1-3*); (II) Assessing mental health services utilization among adolescents with behavioural and mental health issues (*Studies 4-6*); and (III) Measuring socioeconomic inequality in behavioural and mental health problems and the utilization of mental health services among adolescents (*Studies 7-8*) in Australia. The thesis reveals that the prevalence of bullying, victimization, mental disorders, self-harm, and suicidality is especially high among Australian adolescents, although many adolescents with behavioural and mental health problems do not access any mental health services. The results show that a variety of sociodemographic factors are associated with behavioural and mental health problems (bullying, victimization, mental disorders, self-harm, and suicidality) together with the use of mental health services. Further, the thesis finds that bullying victimization can be indicators for mental disorders, self-harm and suicidality in adolescents. Moreover, mental disorders such as depression and anxiety disorder, in particular, have a mediating effect on the association between bullying victimization and health risk behaviours (self-harm and suicidality) in adolescents.

In addition, this thesis reveals that socioeconomic disparities exist in behavioural and mental health, showing that adolescents from low-income families reported more bullying victimization, mental disorders, and suicidal behaviour than those from middle- and high-income families. The results also show that health services (e.g., general practitioners, psychiatrists, psychologists, community clinics) are more likely to be accessed by adolescents from economically worse-off families in comparison to their counterparts, implying pro-poor inequalities. in contrast, online services are found to be mostly used by adolescents from high-income families compared with adolescents from low-income families.

Furthermore, the current thesis provides a better understanding of the social determinants (including inequality) of behavioural and mental health, and the use of mental health services among adolescents in Australia. Additionally, the findings of the thesis will help healthcare providers, researchers, academics, and policymakers to take new initiatives and implement effective prevention and

evidence-based intervention programs to reduce the burden of behavioural and mental health problems and increase the use of mental health services among adolescent with mental health problems in Australia.

KEYWORDS

Social determinants; Socioeconomic inequality; Behavioural and mental health problem; Mental disorder; Bullying victimization; Self-harm; Suicidality; Service utilization; Adolescents; Australia

CERTIFICATION OF THESIS

This Thesis is entirely the work of *Md Irteja Islam* 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 a degree or award in this university or any other educational institution, except where acknowledged.

PhD Candidate: *Md Irteja Islam*

Principal Supervisor: *Dr Rasheda Khanam, Associate Professor*

Associate Supervisor: *Dr Enamul Kabir, Senior Lecturer*

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

STATEMENT OF CONTRIBUTION

The following papers produced from this thesis were the agreed share of contribution between the PhD candidate and other co-authors. The details of the scientific contribution of each researcher are provided below:

1. **Islam MI**, Yunus FM, Kabir E and Khanam R. Evaluating risk and protective factors for suicidality and self-harm in Australian adolescents with traditional bullying and cyberbullying victimizations. *American Journal of Health Promotion* – Under second review.

   The overall contribution of *Md Irteja Islam* was 70% to the development of the concept, data extraction, analyses, interpretation, initial drafting and revising the final submission. *Dr Fakir Md Yunus* contributed 10%, assisted in writing the initial draft. *Dr Enamul Kabir* and *Associate Professor Rasheda Khanam* contributed to the concept development, edited and provided important technical inputs by 10% and 10%, respectively.

2. **Islam MI**, Kabir E, Khanam R. Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data. Psychiatry Research Volume 292, October 2020, 113364

   https://doi.org/10.1016/j.psychres.2020.113364

   The overall contribution of *Md Irteja Islam* was 75% to the development of the concept, data extraction, analyses, interpretation, initial drafting and revising the final submission. *Dr Enamul Kabir* contributed 10%, assisted in designing the study, review and editing of the manuscript. *Associate Professor Rasheda Khanam's* contribution was 15%, supervised, reviewed and provided technical inputs to the article.

3. **Islam MI**, Khanam R and Kabir E. Effect of mental disorders on the association between bullying victimization, suicidal ideation, and self-harm in Australian adolescents: A mediation analysis. *Journal of Affective Disorder* – Under second review.

   The overall contribution of *Md Irteja Islam* was 75% to the development of the concept, data extraction, analyses, interpretation, initial drafting and

revising the final submission. *Dr Enamul Kabir* and *Associate Professor Rasheda Khanam* contributed to the concept development, edited and provided important technical inputs by 10% and 15%, respectively.

4. **Islam MI,** Yunus FM, Salam, SS, Kabir E and Khanam R. Mental health services use among adolescent bullying victims in Australia: Results from a nationwide survey. *Children and Youth Services Review* – Under review.

   The overall contribution of *Md Irteja Islam* was 65% to the development of the concept, data extraction, analyses, interpretation, initial drafting and revising the final submission*. Dr Fakir Md Yunus* and *Ms Shumona Sharmin Salam* contributed 15%, in writing the initial draft. *Dr Enamul Kabir* contributed 10%, assisted in designing the study, review and editing of the manuscript. *Associate Professor Rasheda Khanam's* contribution was 10%, supervised, reviewed and provided technical inputs to the article.

5. **Islam MI**, Kabir E, Khanam R. The use of mental health services by Australian adolescents with mental disorders and suicidality: Findings from a nationwide cross-sectional survey. *PLOS One.* 2020 April 10 https://doi.org/10.1371/journal.pone.0231180

   The overall contribution of *Md Irteja Islam* was 70% to the development of the concept, data extraction, analyses, interpretation, initial drafting and revising the final submission. *Dr Enamul Kabir* and *Associate Professor Rasheda Khanam* contributed to the concept development, edited and provided important technical inputs by 15% and 15%, respectively.

6. **Islam MI**, Kabir E, Khanam R. Suicidality, Mental Disorder and the Utilization of Mental Health Services among Australian Adolescents. *Children and Youth Services Review*. 2020 Feb 8:104821. https://doi.org/10.1016/j.childyouth.2020.104821

   The overall contribution of *Md Irteja Islam* was 70% to the development of the concept, data extraction, analyses, interpretation, initial drafting and revising the final submission*. Dr Enamul Kabir* contributed 15%, assisted in designing the study, review and editing of the manuscript. *Associate Professor Rasheda Khanam's* contribution was 15%, supervised, reviewed and provided

technical inputs to the article.

7. **Islam MI,** Ormsby GM, Kabir E and Khanam R. An estimation of socioeconomic inequality in behavioural and mental health-related problems among Australian adolescents: Using concentration index approach. *PLOS One* – Under review.

   The overall contribution of *Md Irteja Islam* was 65% to the development of the concept, data extraction, analyses, interpretation, initial drafting and revising the final submission. *Dr Gail Ormsby* contributed 15%, in writing and reviewing the initial draft. *Dr Enamul Kabir* contributed 10%, assisted in designing the study, review and editing of the manuscript. *Associate Professor Rasheda Khanam's* contribution was 10%, supervised, reviewed and provided technical inputs to the article.

8. **Islam MI,** Salam, SS, Kabir E and Khanam R. Inequality in the mental health services utilization among Australian adolescents: A decomposition analysis'. *Public Health* – Under review.

   The overall contribution of *Md Irteja Islam* was 70% to the development of the concept, data extraction, analyses, interpretation, initial drafting and revising the final submission. *Ms Shumona Sharmin Salam* contributed 10%, in writing the initial draft. *Dr Enamul Kabir* and *Associate Professor Rasheda Khanam* contributed to the concept development, edited and provided important technical inputs by 10% and 10%, respectively.

ACKNOWLEDGEMENTS

To begin with, I would like to pay my innermost gratitude to my creator Almighty Allah - the most graceful, beneficent and merciful. Honestly, undertaking this PhD at the University of Southern Queensland (USQ), Australia was a truly life-changing experience for me, and without the support and encouragement, I got from many people it was not possible to do so.

I would like to express my sincere appreciation to my Principal Supervisor *Associate Professor Rasheda Khanam* for the endless support of my PhD study and related research, for her endurance, inspiration, and immense knowledge. Her guidance and sympathetic encouragement helped me in all the time of PhD research and writing of this thesis. I could not have imagined having a better supervisor and mentor for my PhD program. Besides my Principal Supervisor, my heartfelt thanks go to *Dr Enamul Kabir* (Senior Lecturer at USQ) for his constant encouragement and supervisory role in my PhD study. Without his able guidance and invaluable contextual insights, this PhD would have been difficult. Moreover, I am grateful to Dr Barbara Harmes (Higher Degree Research English Language Advisor, USQ) for proofreading the entire thesis. Without her voluntary feedback and comments on the thesis, it would not have been easy for me as a non-native English speaker.

I gratefully acknowledge the Scholarship and financial support I received towards my PhD from the USQ Graduate Research School, without which this PhD would not have been achievable. My gratitude is also due to *Professor Peter Terry* (Dean, Graduate Research School, USQ) and *Dr Samantha Rose* (Director, Division of Research and Innovation, USQ) for believing in my capability and providing the financial assistance I received through the USQ Division of Research and Innovation. I thank my fellow PhD colleagues for the stimulating discussions and for all the fun we have had in the last three years.

Last but not the least, my deep appreciation goes to my family, parents, in-laws, relatives and friends, who were always believing in me and encouraging me to follow my dreams. In Particular, my lovely wife *Tonima Azad Tony* and my little princess *Idalika Islam*, who has been by my side right through this PhD,

experiencing every single minute of it, sacrificing, persevering, and without whom, I would not have had the courage to embark on this journey in the first place. *Tony* helped me by taking full care of our daughter, providing unconditional love and support, and taking me away from all household duties. While Baby *Idalika* has also expressed his pity that I could not give her enough time because of my PhD studies and work. I am greatly indebted to my ever-caring and loving parents - *Veena Chowdhury* and *Md Nazrul Islam*, who supported me unconditionally and spiritually throughout my PhD study and my entire life. I am also grateful to my mother-in-law, *Nurjahan Begum*, for her unconditional love, immense mental and religious support. Finally, I would like to acknowledge all my teachers and supervisors back home in Bangladesh and in the UK, which helped me to reach this stage.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

The World Health Organization (WHO)

Sustainable Development Goals (SDGs)

Non-communicable diseases (NCDs)

Global Burden of Disease (GBD)

Disability-adjusted life-years (DALYs)

Attention-deficit-hyperactivity-disorder (ADHD)

Major depressive disorder (MDD)

Anxiety disorder (AD)

Conduct disorder (CD)

Bullying victimization (BV)

Australian Bureau of Statistics (ABS)

General Practitioners (GPs)

Young Minds Matter (YMM)

The University of Western Australia (UWA)

Australian Government Department of Health (AGDH)

Australian Data Archive (ADA)

Centre for Disease Control and Prevention (CDC)

Computer-assisted personal interview (CAPI)

Commission of Social Determinants of Health (CSDH)

Diagnostic interview schedule for children - Version IV (DISC-IV)

Crude odds ratio (COR)

Adjusted odds ratio (AOR)

Concentration Index (CI)

Confidence Interval (CI)

Socioeconomic status (SES)

The University of Southern Queensland (USQ)

LIST OF PAPERS (PUBLISHED/UNDER-REVIEW) INCLUDED IN THE THESIS

1. **Islam MI**, Yunus FM, Kabir E and Khanam R. Evaluating risk and protective factors for suicidality and self-harm in Australian adolescents with traditional bullying and cyberbullying victimizations. *American Journal of Health Promotion* – Under 2nd review (Appendix – 1).
2. **Islam MI**, Kabir E, Khanam R. Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data. Psychiatry Research Volume 292, October 2020, 113364
   https://doi.org/10.1016/j.psychres.2020.113364
3. **Islam MI**, Khanam R and Kabir E. Effect of mental disorders on the association between bullying victimization, suicidal ideation, and self-harm in Australian adolescents: A mediation analysis. *Journal of Affective Disorders* – Under 2nd review (Appendix – 2).
4. **Islam MI,** Yunus FM, Salam SS, Kabir E and Khanam R. Mental health services use among adolescent bullying victims in Australia: Results from a nationwide survey. *Children and Youth Services Review* – Under 2nd review (Appendix – 3).
5. **Islam MI**, Kabir E, Khanam R. The use of mental health services by Australian adolescents with mental disorders and suicidality: Findings from a nationwide cross-sectional survey. *PLOS ONE.* 2020 April 10
   https://doi.org/10.1371/journal.pone.0231180
6. **Islam MI**, Kabir E, Khanam R. Suicidality, Mental Disorder and the Utilization of Mental Health Services among Australian Adolescents. *Children and Youth Services Review*. 2020 Feb 8:104821.
   https://doi.org/10.1016/j.childyouth.2020.104821
7. **Islam MI,** Ormsby GM, Kabir E and Khanam R. An estimation of socioeconomic inequality in behavioural and mental health-related problems among Australian adolescents: Using concentration index approach. *PLOS One* – Under review (Appendix – 4).

8. **Islam MI,** Salam, SS, Kabir E and Khanam R. Inequality in the mental health services utilization among Australian adolescents: A decomposition analysis'. *Public Health* – Under review (Appendix – 5).

CHAPTER 1 – INTRODUCTION

Typically, a PhD thesis by publication consists of a series of articles (which are to be published in peer-reviewed journals) on a particular topic bookended by significant introductory and concluding chapters. The main purpose of this introductory chapter of the current PhD thesis by publication is to provide background information and rationale of doing this research on the topic: behavioural and mental health problems and service utilization among adolescents in Australia. Following this section, eight original papers (3 published, 5 under-review in peer-reviewed journals) are presented cohesively in subsequent chapters with a conclusion at the end of the thesis. The overall aim of the thesis is to understand the determinants and the socioeconomic inequality of behavioural and mental health problems (bullying, mental disorder, self-harm, and suicidality), and service utilization among Australian adolescents.

1.0 Overview

The World Health Organization (WHO) defined health as *'a state of complete physical, mental, and social wellbeing, and not merely the absence of disease or infirmity'* [1]. However, behavioural and mental health problems remains an overlooked part of global health efforts, despite the fact that more than 80% of people across the world reporting mental health problems including self-harm, suicidality, neurological and substance use disorder [2]. Therefore, the Director-General of the World Health Organization declared in 2019 that there was a compelling need to motivate societies and individuals to meet the highest level of wellbeing for children and adolescents, and this could be accomplished only when their mental health and well-being and their rights were guaranteed, and launched the WHO Special Initiative for Mental Health (2019-2023) [2]. The main objective of the WHO Special Initiative for Mental Health (2019-2023) is to scale-up affordable and quality mental health services as a part of Universal Health Coverage for more than 100 million people globally by 2023 [2]. In addition, the guarantee of mental health is included as one of the UN's Sustainable Development Goals (SDGs) as it is recognized by global leaders that the target to reduce by one-third mortality from non-communicable diseases (NCDs) via prevention and treatment cannot be achieved without the inclusion of mental

health and wellbeing as vital global priorities [3, 4]. In line with the target of SDGs, this thesis addresses the burden of behavioural issues and mental health problems among Australian adolescents, which will not only depict the current situation for mental health care needs in Australia but also help design strategies for context specific interventions globally [2]. Moreover, the thesis examines the effect of several social determinants on behavioural issues and mental health problems and access to services. Understanding these determinants is important as it has been found that people with behavioural and mental health-related problems experience violation of their human rights, discrimination and social stigma [2].

This introductory chapter of the PhD thesis provides,

- Background of the research
- Research gap
- Research objectives
- Research questions
- Brief methodology
- Theoretical background
- Conceptual framework, and
- A brief outline of the thesis

1.1 Background

Mental health is a fundamental part of a person's overall health status [2]. It is a state of well-being in which an individual can understand their capabilities, cope with normal life stresses, work efficiently and make a significant contribution to society [5]. The importance of mental health to the achievement of global development goals has been increasingly recognized in recent years and is included in the SDGs [2, 6]. One major reason for this importance is that mental health problems are reported to be major drivers of the evolution of global morbidity, disability and mortality [7, 8]. These problems affect all communities and age groups (adolescents in particular) throughout the world, including both developing and developed countries [9]. For example, the latest Global Burden of Disease Study (GBD) conducted in 2017 considered bullying victimization for the first time and estimated that globally mental disorders are in sixth place in terms

of overall disability-adjusted life-years (DALYs) [10]. Recent studies also estimated that worldwide, approximately 20% of total children and adolescents were experiencing a mental health problem [8, 9]. Alarmingly, it is reported that more than 80% of people with mental health problems, do not have access to any mental health services due to major sociodemographic, economic, cultural, environmental, and political transitions [2, 8, 11]. Evidence suggested that individuals from socioeconomically disadvantaged background - living in regional areas, less educated, unemployed and with low household income are more likely to experiencing mental health problems. Further, these factors are thought to be the key elements for inadequate service use [7, 14]. Moreover, it is reported that inappropriate service use can lead to serious mental health hazards such as suicide and it may be no coincidence that suicide is now recognized as one of the principal causes of mortality in adolescents and youths aged between 15-29 years across the world [6, 10].

In Australia, behavioural and mental health problems, together with the lack of access to mental health services among adolescents, continues to be major public health concerns [12-14]. Mental health problems cover a spectrum of conditions that include bullying victimization, substance use disorder, mental disorders, self-harm, and suicidality [8, 15]. The prevalence of these mental health problems together with less access to mental health services among adolescents pose a significant burden in the Australian community [8, 16-18]. The following statistics, particularly relating to bullying, mental disorder, self-harm, suicidality, and mental health services in adolescents facilitate the formulation of the research objectives and questions for this thesis.

First, bullying, an intentional repetitive acts of aggression involving one or more individuals resulting from a power imbalance [19, 20], has currently become a significant public health issue among adolescents in Australia [21]. Bullying can be physical – hits/assaults, verbal - insults, relational – rumours, and cyber via social media using modern technologies [22-24]. Recent studies estimated that one in seven children and/or adolescents have reported bullying victimization in the past 12 months in Australia [25, 26], while other studies report almost 30% and 12% of Australian adolescents aged 13-17 experienced traditional bullying

and cyberbullying victimization, respectively [26, 27]. These figures are alarming because evidence suggests that although bullying typically occurs during adolescence, it may persist in adulthood with serious detrimental effects such as mental disorders and suicide [24, 28-30]. For example, a recent study reported that in Australia, 0.16% of total DALYs for all causes of disease in both sexes and all ages are attributable to bullying victimisation [10, 21].

Second, mental disorders, are one of the leading causes of disease burden in Australia after cancer (18%), cardiovascular disease (14%) and musculoskeletal disorder (13%), as reported by the GBD study in 2017 [10, 21]. In the category of mental disorders, major depressive disorder and anxiety disorder have been found to be the major contributors of DALYs in Australia [21, 31]. It has recently been estimated that 7.4% of 4–17-year-olds in Australia have been diagnosed with attention-deficit-hyperactivity-disorder (ADHD), followed by anxiety disorder (6.9%), depressive disorder (2.8%) and conduct disorder (2.1%). Evidence suggests that together these four disorders among children and adolescents contribute nearly 12% of the GBD in Australia [13, 15, 17]. This figure is one of the great concerns in Australia as previous research suggests that mental disorders can be key indicators of self-harming and suicidal behaviour in adolescents [17, 32]. For example, a previous study reports that 20% of those who attempted suicide in the age group 12-17 years were diagnosed with a mental disorder [13, 15, 17].

Third, self-harm and suicidal behaviour (suicidal ideation, plan, and attempt) significantly contribute to the burden of disease globally [32-34]. It has recently been estimated that the prevalence of self-harm, suicidal ideation, suicidal plans, and suicidal attempts were respectively 7.5%, 5.2%, 2.4% and 8% in Australian adolescents aged 12-17 years [35, 36]. In 2019, the Australian Bureau of Statistics (ABS) reported that the rate of self-harm and suicidality had not reduced significantly in the past five years from 2014 to 2018 in Australia [37]. This statistic does not alleviate any anxiety, since self-harming and suicidal behaviour may ultimately lead to suicide [38, 39]. Moreover, it is recognised as the leading cause of death in adolescents and youths aged between 15-24 years in Australia [33, 40].

In Australia, mental health services are defined by the activity and features of Australian health and social services offered to people with mental illness. These services operate through the distribution of functions and liabilities in Australia's mental health system, with care being provided and/or funded by the Australian federal government, state and territory governments, and non-government industries [41, 42]. State and territory governments fund the system through the national universal health insurance scheme, Medicare, and provide both specialised and non-specialised mental health services in public hospitals and psychiatric hospitals, together with community and residential mental health care settings. The federal government also provides mental health services through telephone and online support systems. There is, moreover, an option to use private-sector mental health services (such as psychologists, psychiatrists and other allied health practitioners such as nurses, community mental health worker) using private health insurance [41, 42]. Moreover, non-government organizations are also available in Australia to provide mental health services. For adolescents in Australia, four broad categories of mental health services are commonly used: health services (including GPs, psychiatrists, psychologists, nurses, psychiatric and general hospitals and clinics), school-based services, telephone services and online services [13, 43]. However, it is estimated that in 2009-10 only 46% of Australian populations accessed the any mental health services they required to treat their mental health problems in the previous 12 months [44]. While it has been reported in 2017-18 that about 8.7% of Australians visited only General Practitioners (GPs) for mental health issues, depicting poor access to health services for mental health problems in Australia [41]. In addition, despite having multiple services delivered by both the public and private health systems, a recent study revealed that only around 60% of 12–17-year-olds adolescent accessed mental health service with a mental health-related issue [43, 45]. That means a significant proportion of adolescents who are experiencing mental health problems do not use any services [43, 45], which shed light on research to identify social determinants associated with non-optimal service use particularly among adolescents.

1.2 Literature search strategy

A range of electronic bibliographic databases were systematically searched from the commencement of PhD program in February 2018 to March 2020 for finding the research gap regarding mental health and service use among Australian adolescents that have global impact. Searched databases included Cochrane, PubMed, PsychInfo, MEDLINE and Google Scholar. A broad scope was kept in the search to avoid omitting relevant papers on the topic using a combination of keywords. The applied searched term included 'social determinants', 'socioeconomic status', 'inequality', 'adolescents', 'children', 'behavioural issue', 'mental health problem', 'bullying', 'traditional bullying', 'cyberbullying', 'victimization' 'mental disorder', 'depression', 'anxiety disorder', 'conduct disorder', 'ADHD', 'self-harm', 'suicidality', 'suicidal ideation', 'suicidal plan', 'suicidal attempt', 'service use', 'health service', 'school service', 'telephone service', 'online service', 'mental health service', 'cross-sectional survey', 'longitudinal study', 'global', 'developed country', 'Australia'. The search items were systematically combined using the medical subject headings (MeSH) function of the various databases. In addition, a Boolean searching technique was used to combine and filter search terms using 'AND', 'OR' and 'NOT'. Additionally, the reference lists of the relevant studies were also checked to distinguish papers that may have been overseen by the electronic search for finding the research gaps.

1.3 Research gap

Even though a significant amount of research has shown how behavioural and mental health-related problems can be prevented and treated and how mental health can be advanced, their transition into real-world outcomes has been slow [8, 11]. Unfortunately, the treatment and care of an individual with behavioural and mental health problems has not yet been the key focus of global policymakers and donor organizations [8, 46]. As a result, people with behavioural and mental health issues are largely ignored by the researchers, academics and healthcare professionals in the world [46]. Persistent stigma and prejudice contribute, at least in part, to the disparity between the global burden of disease due to mental illnesses and the care given to these conditions [8, 47]. Stigma, reflected in unequal social, policy and regulatory systems, creates a discrepancy between

physical and mental healthcare facilities, with less availability, accessibility and consistency in quality of services for the latter [8, 48].

In addition, studies have found that the burden of mental health problems has been underestimated as a result of the following issues: firstly, the similarity between neurological and psychiatric disorders; secondly, grouping self-harm, suicidality and suicide-related activities as a special category beyond the limits of mental disorders; thirdly, typically connecting all pain syndromes with musculoskeletal conditions; fourthly, the omission of personality and behavioural issues like bullying in estimating the burden of mental disease; and lastly, inadequate understanding of the risk to health from related causes of serious mental health problems [8, 49].

The present PhD thesis focuses on the common behavioural and mental health issues of adolescents aged 12-17 years in Australia, as it is strongly suggested in previous research that, in this period of life, one's unique mental health can be greatly influenced by several social, environmental, cultural, behavioural, biological and genetic factors [11, 50]. In this thesis, bullying, mental disorders, self-harm and suicidality are commonly characterized as behavioural and mental health problems to measure the burden of disease and to eliminate the underestimation of their consequence that has been reported in previous studies [49].

One of the main gaps that will be investigated in this thesis is that the national estimates are inadequate regarding behavioural and mental health problems among adolescents in Australia, as the majority of the previous research is state-based [51]. For research in this area to be effective, a national profile is required. Further, most of the previous research has only considered traditional bullying and identified the risk/protective factors of self-harm and suicidality among those who reported traditional bullying only [52, 53], but not cyberbullying. Furthermore, a series of exploratory studies in the literature have shown the association of traditional bullying victimization with depression, anxiety and suicidality, but none of the literature has previously examined the association between cyberbullying victimization with a range of outcome variables such as ADHD, depression, anxiety, conduct disorder, self-harm and suicidality in the

cohort of 12-17 years [54, 55]. In addition, even though substantial evidence has shown that bullying has detrimental effects on mental health, none of the studies has tested the mediating effect of each mental disorder (ADHD, depression, anxiety and conduct disorder) on the association between both traditional bullying and cyberbullying with self-harm and suicidality among 12–17-year-olds [55, 56].

Further, most studies conducted in Australia, have assessed the utilization of mental health services only among those who are diagnosed with a mental disorder and/or substance disorder and mostly among adults. To the best of our knowledge, no one has assessed the use of mental health services among bullied adolescents and particularly among those who specifically experience self-harm and/or suicidality [13, 43]. Moreover, most previous research has not examined the interaction between different mental health problems and service use involving adolescents. For example, while Pirkis, Burgess [57] examined the effect of the simultaneous presence of mental disorders and suicidality on service use among adults in Australia, they did not investigate the effect among adolescents.

Furthermore, in recent years, an analysis of socioeconomic inequalities involving adolescents' physical and mental health has increased significantly worldwide [58, 59], with the belief that there might be an inverse relationship between socioeconomic inequality and mental health in adolescents [60, 61]. However, many specific issues have been under-researched in Australia. These issues include inequalities in behavioural and mental health problems, encompassing bullying, self-harm and suicidality, and inequalities in the utilization of mental health services among adolescents. For example, a recent study by Bartram and Stewart [62] measured the inequalities in the mental health services using a nationally representative sample of Australian adults, but not involving adolescents aged between 12-17 years.

1.4 Research objectives and research questions

Given the background of the study and an overview of the research gap, there is both a pressing need and an opportunity to understand the determinants of behavioural and mental health problems and mental health services utilization

among adolescents. As an associated but separate issue, there is a need to understand how socioeconomic disparities affect mental health service use of adolescents. Hence, the primary aim of this thesis by publication is to investigate whether and to what extent social determinants (demographic, socioeconomic, physical, psychological factors) impact behavioural and mental health conditions (bullying, mental disorders, self-harm, and suicidality, in particular) and the use of mental health services among 12-17-year-olds adolescents in Australia. Additionally, the thesis measures the socioeconomic inequalities that are revealed in bullying, mental disorders, self-harm, and suicidality, as well as in the utilization of mental health services by adolescents.

To achieve the research goal of this thesis, eight empirical studies have been conducted using the nationally representative cross-sectional data from the second Child and Adolescent Survey of Mental Health and Wellbeing (YMM) in Australia. The thesis is structured under three broad research themes: (I) Identifying the indicators of behavioural and mental health problems in adolescents; (II) Assessing the utilization of mental health services by adolescents with behavioural and mental health issues; and (III) Measuring socioeconomic inequality in behavioural and mental health problems as they relate to the utilization of mental health services in adolescents (Figure 1).

The included studies have been developed according to the goals of the thesis and are focused on the behavioural and mental health-related issues in the adolescent. All the studies are quantitative, using a cross-sectional YMM survey data. Table 1 depicts the specific objectives and research questions of each study included in the thesis.

Figure 1 Research theme and studies included in the thesis.

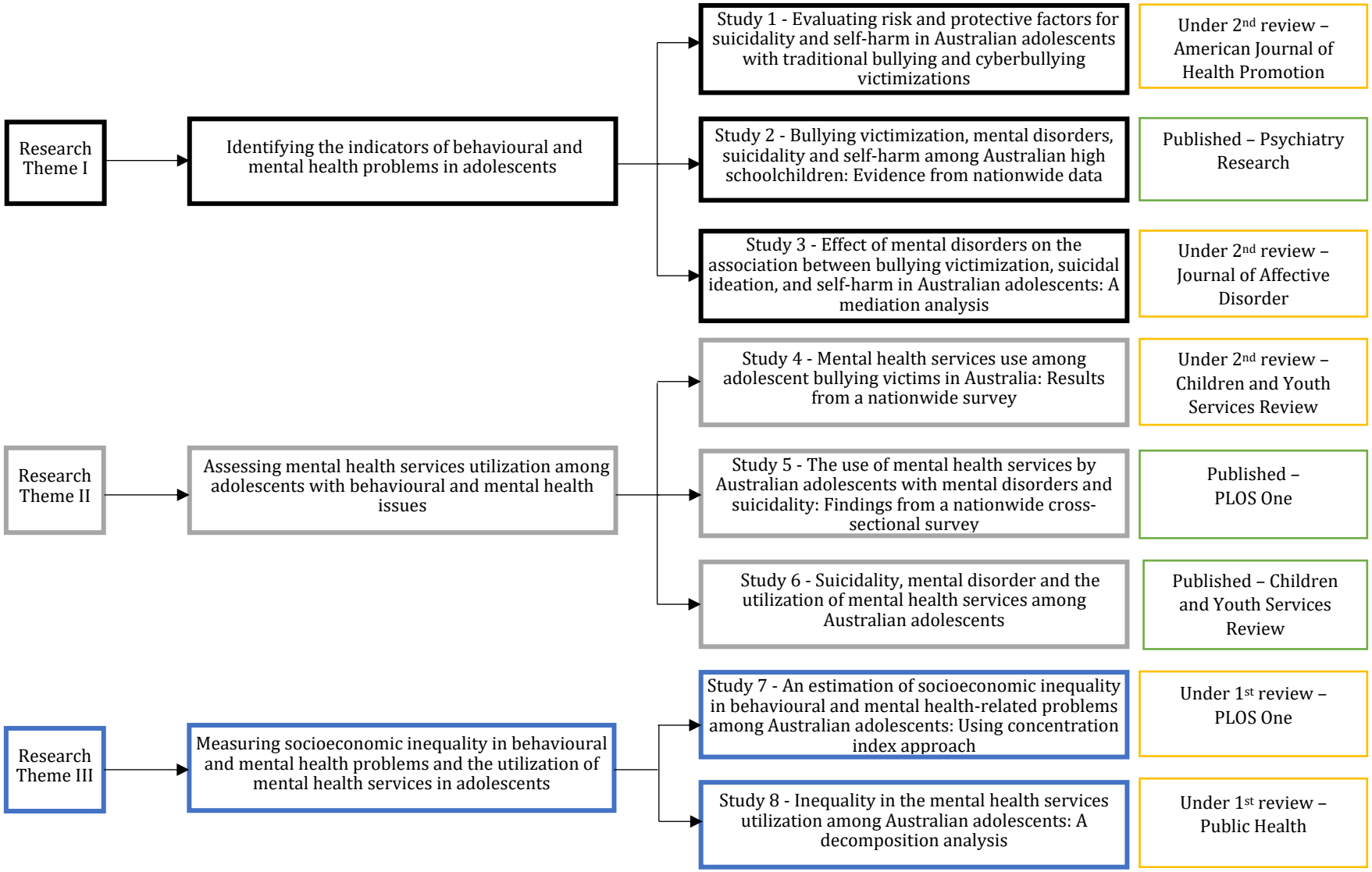


Table 1 Objectives and research questions of the conducted studies

Research Themes	Study No.	Study objective/s	Research questions	Age group	Sample Size	Main Explanatory variable	Outcome variables	Statistical measures
Theme I - Identifying the indicators of behavioural and mental health problems in adolescents	Study 1	- To determine the factors associated with self-harm and suicidality among bullying victims during adolescence	- What factors have a detrimental effect on self-harm and suicidality in both traditional and cyberbullying victims - What factors have a protective effect on self-harm and suicidality in both traditional and cyberbullied adolescents	14-17	2125	- Sociodemographic factors (age, gender, household income, location) - Risk factors (Parental distress, substance use, mental disorder, psychosis, eating disorders, sexual activity) - Protective factors (high self-esteem, social support, academic performance, schooling, sleep)	- Self-harm - Suicidality - Bullying victimization (Traditional and cyber)	- Descriptive statistics - Bivariate analysis - Binary logistics regression
	Study 2	- To investigate the association between bullying victimization, mental disorder, self-harm and suicidality in children and adolescents	- Whether bullying (traditional, cyber and both, separately) is associated with any mental disorder (major depressive disorder, ADHD, anxiety and conduct disorder) - To what extent bullying increases the risk of self-harm suicidality (ideation, plan, attempt)?	12-17	2166	- Traditional bullying - Cyberbullying - Both bullying	- Mental disorder (major depressive disorder, ADHD, anxiety and conduct disorder) - Self-harm - Suicidality (ideation, plan, attempt)	- Descriptive statistics - Bivariate analysis - Binary logistics regression

Research Themes	Study No.	Study objective/s	Research questions	Age group	Sample Size	Main Explanatory variable	Outcome variables	Statistical measures
	Study 3	- To examine the mediating effect of mental disorders on the association between bullying victimization, suicidal ideation, and self-harm among children and adolescents	- Do mental disorders (major depressive disorder, ADHD, conduct disorder and anxiety disorder, separately) have mediating effect on the association between bullying victimization (traditional, cyber and both) and suicidal ideation? - Whether mental disorders (major depressive disorder, ADHD, conduct disorder and anxiety disorder, separately) mediate the association between bullying victimization (traditional, cyber and both) and self-harm?	12-17	2522	- Bullying (traditional, cyber and both) - Mediator: Mental disorder (Major depressive disorder, ADHD, conduct disorder and anxiety disorder)	- Self-harm - Suicidal ideation	- Descriptive statistics - Bivariate analysis - Mediation analysis using Baron and Kenny Approach - Sobel test
Theme II - Assessing mental health services utilization among adolescents with behavioural and mental health issues.	Study 4	- To assess the utilization of mental health services among adolescent bullying victims	- What is the impact of bullying victimization in the utilization of different mental health services in adolescents? - Whether the interaction terms (between bullying victimization, mental disorder, self-harm, and suicidality) have an impact on mental health services or not?	12-17	2218	- Traditional bullying - Cyberbullying - Mental disorder - Self-harm - Suicidality	- Mental health services (health service, school service, telephone service, online service)	- Descriptive statistics - Bivariate analysis - Binary logistics regression

Research Themes	Study No.	Study objective/s	Research questions	Age group	Sample Size	Main Explanatory variable	Outcome variables	Statistical measures
	Study 5	To identify the factors associated with mental health service utilization in adolescents with mental disorder and suicidality	- What is the demographic, socioeconomic and health-related factors associated with mental health services utilization among Australian adolescents with mental disorder and suicidality?	13-17	2134	- Demographic factors - Socioeconomic factors - Behavioural and health-related factors	- Mental health services (health service, school service, telephone service, online service)	- Descriptive statistics - Bivariate analysis - Binary logistics regression
	Study 6	- To assess the mental health service use among adolescents with suicidality and to test whether service use is affected by the simultaneous presence of suicidality and mental disorder	- What is the effect of suicidal behaviour among children and adolescents regarding the use of mental health services? - To what extent service use is impacted by the simultaneous presence of mental disorder and suicidality?	13-17	2134	- Suicidality - Mental disorder	- Mental health services (health service, school service, telephone service, online service)	- Descriptive statistics - Bivariate analysis - Binary logistics regression
Theme III - Measuring socioeconomic inequality in behavioural and mental health problems and the utilization of mental health	Study 7	- To measure inequality in behavioural (bullying) and mental health-related issues (mental disorder, self-harm, suicidality) in children and adolescents	- Whether social disparities exist in bullying, mental disorder, self-harm and suicidality among children and adolescents? - Is the inequality varies using two different socioeconomic rank variables, income-based and area-based?	12-17	2521	- Equivalised household income quintile - Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) quintile (Area-based rank variable)	- Bullying - Mental disorder - Self-harm - Suicidality	- Descriptive statistics - Erreyger's Corrected Concentration Index approach

Research Themes	Study No.	Study objective/s	Research questions	Age group	Sample Size	Main Explanatory variable	Outcome variables	Statistical measures
services in adolescents.	Study 8	- To determine the socioeconomic inequality in the utilization of mental health services among Australian adolescents - To decompose the observed socioeconomic inequality into potential determinants	- Does mental health services utilization vary significantly among children and adolescents according to the socioeconomic status (poorest to richest)? - To what extent social determinants contribute to the inequality of mental health services utilization?	13-17	2268	- Equivalised household income quintile	- Mental health services (health service, school service, telephone service, online service)	- Descriptive statistics - Logistics regression - Concentration Index estimation - Decomposition analysis

1.5 Brief methodology

The current PhD thesis utilized cross-sectional data that comes from the second Child and Adolescent Survey of Mental Health and Wellbeing (YMM) in Australia. YMM was nationally conducted in 2013-14 by the Telethon Kids Institute, The University of Western Australia (UWA) in partnership with Roy Morgan Research, and funded by the Australian Government Department of Health. The YMM survey protocol was ethically approved by the Human Research Ethics Committees of UWA (RA/4/1/9197) and the Australian Government Department of Health (Project 17/2012). Participation in the YMM study was voluntary, and all respondents provided verbal and written informed consent to take part in the survey [14, 63].

YMM was conducted involving a random probability-based sample by employing a multi-stage area-based sampling technique, designed to be representative of households in Australia with children and adolescents aged 4-17 year-olds [63]. When there was a household with more than one eligible child, YMM randomly selected one for the study. In total, 6310 parents/carers of children and adolescents aged 4-17 years (55% of eligible households) completed a computer-assisted personal interview (CAPI) questionnaire via face-to-face interview. Further, 2967 children and adolescents aged 12-17 years (89% of eligible households) provided information on health risk behaviours and service use by completing a self-reported tab-based questionnaire privately at home [63, 64]. The YMM survey, however, omitted the most remote areas, homeless children and adolescents, children and adolescents living in residential care and households where English interviews were unlikely. Detailed information regarding YMM survey methodology can be found elsewhere [63].

In the thesis, adolescents aged between 12–17 years were considered. This is because detailed information about the key variables of interest (substance use, bullying, self-harm, suicidality, and online service use) of this thesis is only available in self-reported child-data. The information on demographics, socioeconomic characteristics, mental disorders, and service use was gathered mostly from parent-data. However, to achieve the objectives of each study in the thesis and to maintain the age comparability across the survey, the number of

samples varied in the analysis. For example, *Study 1* of the thesis was limited to children and adolescents aged 14-17 years because information on psychosis was only available from children and adolescents who were aged more than 14 years. Similarly, to accomplish the goals of the studies, during the analysis *Study 2-4* and *Study 7* were restricted to the 12-17-years age group, while *Study 5*, *Study 6* and *Study 8* were limited to the 13-17-years age group. Sample size, selected variables (outcome and explanatory) and statistical measures for each conducted study are also mentioned in Table 1.

1.6 Theoretical underpinning

The essence of the behavioural and mental health burden is that it can be understood as a social dynamic and can be explained with relevant theories and/or models. Even though the thesis is based on a secondary dataset, the findings of each study included in the thesis are underpinned by a suitable theoretical framework. The following three theories are adopted in the thesis.

1.6.1 Erikson's theory of psychosocial development: It primarily characterizes an individual as a way of negotiating their biological and sociocultural factors during the eight stages of a lifecycle from infancy to adulthood. For example, according to this theory the adolescence must achieve identity in occupation, gender roles, politics, and, in some cultures, religion when a child enters into the adolescence stage (12-19 years) from childhood stage (5-12 years) [65]. Moreover, it can be used for the individuals to augment awareness and provide treatment in the appropriate context to social and cultural factors [65]. In the thesis, *Study 1 - 3 (Research Theme I)* examined the effect of psychosocial factors on behavioural (bullying) and mental health problems (mental disorders, self-harm, and suicidality), and investigated how a behavioural factor (bullying) can lead to self-harm and suicidality in adolescents aged 12-17 years.

1.6.2 Andersen's Behavioural Model of Service Utilization: It is incredibly effective in developing a framework to identify different factors (socioeconomic, psychosocial, clinical and facilitating) that influence an individual's care-seeking decisions [66, 67]. In addition, this model helps to understand how and why people utilise services, investigate inequality

in service use and supporting policy formulations that allows for equitable service utilization [66, 67]. This thesis tested the validity of theory for the Australian healthcare system using behavioural (bullying) and mental health problems (mental disorder, self-harm, and suicidality) as clinical factors. In the thesis, *Study 4,* and *Study 6* under the *Research Theme II*, aim to investigate the impact of behavioural and mental health-related factors (bullying, mental disorders and suicidality) in the utilization of mental health services in adolescents. Additionally, the effect of interaction terms between bullying, mental disorder and suicidality on the care-seeking behaviour were also examined. Moreover, *Study 5 (Research Theme II) and Study 8 (Research Theme III)* examined whether socioeconomic and psychosocial factors (including inequality) influence care-seeking behaviour in adolescents with behavioural and mental health problems.

1.6.3 Ecosocial theory: This theory by Krieger et al. has developed new insights into the determinants of the population distribution of diseases and socioeconomic inequalities in health-related outcomes. The theory combines social and biological factors and employs a complex historical, and ecological approach [68-70]. Following the ecosocial theory, *Study 7,* and *Study 8* under the *Research Theme III*, examined whether socioeconomic inequality exists in behavioural and mental health problems and the use of mental health services. Further, *Study 8* examined the contribution of each social determinant in the socioeconomic inequalities in the utilization of mental health services among adolescents in Australia.

1.7 Conceptual framework

A conceptual framework from the public health perspective is equally important for two reasons: first, to guide original research to expand an understanding of determinants and procedures; and second, to guide policymaking to shed light on the appropriate entry points for interventions and policy formulations [70]. The conceptual framework of the thesis explains the proposed hypothesis, exploring the direct and/or indirect connections that exist between individual, sociodemographic, environmental, behavioural, biological, psychological, and

other associated factors. In addition, it outlines the mental health problems and service utilization following the World Health Organization (WHO) recommended the Commission on Social Determinants of Health (CSDH) framework [70]. One of the main goals of the CSDH framework is to create a critical distinction between the procedures underlying social stratification and the determinants of health that are triggered by stratification and contribute to health disparities. Additionally, the CSDH framework guides policy actions on the social determinants of health and helps to identify effective policy interventions that will reduce health inequalities [70]. The CSDH framework is divided into structural determinants and intermediary determinants. Structural determinants (such as gender, age, race, ethnicity, household income, education, and occupation) create stratification and social class distinctions within society that identify a person's socio-economic position within the hierarchy of power, reputation, and access to resources [70, 71]. The main components of intermediary determinants of health are material circumstances (housing, quality of life, environmental factors), psychosocial circumstances (family relationships, social support, psychosocial stressors, stressful circumstances), behavioural/biological factors (malnutrition, physical inactivity, drug abuse, bullying), health services, and the risk of exposure to compromised health conditions (chronic diseases, injury, mental disorders, self-harm, suicidality) [70, 71].

Globally, behavioural, and mental health problems during adolescence have been found to pose a serious public health burden because of their increasing prevalence in the last two decades. [11, 14, 50]. Evidence suggests that social determinants predict a wide variety of threats over the course of a person's life, starting from adverse birth outcomes and child development, behavioural issues, and physical and mental health problems and ending with the risk of premature death [8, 50]. Socioeconomic inequalities have also been reported by many researchers concerning behavioural and health issues, and service access in children and adolescents [72-74].

Using the concept of the CSDH framework, the current thesis examines whether and to what extent structural and intermediary determinants are associated with

the risk of developing behavioural (bullying victimization) and mental health problems (mental disorder – anxiety, depression, ADHD, conduct disorder, non-suicidal self-harm, and suicidality – ideation, plan, attempt), and mental health services utilization and ultimately on the mental health and well-being in adolescents. Moreover, the proposed model intends to investigate the contribution of social determinants in income-based inequality of behavioural and mental health problems and the utilization of mental health services by Australian adolescents. The thesis deems structural determinants to be the age of the adolescent, gender, ethnicity, location, grade at school, parental occupation, parental education, household income, area-based socioeconomic position. While intermediary determinants include family functioning, family type, stressful life events, substance use, bullying, mental disorders, self-harm, suicidality, and mental health services.

Figure 2 provides a basic description of the conceptual framework of this thesis. It shows the relation of structural and intermediary determinants with behavioural and mental health problems (*Studies 1-3, Research Theme I*), and with the mental health service use (*Studies 4-6, Research Theme II*). Moreover, Figure 2 depicts the impact of social determinants on the inequality in behavioural and mental health and the utilization of mental health services (*Studies 7 and 8, Research Theme III*).

1.8 Thesis outline

PhD thesis by publication is becoming increasingly common and may be motivated by two primary factors: (I) the significance of publications for calculating university research output; and (II) increased competition in the post-PhD job market [75, 76]. Typically, a PhD thesis does not have a rigid format; rather students can formulate their thesis in any way that best fits their project and discipline. However, PhD thesis by publication is usually presented as a collection of papers framed by an important introductory chapter and conclusion [76]. This section of the thesis addresses the overall structure and organisational pattern. The thesis comprises the following five chapters.

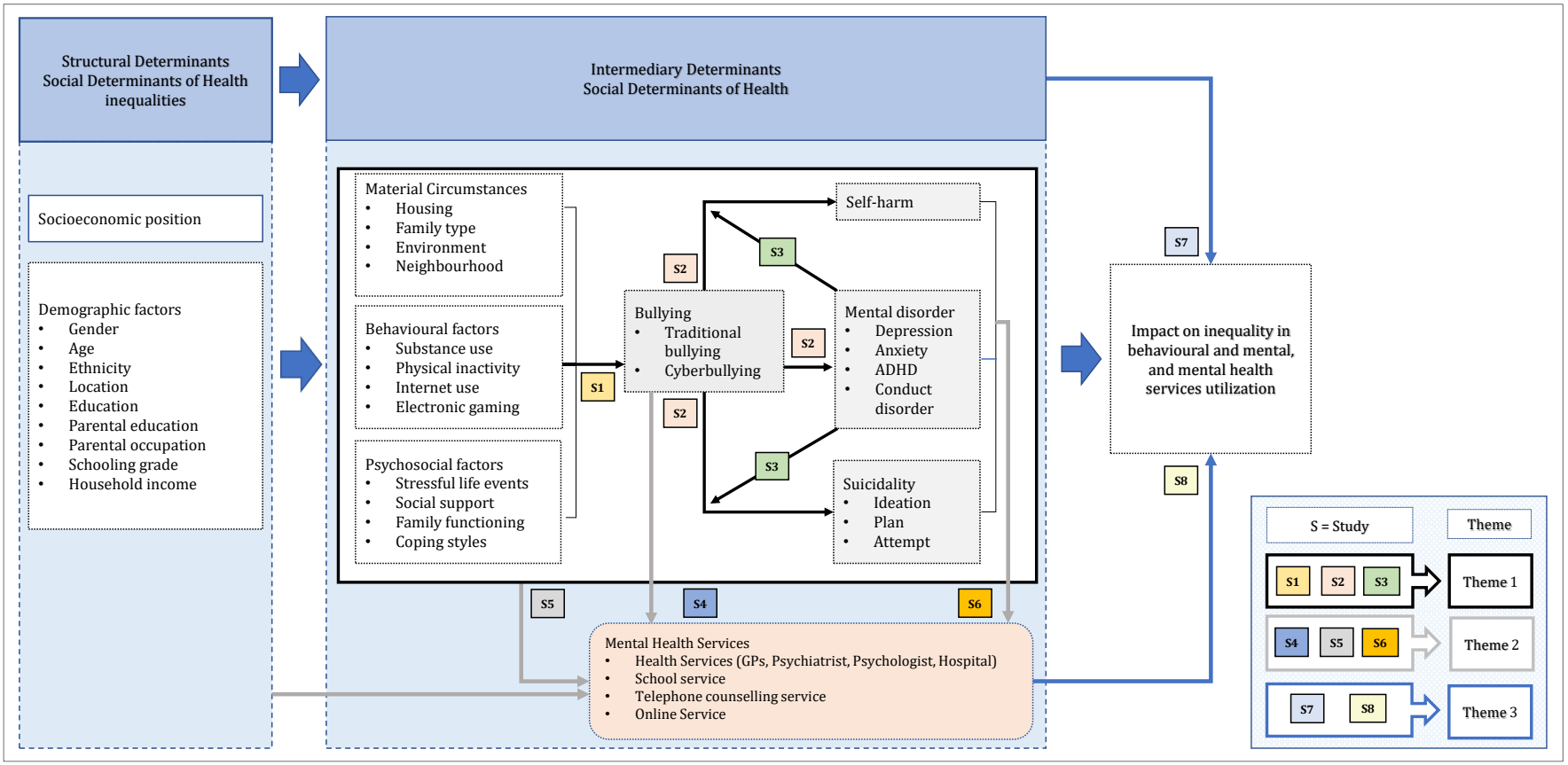


Figure 2 Conceptual Framework of the thesis.

Chapter 1 describes the development of the concept, research background and problem, research gap, research objectives and questions, data source and participants, theoretical and conceptual framework of the thesis.

Chapter 2 explains the objectives of *Research Theme I: Understanding the determinants of behavioural and mental health problems in child and adolescents*, which includes three research studies. *Study 1* and *Study 3* are under review, while *Study 2* has been published in a peer-reviewed journal.

Chapter 3 rationalises the objectives of *Research Theme II: Assessing the need of mental health services among child and adolescents with behavioural and mental health issues,* which contains three research papers. *Study 5* and *Study 6* are published in Q1 journals, and *Study 4* is under review.

Chapter 4 justifies the objectives of *Research Theme III: Measuring inequality in behavioural and mental health problems and in the utilization of mental health services in children and adolescents,* which covers two studies (*Study 7* and *Study 8* – both are under-review)

Chapter 5 explains the overall conclusion and policy implications of the thesis.

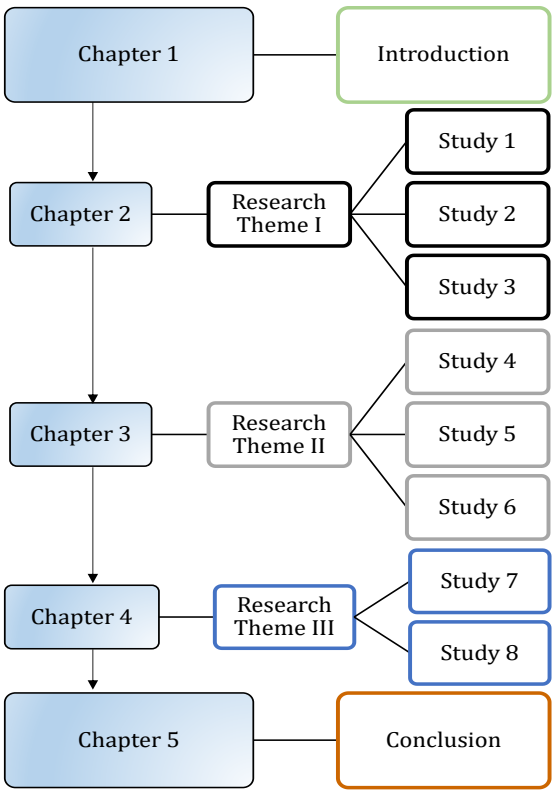


Figure 3 Flow chart of the thesis outline

CHAPTER 2 – RESEARCH THEME I

2.0 Overview

Research Theme I – Identifying the indicators of behavioural and mental health problems in adolescents, is described in Chapter 2 of this thesis. Three studies *(Study 1-3)* are included in *Research Theme I*, which in general, examined the association and/or interaction between social determinants (demographic, socioeconomic, behavioural, psychological, biological etc.), bullying victimization and mental health problems (mental disorders, self-harm and suicidality) among adolescents in Australia. Summary of each included studies in this theme are as follows,

- *Study 1* identified the risk factors and protectives factors associated with self-harm and suicidality among both traditional bullying and cyberbullying victims aged between 14-17 years in Australia. The findings of the study show that parental distress, substance use, mental disorder, psychosis, eating disorders and sexual activity increased the risk of self-harm and suicidality among bullying victims. While high self-esteem, social support and adequate sleep had a protective effect. *Study 1* concludes that researchers and policymakers should consider the risk and protective factors for the promotion of effective prevention and intervention program to reduce self-harm and suicidality among bullying victims.
- *Study 2* was to test the individual effect of traditional bullying, cyberbullying and both bullying on mental disorders, self-harm and suicidality among children and adolescents in Australia. Findings of this study suggest that traditional bullying and cyberbullying increases the probability of depression, self-harm, and suicidality in 12-17-year-olds Australians. This study also indicates the need for providing resources for early identification of bullying victimization involving children and adolescents to reduce the prevalence of depression, self-harm, and suicidality.
- *Study 3* aimed to investigate whether and to what extent mental disorders (major depressive disorder, ADHD, anxiety disorder and conduct disorder) mediate the association between bullying victimization (traditional bullying,

cyberbullying and both), self-harm and suicidal ideation. *Study 3* found that depression mediated the association of bullying victimization (traditional and/or cyber) with self-harm and suicidal ideation. While anxiety disorder only mediating the association between traditional bullying victimization and suicidal ideation. ADHD and conduct disorder did not have any mediating effect. This study also seeks the attention of the healthcare providers and parents/caregivers to reduce traditional bullying and cyberbullying by depicting the role of mental disorders (depression and anxiety) in children and adolescents bullying victims of Australia.

Details of the above-conducted studies under *Research Theme I* are provided from the next page.

2.1 Study 1 - Evaluating risk and protective factors for suicidality and self-harm in Australian adolescents with traditional bullying and cyberbullying victimizations_(Under 2nd review in the American Journal of Health Promotion, Q1, IF: 2.232, SNIP: 0.921, Publisher - SAGE)

Abstract

Purpose:

To identify and compare important risk and protective factors associated with suicidality and self-harm among traditional bullying and cyberbullying victims aged 14-17-years in Australia.

Design:

Cross-sectional population-based study.

Setting:

Young Minds Matter: a nationwide survey in Australia

Subjects:

Adolescents aged 14-17-years (n = 2125).

Measures:

Self-harm and suicidality were outcome variables, and explanatory variables included were sociodemographic factors (age, gender, country of birth, household income, location, family type), risk factors (parental distress, family functioning, family history of substance use, child substance use, mental disorder, psychosis, eating disorders, sexual activity) and protective factors (high self-esteem, positive mental health or resilience, school connectedness, sleep) among two types of bullying victims - traditional and cyber. Traditional bullying included physical (hit, kick, push) or verbal (tease, rumours, threat, ignorance) bulling, and cyberbullying included teasing messages/pictures via email, social medial using the internet and/or mobile phones.

Analysis:

Bivariate analysis and binary logistic regression models. Statistical metrics include Hosmer-Lemeshow Goodness-of-Fit-test, VIF test, Linktest and ROC curve for model performance and fitness.

Results:

Overall, 25.6% of adolescents were traditional bullying victims and 12% were cyberbullying victims. The percentages of self-harm (32.8% vs 22.3%) and suicidality (34.4% vs 21.6%) were higher in cyberbullying victims than in traditional bullying victims. Girls were more often bullied and likely to experience suicidal and self-harming behaviour than boys. Parental distress, mental disorder and psychosis were found to be significantly associated with the increased risk for self-harm and suicidality among both bullying victims ($p<0.05$). While, eating disorder and sexual activity increased the risk of suicidality in traditional bullying victims and self-harm in cyberbullying victims, respectively. Positive mental health/resilience and adequate sleep were found be significantly associated with decreased suicidality and self-harm in both bullying victims.

Conclusion:

Self-harm and suicidality were common in bullying victims. The findings highlight that the risk and protective factors associated with self-harm and suicidality among adolescents bullying victims should be considered for the promotion of effective self-harm and suicide prevention and intervention programs.

Keywords

Suicidality; Self-harm; Traditional bullying; Cyberbullying; Adolescent

Purpose

Bullying is commonly referred to as repetitive acts of intentional face-to-face aggression that involves one or more individuals resulting in physical harm or mental injury through a power imbalance relationship [1-3]. Typically, bullying is manifested by physical aggression, social rejection, and verbal harassment - termed as traditional bullying[4]. While in recent years, besides the traditional form of bullying, a new form of bullying has emerged using modern technologies of information and communication – termed as cyberbullying [5,6]. Nowadays, both traditional bullying and cyberbullying victimization are found to be highly prevalent[2,7] and considered as one of the global public health concerns, predominantly occurs during adolescence and may persist in early adulthood [6,8]. A recent cross-national study involving 83 countries reported that 30.5% of adolescents aged 12-17 years were either traditionally or cyber bullied [9]. A meta-analysis of 46 studies in Australia documented that almost one out seven adolescents were being bullied in the past 12-months, with about one in four school going children experienced lifetime bullying [10]. Further, recent studies estimated that about 29% of 13-17 years Australian adolescents were traditional bullying victims, and 12% reported cyberbullying victimization [11,12].

Evidence have documented adverse effects of bullying victimization on developmental trajectories in children and adolescents [4] and found associated with the increased risk of anxiety, depression, substance abuse disorder, interpersonal problems, behavioural problems, low self-esteem, and poor academic performance [2,7,13]. Moreover, longitudinal studies have indicated that the victims of traditional bullying and cyberbullying were at a higher risk of suicidal and non-suicidal self-harming behaviour [2,6,14]. For instance, Ford, et al.[15] reported that bullying victims were associated with more than three-times increased prevalence of self-harm and suicidality (ideation and attempt) among 14-15 year-olds in Australia. This indicated that prevention of bullying victimizations and its consequences (e.g. self-harm, suicidality) is a key to reducing emotional and behavioural problems, self-harm, suicidality and ultimately suicide in adolescents [16].

Since bullying is recognized as a mental health risk factor among adolescents [15], past studies have identified some important risk and protective factors such as psychological characteristics of the victims, socioeconomic status and stressors, family background, cultural norms and coping styles associated with bullying victimization [4,17]. However, previous studies rarely have examined the risk and protective factors associated with suicidality and self-harm among adolescent bullying victims[6,14-16] and no such studies have been conducted in Australia. Worldwide, limited studies have identified factors such as substance abuse, physical abuse, depression, lower life satisfaction and low self-esteem as risk factors, and social support, academic performance and resilience as protective factors for suicidality and self-harm only in adolescents with traditional bullying victimization[6,14,16]. While few important factors such as psychosis[18], family type, family functioning, parental stress[19], parental substance abuse[19,20], internet addiction [7], eating disorder [21] and less sleep duration[22] related to suicidality/self-harm among adolescents have not often been examined in both traditional and cyber bullying victims. In addition, to the best of our knowledge, no previous studies have considered both traditional bullying and cyberbullying victims in a single study to compare the impact of the factors, and none of the studies used a national sample. This warrants further research to identify risk and protective factors for suicidality and self-harm among adolescents involved in bullying victimizations (traditional and cyber), that can help direct and formulate the health promotion strategies for assessment, prevention, and intervention.

Thus, the purpose of the current study is - (i) to identify risk factors associated with suicidality and self-harm among adolescents involved in two types of bullying victimizations (traditional and cyber); (ii) to examine the protective factors against suicidality and self-harm in adolescents with traditional bullying and cyberbullying victimization, and (iii) to compare the impact of risk/protective factors on suicidality and self-harm between two bullying victim groups (traditional and cyber). Moreover, to the best of our knowledge, this is the first study to examine risk and protective factors associated with suicidality and self-harm in adolescents with traditional bullying and cyberbullying

victimization in Australian context using data from the nationwide mental health and wellbeing survey - Young Minds Matter (YMM).

Methods

Design

Data came from Young Minds Matter (YMM): The Second Australian Child and Adolescent Survey of Mental Health and Wellbeing, a population-based nationwide cross-sectional survey conducted in 2013-14. Ethical approval was obtained from the Human Research Ethics Committees of the University (blinded for review) and the Australian Government Department of Health (RA/4/1/9197) [23,24].

Sample

Briefly, YMM deployed a multi-stage, area-based random sampling technique that represented Australian households with children and adolescents aged between 4 and 17 years. If more than one eligible child was present in the household, the sample included a single child randomly. A total of 6310 parents (55% of eligible households) of 4-17-year-olds have voluntarily completed a structured questionnaire via face-to-face interview. Moreover, 2967 children (89% of eligible households) of 11-17 years privately completed a computer-based self-reported questionnaire. However, the homeless children, children from the most distant locations and living in any household/institution where the interviews could not be conducted in English, were excluded. More details about recruitment and representativeness are available elsewhere[23].

In this study, the following criteria were used for sample analyses (n= 2125), generated after merging the self-reported child-data and parent data from the YMM survey.

- The analyses were limited to 14–17-year-olds children to sustain age comparability across the survey because, for example, important risk factors such as psychosis related information were only available from children who were more than 14 years of age.
- The 'Don't know' and 'Prefer not to say' responses were excluded.

Measures

In the survey (self-reported data), children provided information about bullying (traditional and cyber) victimization in the 12 months preceding the survey [12]. Traditional bullying was considered *"when people tease, threaten, spread rumors about, hit, shove, or hurt other people over and over again"* and cyberbullying was measured *"when people use mobile phones or the internet to send nasty or threatening emails or messages, post mean or nasty comments or pictures on websites like Facebook or Twitter, or have someone pretend to be them online to hurt other people over and over again".* The following question was used to measure bullying and (traditional and cyber) victimization in children, *"In the past 12 months, have you ever been traditionally bullied or cyberbullied?"*[12], where the response options were 'Yes' (coded as 1) and 'No' (coded as 0). In this study, from the responses, two binary variables were created - traditional bullying (Yes/No) and cyberbullying (Yes/No).

The dependent variables included suicidality and self-harm. Suicidality was assessed with the item - *"During the past 12 months, did you ever seriously consider attempting suicide?"*[25], where the responses included 'Yes' (coded as 1) or 'No' (coded as 0). While self-harm was measured by the following question – *"Have you ever deliberately done something to yourself to cause harm or injury, without intending to end your own life?"* [26], coded 1 for 'Yes' and 0 for 'No'. Note that only children 12–17-year-olds (self-report) answered the questions related to suicidality and self-harm, where all responses were kept private and not exchanged with parents who consented.

Independent variables were categorized into two domains: risk factors and protective factors, comprising identified correlates of suicidality and self-harm in children and adolescents (Table 1). Measures reflected items typically used in previous population-based studies involving children and adolescents [14,23].

Sociodemographic covariates included age (continuous variable in years), gender (Boys/Girls), ethnicity (Australian/Overseas), area of residence (Cities/Regional and remote), household income (Low/Medium/High), family type (Original/Others).

Analysis

Initially, bivariate analysis was conducted to examine the predictor variables and their distributions over the variables of interest (suicidality and self-harm among bullying victims – traditional and cyber). Pearson's chi-square test signified the strength of bivariate associations and guided which variables are needed to be included in the later regression models. Binary logistic regressions were carried out separately for risk factors and protective factors related to suicidality and self-harm for each of the bullying groups. Demographic factors associated with suicidality and self-harm among bullying victims in the bivariate analysis with $p<0.05$ were adjusted in all logit models. Adjusted odds ratio (AOR) was calculated, and the significance level was set at $p<0.05$.

The assumptions of logistic regressions were assessed by Goodness-of-fit of the model using the Hosmer-Lemeshow test [27], and the variance inflation factor (VIF) test [28] was used to detect the multicollinearity among the predictor variables. In addition, Link test [29] was performed for testing the specification of each logit model. Finally, the receiver operating characteristic (ROC) curve was utilized to verify the predictive power of the fitted models [30]. All analyses were performed using the Stata software version 14.1.

Table 1 Risk and Protective factors

Variable	Description of variables
Risk factors	
Parental distress	Level of psychological distress of the parents was assessed using the 10-item Kessler Psychological Distress Scale and then scores were categorized - (low/moderate/high/very high)
Stressful family events	Anyone in the family experienced any type of life-stress events in the past 12 months - (Yes/No)
Family functioning	The functioning of the families was categorized based on family relationship, breakup and/or separation - (Good/Poor)
Family substance use	History of smoking and/or drinking alcohol by parents - (Yes/No)
Substance use	Smoking, drinking alcohol, using cannabis or other non-prescribed drugs by Child - (Yes/No)
Mental disorder	Presence of any of the following mental illnesses in a Child - ADHD or Major depressive disorder or Anxiety disorder or Conduct disorder - (Yes/No)
Psychosis	Presence of any psychotic symptoms such as hallucinations, or delusions and disturbing thoughts - (Yes/No)
Addictive to Internet/e-games	Addictive internet, social media and electronic gaming behaviour were defined when a Child found to be reported at least four of the five individual indicators. Combining all the responses the variable was dichotomized into - (Yes/No).
Eating disorder	Whether the Child reported having any eating disorder such as anorexia nervosa or bulimia? - (Yes/No)
Sexual activity	Whether the Child had sexual intercourse? - (Yes/No)
Protective factors	
Self-esteem	Overall, how to feel good about the abilities compared to others (e.g., at school, playing sports or socially) - (Low/High)
Social support	How a child gets along with people, friends, parents - (Yes/No)
School connectedness	How children feel about going to school? - (Low/High)
Academic performance	Performance a child in Math, English, Science, Arts and Sports compared with other students in the class - (Below Avg./Above Avg.)
Sleep	How many hours of sleep does the child get on a school/ workday night (3-7 hours/8-12 hours)

Results

Data on bullying victimization were provided by 2125 children in Table 2, with 25.6% (n=543) reported traditional bullying and 12.0% (n=256) experiencing cyberbullying victimization. The prevalence of suicidality and self-harm were respectively 22.3% (n=121) and 21.6% (n=117) among traditional bullying victims. While 34.4% (n=88) and 32.8% (n=84) reported suicidality and self-harm in cyberbullying victims, respectively.

Table 2 Predictors (demographic, risk, and protective factors) of Suicidality and Self-harm in two bullying victim groups: Bivariate analysis

Variables	Traditional bullying (n=543, 25.6%)		Cyberbullying (n=256, 12.1%)	
	Suicidality	Self-harm	Suicidality	Self-harm
	n (%)	n (%)	n (%)	n (%)
Total	121 (22.3)	117 (21.6)	88 (34.4)	84 (32.8)
Demographics				
Age				
14 to ≤15	35 (28.9)	36 (30.8)	27 (30.7)	26 (30.9)
>15 to 17	86 (71.1)	81 (69.2)	61 (69.3)	58 (69.1)
p-value	0.020	0.071	0.205	0.245
Gender				
Boys	35 (28.9)	26 (22.2)	19 (21.6)	17 (20.2)
Girls	86 (71.1)	91 (77.8)	69 (78.4)	67 (79.8)
p-value	<0.001	<0.001	0.001	<0.001
Country of birth				
Australia	104 (85.9)	99 (84.6)	77 (87.5)	73 (86.9)
Overseas	17 (14.1)	18 (15.4)	11 (12.5)	11 (13.1)
p-value	0.825	0.487	0.890	0.735
Area of residence				
Cities	72 (59.5)	74 (63.3)	50 (56.8)	51 (60.7)
Regional/Remote	49 (40.5)	43 (36.8)	38 (43.2)	33 (39.3)
p-value	0.818	0.478	0.080	0.435
Household income[a]				
Low	34 (28.1)	34 (29.1)	26 (29.6)	25 (29.8)
Medium	63 (52.1)	56 (47.8)	45 (51.1)	37 (44.1)
High	24 (19.8)	27 (23.1)	17 (19.3)	22 (26.2)
p-value	0.160	0.419	0.148	0.506
Family type[b]				
Original	60 (49.6)	52 (44.4)	44 (50.0)	38 (45.2)
Step/Blended/Others	61 (50.4)	65 (55.6)	44 (50.0)	46 (54.8)
p-value	0.441	0.044	0.651	0.530
Risk factors				
Parental psychological distress				
Low	6 (4.9)	5 (4.3)	3 (3.4)	3 (3.6)
Moderate	13 (10.7)	14 (11.9)	10 (11.4)	12 (14.3)
High	36 (29.7)	36 (30.8)	23 (26.1)	19 (22.6)
Very high	66 (54.7)	62 (53.0)	52 (59.1)	50 (59.5)
p-value	<0.001	<0.001	<0.001	<0.001
Stressful life events for family				
Yes	78 (64.5)	80 (68.4)	57 (64.8)	59 (70.2)
No	43 (35.5)	37 (31.6)	31 (35.2)	25 (29.8)
p-value	0.738	0.187	0.428	0.587
Family functioning				
Good	90 (74.4)	92 (78.6)	65 (73.9)	61 (72.6)
Poor	31 (25.6)	25 (21.4)	23 (26.1)	23 (27.4)
p-value	0.040	0.492	0.152	0.085
Family substance use				
Yes	46 (38.0)	55 (47.0)	33 (37.5)	34 (40.5)
No	75 (62.0)	62 (53.)	55 (62.5)	50 (59.5)
p-value	0.362	0.182	0.644	0.815
Substance use in Child				
Yes	99 (81.8)	96 (82.1)	74 (84.1)	72 (85.7)
No	22 (18.2)	21 (17.9)	14 (15.9)	12 (14.3)

Variables	Traditional bullying (n=543, 25.6%)		Cyberbullying (n=256, 12.1%)	
	Suicidality	Self-harm	Suicidality	Self-harm
	n (%)	n (%)	n (%)	n (%)
p-value	<0.001	<0.001	<0.001	<0.001
Mental disorder in Child				
Yes	92 (76.0)	88 (75.2)	69 (78.4)	66 (78.6)
No	29 (24.0)	29 (24.8)	19 (21.6)	18 (21.4)
p-value	<0.001	<0.001	<0.001	<0.001
Psychosis in Child				
Yes	76 (62.8)	81 (69.2)	55 (62.5)	56 (66.7)
No	45 (37.2)	36 (30.8)	33 (37.5)	28 (33.3)
p-value	<0.001	<0.001	0.001	<0.001
Addictive to Internet and e-games				
Yes	16 (13.2)	17 (14.5)	12 (13.6)	15 (17.9)
No	105 (86.8)	100 (85.5)	76 (86.4)	69 (82.1)
p-value	0.067	0.019	0.490	0.033
Eating disorder				
Yes	47 (38.8)	41 (35.0)	34 (38.6)	31 (36.9)
No	74 (61.2)	76 (65.0)	54 (61.6)	53 (63.1)
p-value	<0.001	<0.001	<0.001	0.001
Sexual activity				
Yes	57 (47.1)	55 (47.0)	47 (53.4)	48 (57.1)
No	64 (52.9)	62 (63.0)	41 (46.6)	36 (42.9)
p-value	<0.001	<0.001	<0.001	<0.001
Protective factors				
Self-esteem				
Low	84 (69.4)	87 (74.4)	61 (69.3)	63 (75.0)
High	37 (30.6)	30 (25.6)	27 (30.7)	21 (25.0)
p-value	<0.001	<0.001	0.085	0.003
Positive mental health and resilience				
Yes	112 (92.6)	108 (92.3)	80 (90.9)	77 (91.7)
No	9 (7.4)	9 (7.7)	8 (9.1)	7 (8.3)
p-value	<0.001	<0.001	0.006	0.026
School connectedness				
Low	79 (65.3)	82 (70.1)	54 (61.4)	60 (71.4)
High	42 (34.7)	35 (29.9)	34 (38.6)	24 (28.6)
p-value	0.001	<0.001	0.458	0.003
Sleep				
<8 hours	86 (71.1)	87 (74.4)	61 (69.3)	61 (72.6)
8-12 hours	35 (28.9)	30 (25.6)	27 (30.7)	23 (27.4)
p-value	<0.001	<0.001	0.003	<0.001

Note:
[a]Household income: Low (<$52000), Medium ($52000-$129999) and High (>$130000)
[b]Family type: original families mean children are natural, adopted, or foster child of both parents, and no stepchild; other families include step, blended and children from families who are not natural, adopted, foster or step of either parent.
Level of significance considered: p<0.001, p<0.01, p<0.05

Relationship of suicidality and self-harm in bullying victims (traditional and cyber) with demographic, potential risk, and protective factors

The bivariate analysis in Table 2 illustrates that children aged >15-17-years compared to other age-group were more likely to report suicidality and self-harm in both bullying victim groups. While the percentages of girls reported

suicidality (78%) and self-harm (80%) in cyberbullying victims were slightly higher than those in traditional bullying victims (suicidality: 71% and self-harm: 77%). Surprisingly, country of birth, area of residence, household income and family type did not have any differentiated significant impact on suicidality and self-harm in both bullying victim groups and hence did not considered in the logit models.

In addition, the bivariate analysis demonstrates that children who had a history of substance use, a mental disorder, parental psychological distress, and an experience of sexual activity reported higher percentages of suicidality and self-harm in cyberbullying victimization compared to traditional bullying with a p-value of <0.001 (Table 2). While the percentages of children with psychotic symptoms and eating disorder reported more suicidality and self-harm in traditional bullying victims than among cyberbullying victims.

Further, Table 2 shows that the percentages of children with positive mental health/resilience were slightly higher in reporting suicidality (93%, p<0.001) and self-harm (92%, p<0.001) among traditional bullying victims than in cyberbullying victims (suicidality: 90%, p=0.006; self-harm: 91%, p=0.026). While the proportions of high school connectedness and normal sleep hours/day were higher in reporting suicidality and self-harm in cyberbullying victims compared to traditional bullying victimization.

Table 3 Odds of risk factors associated with suicidality and self-harm among two bullying victim groups: Binary logit models.

Variables	Traditional bullying		Cyberbullying		VIF[3]
	Model 3a (Suicidality)	Model 3b (Self-harm)	Model 3c (Suicidality)	Model 3d (Self-harm)	
	OR[1] (95% CI[2])	OR (95% CI)	OR (95% CI)	OR (95% CI)	
Demographics					
Age (ref. 14 to ≤15)					1.17
>15 to 17	1.13 (0.63, 2.01)	1.12 (0.62, 2.04)	1.41 (0.66, 3.01)	1.35 (0.62, 2.92)	
Gender (ref. Boys)					1.07
Girls	1.34** (0.78, 2.27)	2.44** (1.40, 4.25)	1.74** (0.85, 3.57)	1.87** (0.89, 3.90)	
Risk factors					
Parental psychological distress (ref. Low)					1.54
Moderate	1.16 (0.41, 3.29)	1.43 (0.47, 4.31)	1.78 (0.42, 7.39)	2.03 (0.49, 8.30)	
High	3.12* (1.18, 8.24)	3.40* (1.20, 9.66)	3.73 (0.95, 14.57)	2.23 (0.55, 8.99)	
Very High	7.59*** (2.82, 20.39)	6.96*** (2.40, 20.13)	10.45** (2.64, 41.25)	7.41** (1.86, 29.49)	
Family functioning (ref. Good)					1.02
Poor	1.10 (0.59, 2.02)	0.69 (0.35, 1.31)	0.73 (0.31, 1.65)	0.96 (0.41, 2.22)	
Substance use in child (ref. No)					1.39
Yes	1.34 (0.71, 2.54)	1.49 (0.77, 2.89)	1.03 (0.43, 2.43)	0.98 (0.40, 2.38)	
Mental disorder in child (ref. No)					1.23
Yes	3.78*** (2.22, 6.42)	3.52*** (2.04, 6.07)	3.81*** (1.93, 7.54)	3.88*** (1.91, 7.85)	
Psychosis in child (ref. No)					1.21
Yes	1.70* (1.01, 2.85)	2.68*** (1.58, 4.55)	1.63 (0.82, 3.22)	2.29* (1.15, 4.55)	
Addictive to Internet and e-games (ref. No)					1.06
Yes	1.03 (0.47, 2.27)	1.37 (0.62, 3.03)	0.72 (0.27, 1.90)	1.47 (0.57, 3.86)	
Eating disorder (ref. No)					1.13
Yes	1.84* (1.05, 3.23)	1.27 (0.71, 2.27)	1.74 (0.82, 3.67)	1.30 (0.60, 2.79)	
Sexual activity (ref. No)					1.31
Yes	1.68 (0.94, 3.02)	1.57 (0.87, 2.84)	1.82 (0.87, 3.82)	2.42* (1.15, 5.10)	
Hosmer-Lemeshow statistic[4] (p-value)	0.738	0.257	0.531	0.110	
Link test[5] (OR for hat of the variable of prediction)	1.04***	0.89***	1.04***	1.00***	
Mean VIF (Max)					1.21 (1.54)

Notes: [1]OR = odds ratio; [2]CI = confidence interval. Level of significance considered: p<0.001***, p<0.01**, p<0.05*
[3]VIF (Variance Inflation Factor) = an indicator of measuring multicollinearity; as a rule of thumb, VIF >10 indicates high correlation and VIF around 1 indicates no such correlation and regression can be conducted.
[4]Hosmer-Lemeshow statistic (Goodness-of-fit test) = p-value of <0.05 indicates poor fit and p-value closer to 1 indicate a good logistic regression model fit.
[5]Link test (Model specification test) = hat of the variable of prediction for each model should be significant (p<0.05) to specify the model correctly

Risk factors associated with suicidality and self-harm in bullying victims (traditional and cyber)

The results of binary logistic regressions determining the risk factors of suicidality and self-harm with bullying (traditional and cyber) victimization are shown in Table 3. Children with very high parental psychological distress (OR 7.59, 95% CI=2.82-20.39), a mental disorder (OR 3.78, 95% CI=2.22-6.42), psychosis (OR 1.70, 95% CI=1.01-2.85) and eating disorder (OR 1.84, 95% CI=1.05-3.23) were more likely to experience suicidality in traditional bullying victims compared to their counterparts (Model 3a, Table 3). While presence of a mental disorder and parental psychological distress in children were respectively 3.81 times and 10.45 times more likely to report suicidality in cyberbullying victims (Model 3c, Table 3). Similarly, Model 3b and Model 3d in Table 3 shows the presence of parental psychological distress, mental disorder and psychosis in children is significantly associated with self-harm in both bullying victimizations. Girls were 2.44 times (95% CI=1.40-4.25) more likely to report self-harm than boys among traditional bullying victims, and in case of cyberbullying victims, children with sexual activity were 2.42 times (95% CI=1.15-5.10) more likely to self-harm than those who did not have any sexual experience.

Protective factors associated with suicidality and self-harm in bullying victims (traditional and cyber)

In Table 4, binary logit models were used to assess the association of protective factors with suicidality and self-harm in both bullying groups (traditional and cyber). Model 4a and Model 4c shows that children with lack of positive mental health/resilience (traditional bullying: OR 2.51, 95% CI=1.51-4.17 vs. cyberbullying: OR 2.73, 95% CI=1.42-5.76) were more likely to report suicidality compared to their counterparts. Children with <8 hours sleep/day (OR 1.91, 95% CI=1.18-3.06) were only found to significantly associated with suicidality in traditional bullying victims and not among the cyberbullying victims (Model 4a, Table 4). While Model 4b shows children with low self-esteem were 1.90 times (95% CI=1.15-3.13) more likely to experience self-harm only in traditional bullying victims (not in cyberbullying victims) than

Table 4 Odds of protective factors associated with suicidality and self-harm among two bullying victim groups: Binary logit models.

Variables	Traditional bullying		Cyberbullying		VIF[3]
	Model 4a (Suicidality)	Model 4b (Self-harm)	Model 4c (Suicidality)	Model 4d (Self-harm)	
	OR[1] (95% CI[2])	OR (95% CI)	OR (95% CI)	OR (95% CI)	
Demographics					
Age (ref. 14 to ≤15)					1.03
>15 to 17	1.39 (0.86, 2.22)	1.12 (0.68, 1.83)	1.34 (0.73, 2.43)	1.14 (0.61, 2.11)	
Gender (ref. Boys)					1.05
Girls	2.40*** (1.51, 3.81)	3.62*** (2.19, 5.99)	2.72** (1.46, 5.05)	2.90** (1.51, 5.54)	
Protective factors					
Self-esteem (ref. High)					1.24
Low	1.53 (0.95, 2.45)	1.90* (1.15, 3.13)	1.32 (0.73, 2.38)	1.79 (0.96, 3.33)	
Positive mental health and resilience (ref. Yes)					1.01
No	2.51*** (1.51, 4.17)	2.32** (1.37, 3.94)	2.73** (1.42, 5.26)	2.41* (1.22, 4.73)	
School connectedness (ref. High)					1.18
Low	1.26 (0.79, 2.00)	1.62 (0.99, 2.64)	0.85 (0.47, 1.53)	1.70 (0.92, 3.14)	
Sleep (ref. 8-12 hours/day)					1.21
<8 hours/day	1.91** (1.18, 3.06)	2.30** (1.39, 3.80)	1.78 (0.98, 3.21)	2.05* (1.10, 3.80)	
Hosmer-Lemeshow statistic[4] (p-value)	0.136	0.827	0.420	0.346	
Link test[5] (OR for hat of the variable of prediction)	1.00**	1.26***	1.39***	1.42***	
Mean VIF (Max)					1.12 (1.24)

Notes: [1]OR = odds ratio; [2]CI = confidence interval.
[3]VIF (Variance Inflation Factor) = an indicator of measuring multicollinearity; as a rule of thumb, VIF >10 indicates high correlation and VIF around 1 indicates no correlation and regression can be conducted.
[4]Hosmer-Lemeshow statistic (Goodness-of-fit test) = p-value of <0.05 indicates poor fit and p-value closer to 1 indicate a good logistic regression model fit.
[5]Link test (Model specification test) = hat of the variable of prediction for each model should be significant (p<0.05) to specify the model correctly.
Level of significance considered: p<0.001***, p<0.01**, p<0.05*

those with high self-esteem. Moreover, lack of positive mental health/resilience and inadequate sleep found to be significantly associated with self-harm in both traditional bullying and cyberbullying victims (Model 4b and Model 4d, Table 4).

Evaluating logit models

Table 3 and Table 4 shows the results obtained from several regression diagnostic tests to ensure precise estimation. For example, the VIF with mean 1.21 (Table 3) and 1.12 (Table 4) indicated no evidence of multicollinearity issue of the predictor variables. The Hosmer–Lemeshow statistics in Table 3 and Table 4 showed no significant difference exists between the model and observed data ($p>0.05$), indicates well-fitted models. In addition, Linktest confirmed that each model was properly specified. Lastly, the area under ROC curves confirmed the satisfactory predictive power of each model (Figure 1).

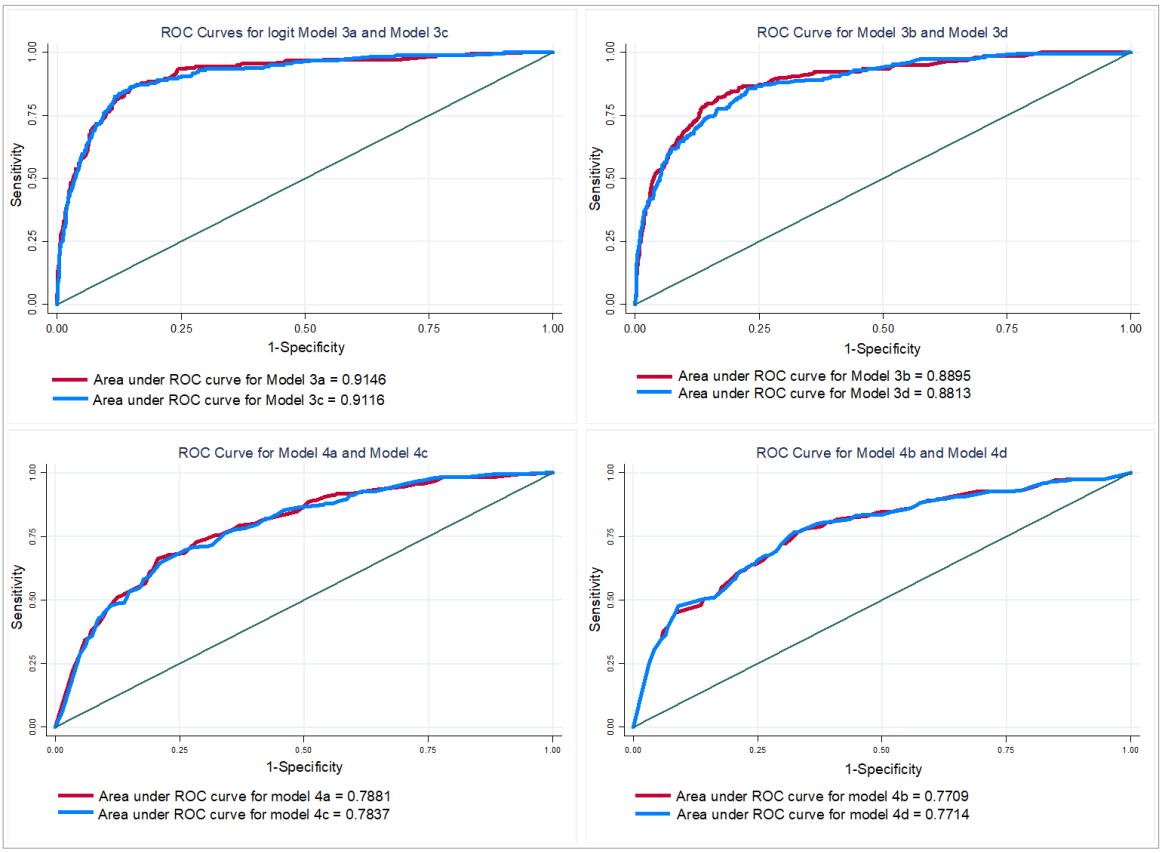


Figure 2 ROC Curves for model accuracy test

Discussion

The high prevalence of bullying (traditional and cyber) victims among a nationally representative sample of adolescents is troubling, particularly when previous studies[2,31-33] have demonstrated the strong associations between bullying victimization and health risk behaviours – suicidality and self-harm in adolescents. Consistent with past research findings [16], this study found that the

percentages of reporting suicidality and self-harm in both types of bullying victims were high. Like the previous studies [34,35], girls were more often traditionally or cyber bullied than boys, and girls were also more likely to report suicidality and self-harm than boys. It also added to existing research by depicting strong associations of risk and protective factors with suicidality and self-harm among Australian adolescents involved in traditional bullying and cyberbullying victimization.

In line with the results of previous studies conducted in the US [14] and China [16], several risk factors for suicidality and self-harm were identified in this study among bullying victims. For example, mental disorders (including depression and anxiety) were found to be the risk factors of suicidality and self-harm in victims of both bullying types, perhaps because mental health problems have a negative impact on an individual's life assessments [36] and subsequently may increase the risk of suicidality and self-harm [7,37]. This study also found that high to a very high level of parental distress was a risk factor for suicidality and self-harm in both types of bullying victims; while other researchers [38,39] typically identified parent and family connectedness and social relationships as risk factors for adolescents' suicidality and self-harm. Furthermore, it has been found that children who had eating disorders (in traditional bullying victims) and a history of sexual activity (in cyberbullying victims) were more likely to be respectively involved in suicidality and self-harm. Studies [39,40] suggested that individuals with eating disorders may confront social stigmatization and discrimination, which could cause depression in the victim and consequently increase the risk of suicidality and self-harm. Surprisingly, the results reported that a history of substance use among bullying victims (traditional and cyber) were not significantly associated with suicidality and self-harm. Though evidences indicated that bullying victims may use substances to deal with unpleasant emotions and then if their self-control was overwhelmed by a provocation caused by substance use, victims can be presented with suicidal and self-harming behavior[16,41]. Moreover, this study suggested that the addiction to the internet and/or electronic games was not a risk factor for suicidality or self-

harm in bullying victims, which was inconsistent with the previous research finding[7].

The current research also revealed that positive mental health and resilience was significantly associated with a reduced risk of suicidality and self-harm in both types of bullying victims, and this was corroborated by the previous studies[16], perhaps because adolescents tend to spend more time with friends and increasingly rely on support from friends at this age[42]. Moreover, although previous meta-analyses[22,43] reported mixed results, this study found that adequate sleep (8-12 hours/day) was positively related with the reduced risk of suicidality and self-harm in bullying victims. One possible explanation is that insufficient sleep may play a role in impairing social connectedness and may subsequently increase depression in an individual and may lead to suicidality and self-harm[22]. Further, high level of self-esteem was found to be significantly associated with self-harm only in traditional bullying victims. While previous research suggested that self-esteem should be promoted and included in the preventive approaches for both suicidality and self-harm in both bullying victims[16,39]. Interestingly, the results did not find any significant association of school connectedness with suicidality and/or self-harm in any bullying victim groups, although a recent study conducted in the US reported that low school connectedness are a potential risk factor for bullying victimization[42,44].

Although the current study utilized a nationwide survey, providing converging evidence for risk and protective factors of suicidality and self-harm in bullying victims (traditional and cyber), the study has some limitations. This cross-sectional data was restricted to 2125 children aged between 14- to 17-year-olds, and data were collected in the year between 2013-14; thus, caution should be exercised before generalizing these results in later years to other age groups (e.g., adults) and for the entire country of Australia. A further limitation of this study was the fact that the information related to bullying and health-risk behaviours (suicidality, self-harm) were self-reported, which always may carry the risk of the response or social desirability bias. This limitation was acceptable because information related to bullying and health-risk behaviours were sensitive and obtained privately from children without disclosing the answers to the

consenting parents. Further, the cross-sectional study design made it impossible to draw causal inferences or conclusions about the temporal relationship among study variables. Therefore, a longitudinal assessment of risk and protective factors associated with suicidality and self-harm should be considered among bullying victims.

Given the magnitude and negative consequences of bullying victimization, better recognition, effective prevention and intervention are essential to prevent detrimental effects (including suicidality and self-harm) in adolescents' mental health, and to promote resilience among adolescents in order to reduce the burden of death by suicide, which is an important public health concern both in Australia and around the world [6,10,15,45]. The study findings regarding risk factors indicated that intervention programs should target both traditional bullying and cyberbullying victims demonstrating problematic behaviour in efforts to prevent suicidality and self-harm. This study also detected some important protective factors, which should be reinforced and fostered by practitioners and policymakers to reduce suicidal and self-harming behaviour in both traditionally bullied and cyberbullied adolescents. Moreover, the present study indicated that further research is warranted on the longitudinal associations between bullying victimization and identified risk and/or protective factors in adolescents.

Conclusion

A significant number of traditionally bullied and cyberbullied adolescents reported suicidality and self-harm, demonstrating the importance of health-risk behaviours in bullying victims. Further, the results supported the belief that the risk of suicidality and self-harm should be monitored among adolescents being bullied. The risk and protective factors of suicidality and self-harm identified in the present study should be considered for the promotion of effective suicide and self-harm prevention and intervention programs in adolescent bullying victims.

SO WHAT?

What is Already known on this Topic?

Evidence has shown that traditional bullying is associated with behavioural and mental health problems including suicidality and self-harm. However, studies

identifying and comparing the role of important risk/protective factors on suicidality and self-harm in both traditional bullying victims and cyberbullying victims among adolescents are lacking.

What does this Article Add?

The main strength of the study is that it provides nationwide survey estimates considering both traditional bullying and cyberbullying victimization among adolescents. In addition, the current study not only identifies but also compares different impacts of risk/protective factors on suicidality and self-harm between traditional bullying and cyberbullying victims among adolescents, which has not done in previous studies.

What are the Implications for Health Promotion Practice or Research?

As shown by this study, children with mental disorder, psychosis and parental psychological distress are important risk factors for suicidality and self-harm in traditional bullying victims as well as in cyberbullying victims. To promote health and reduce suicidal/self-harming behaviour, policies and strategies need to incorporate the early identification and reduction of mental disorder, psychosis, and parental psychological distress in bullying victim (both traditional and cyber) adolescents into mental health promotion programs. In addition, school-based policies, such as early screening for bullying victims to provide mental health education (to increase self-esteem and resilience) can be integrated in the health promotion strategies to decrease the negative consequences such as suicidality and self-harm, and ultimately suicide in children and adolescents.

References

1 Kowalski, R. M. & Limber, S. P. Psychological, physical, and academic correlates of cyberbullying and traditional bullying. *Journal of Adolescent Health* **53**, S13-S20 (2013).

2 Demmrich, S. & Akgül, S. Bullying experience among adolescents with a Turkish migration background in Germany: ethnic class composition, integration, and religiosity as protective factors? *International journal of environmental research and public health* **17**, 4776 (2020).

3 Del Rey, R., Elipe, P. & Ortega-Ruiz, R. Bullying and cyberbullying: Overlapping and predictive value of the co-occurrence. *Psicothema* **24**, 608-613 (2012).

4 Khamis, V. Bullying among school-age children in the greater Beirut area: Risk and protective factors. *Child abuse & neglect* **39**, 137-146 (2015).

5 Kowalski, R. M., Giumetti, G. W., Schroeder, A. N. & Lattanner, M. R. Bullying in the digital age: A critical review and meta-analysis of cyberbullying research among youth. *Psychological bulletin* **140**, 1073 (2014).

6 Quintana-Orts, C. & Rey, L. Traditional bullying, cyberbullying and mental health in early adolescents: Forgiveness as a protective factor of peer victimisation. *International journal of environmental research and public health* **15**, 2389 (2018).

7 Merrill, R. M. & Hanson, C. L. Risk and protective factors associated with being bullied on school property compared with cyberbullied. *BMC public health* **16**, 145 (2016).

8 Waasdorp, T. E. & Bradshaw, C. P. The overlap between cyberbullying and traditional bullying. *Journal of Adolescent Health* **56**, 483-488 (2015).

9 Biswas, T. *et al.* Global variation in the prevalence of bullying victimisation amongst adolescents: Role of peer and parental supports. *EClinicalMedicine*, 100276 (2020).

10 Jadambaa, A. *et al.* Prevalence of traditional bullying and cyberbullying among children and adolescents in Australia: A systematic review and

meta-analysis. *Australian & New Zealand Journal of Psychiatry*, 0004867419846393 (2019).

11 Thomas, H. J. *et al.* Association of different forms of bullying victimisation with adolescents' psychological distress and reduced emotional wellbeing. *Australian & New Zealand Journal of Psychiatry* **50**, 371-379 (2016).

12 Thomas, H. J. *et al.* Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. *Australian & New Zealand Journal of Psychiatry* **51**, 909-920 (2017).

13 Bond, L., Carlin, J. B., Thomas, L., Rubin, K. & Patton, G. Does bullying cause emotional problems? A prospective study of young teenagers. *Bmj* **323**, 480-484 (2001).

14 Borowsky, I. W., Taliaferro, L. A. & McMorris, B. J. Suicidal thinking and behavior among youth involved in verbal and social bullying: Risk and protective factors. *Journal of adolescent health* **53**, S4-S12 (2013).

15 Ford, R., King, T., Priest, N. & Kavanagh, A. Bullying and mental health and suicidal behaviour among 14-to 15-year-olds in a representative sample of Australian children. *Australian & New Zealand Journal of Psychiatry* **51**, 897-908 (2017).

16 Yen, C.-F., Liu, T.-L., Yang, P. & Hu, H.-F. Risk and protective factors of suicidal ideation and attempt among adolescents with different types of school bullying involvement. *Archives of Suicide Research* **19**, 435-452 (2015).

17 Espelage, D. L. & Holt, M. K. Suicidal ideation and school bullying experiences after controlling for depression and delinquency. *Journal of Adolescent Health* **53**, S27-S31 (2013).

18 Carballo, J. *et al.* Psychosocial risk factors for suicidality in children and adolescents. *European child & adolescent psychiatry*, 1-18 (2019).

19 Mars, B. *et al.* Differences in risk factors for self-harm with and without suicidal intent: findings from the ALSPAC cohort. *Journal of affective disorders* **168**, 407-414 (2014).

20 Hawton, K., Saunders, K. E. & O'Connor, R. C. Self-harm and suicide in adolescents. *The Lancet* **379**, 2373-2382 (2012).

21 Portzky, G., van Heeringen, K. & Vervaet, M. Attempted suicide in patients with eating disorders. *Crisis* (2014).

22 Mars, B. *et al.* Predictors of future suicide attempt among adolescents with suicidal thoughts or non-suicidal self-harm: a population-based birth cohort study. *The Lancet Psychiatry* **6**, 327-337 (2019).

23 Hafekost, J. *et al.* Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry* **50**, 866-875 (2016).

24 Lawrence, D. *et al.* Key findings from the second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry* **50**, 876-886 (2016).

25 Zubrick, S. R. *et al.* Suicidal behaviours: prevalence estimates from the second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry* **50**, 899-910 (2016).

26 Zubrick, S. R. *et al.* Self-harm: prevalence estimates from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. *Australian & New Zealand Journal of Psychiatry* **50**, 911-921 (2016).

27 Hosmer Jr, D. W., Lemeshow, S. & Sturdivant, R. X. *Applied logistic regression*. Vol. 398 (John Wiley & Sons, 2013).

28 Murray, L., Nguyen, H., Lee, Y.-F., Remmenga, M. D. & Smith, D. W. Variance inflation factors in regression models with dummy variables. (2012).

29 Jones, A. M. Models for health care. *University of York., Centre for Health Economics* (2010).

30 Seshan, V. E., Gönen, M. & Begg, C. B. Comparing ROC curves derived from regression models. *Statistics in medicine* **32**, 1483-1493 (2013).

31 Alavi, N., Roberts, N., Sutton, C., Axas, N. & Repetti, L. Bullying victimization (being bullied) among adolescents referred for urgent psychiatric consultation: prevalence and association with suicidality. *The Canadian Journal of Psychiatry* **60**, 427-431 (2015).

32 Bannink, R., Broeren, S., van de Looij–Jansen, P. M., de Waart, F. G. & Raat, H. Cyber and traditional bullying victimization as a risk factor for mental health problems and suicidal ideation in adolescents. *PloS one* **9**, e94026 (2014).

33 Chou, W.-J., Wang, P.-W., Hsiao, R. C., Hu, H.-F. & Yen, C.-F. Role of school bullying involvement in depression, anxiety, suicidality, and low self-esteem among adolescents with high-functioning autism spectrum disorder. *Frontiers in psychiatry* **11**, 9 (2020).

34 Pontes, N. M., Ayres, C. G., Lewandowski, C. & Pontes, M. C. Trends in bullying victimization by gender among US high school students. *Research in Nursing & Health* **41**, 243-251 (2018).

35 Pontes, N. M., Ayres, C. G. & Pontes, M. C. Additive interactions between gender and bullying victimization on depressive symptoms and suicidality: youth risk behavior survey 2011–2015. *Nursing research* **67**, 430-438 (2018).

36 Forsyth, C. J., Biggar Jr, R. W. & Chen, J. Bullied youth: suicide attempts, planning, ideation, and pre-ideation. *Criminal Justice Studies* **33**, 170-177 (2020).

37 Henry, K. L. *et al.* The potential role of meaning in life in the relationship between bullying victimization and suicidal ideation. *Journal of youth and adolescence* **43**, 221-232 (2014).

38 McMahon, E. M., Reulbach, U., Keeley, H., Perry, I. J. & Arensman, E. Reprint of: Bullying victimisation, self harm and associated factors in Irish adolescent boys. *Social science & medicine* **74**, 490-497 (2012).

39 Brausch, A. M. & Gutierrez, P. M. Differences in non-suicidal self-injury and suicide attempts in adolescents. *Journal of youth and adolescence* **39**, 233-242 (2010).

40 Hawker, D. S. & Boulton, M. J. Twenty years' research on peer victimization and psychosocial maladjustment: A meta-analytic review of cross-sectional studies. *The Journal of Child Psychology and Psychiatry and Allied Disciplines* **41**, 441-455 (2000).

41 Litwiller, B. J. & Brausch, A. M. Cyber bullying and physical bullying in adolescent suicide: the role of violent behavior and substance use. *Journal of youth and adolescence* **42**, 675-684 (2013).

42 Vidourek, R. A. & King, K. A. Risk factors for peer victimization among middle and high school students. *Children* **6**, 11 (2019).

43 Harris, L. M., Huang, X., Linthicum, K. P., Bryen, C. P. & Ribeiro, J. D. Sleep disturbances as risk factors for suicidal thoughts and behaviours: a meta-analysis of longitudinal studies. *Scientific reports* **10**, 1-11 (2020).

44 Taliaferro, L. A. & Muehlenkamp, J. J. Risk and protective factors that distinguish adolescents who attempt suicide from those who only consider suicide in the past year. *Suicide and Life-Threatening Behavior* **44**, 6-22 (2014).

45 Hemphill, S. A., Kotevski, A. & Heerde, J. A. Longitudinal associations between cyber-bullying perpetration and victimization and problem behavior and mental health problems in young Australians. *International journal of public health* **60**, 227-237 (2015).

2.2 Study 2 - Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data (Published in the Psychiatry Research Journal, Q1, IF: 2.474, SNIP: 0.968, Publisher - Elsevier)

Psychiatry Research 292 (2020) 113364

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data

Md. Irteja Islam[a,b,*], Rasheda Khanam[a], Enamul Kabir[a]

[a] Centre for Health Research and School of Commerce, University of Southern Queensland, West Street, Darling Heights, Toowoomba, Queensland 4350, Australia
[b] Maternal and Child Health Division, International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), 68, Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh

ARTICLE INFO

Keywords:
Traditional bullying
Cyberbullying
Mental disorder
Major depressive disorder
ADHD
Conduct disorder
Anxiety disorder
Suicidality
Self-harm
Schoolchildren

ABSTRACT

The effects of bullying on mental health among adolescents are of major public health concern, especially following modern bullying methods that technologically victimize adolescents. However, the independent effects of different forms of bullying (traditional, cyberbullying or both) on different types of mental disorders, suicidality and self-harm are not clear. Using a cross-sectional study design, involving 2166 Australian high schoolchildren (1131 Boys and 1035 Girls) aged 12-17 years, this study examined the associations of bullying victimization (traditional, cyber and both) with mental disorders, suicidality (ideation, plan and attempt) and self-harm. Both bivariate and multivariate analyses were employed to assess the associations. Victims of traditional bullying and cyberbullying incurred a significantly higher risk of major depressive disorder, suicidality and self-harm compared to those who had not encountered such threats. Findings also indicated the need for early identification of bullying victims to prevent the risk of mental disorders, suicidality and self-harm in schoolchildren. Furthermore, this evidence can be utilized to inform decisions regarding the provision of resources to address this important health issue in the context of any developed countries like Australia.

1. Introduction

The mental health among young people continues to be an important public health issue worldwide and in Australia (Islam et al., 2020; Vu et al., 2018) and has a significant contribution to the burden of disease globally (Kinchin and Doran, 2018; Patton et al., 2016). There is also evidence that mental health problems cover a spectrum of illnesses including mental disorders, suicidality and self-harm, which may differ in intensity and duration, and may occur occasionally and might have adverse effects on the quality of life (AIHW, 2019b; Vu et al., 2018).

The most recent estimates in Australia showed that one in 7 children (approximately 14%) aged between 4-17 years diagnosed with one or more mental disorders in the past-12 months (AIHW, 2019b; Vu et al., 2018). The highest proportion of children who had attention deficit hyperactivity disorder (ADHD) was 7.4% followed by anxiety disorders (6.9%), major depressive disorder (2.8%) and conduct disorder (2.1%); altogether constitutes about 12.1% of the global burden of disease (GBD) in Australia (AIHW, 2019b; Vu et al., 2018). Suicidality (ideation, plan, attempt and suicide itself) and self-harm also has significant contribution to the disease burden in Australia and are considered as the leading causes of death among Australian aged 15-24 years (AIHW, 2019a; Kinchin and Doran, 2018). In Australia, the 12-months prevalence of suicidal ideation, suicide plan, suicide attempt and non-suicidal self-harm in 12-to-17-year-old schoolchildren was most recently estimated to be 7.5%, 5.2%, 2.4% and 8%, respectively (Islam et al., 2020; Zubrick et al., 2016). Since the rates of mental disorders, suicidality and self-harm have not changed significantly in the 5-years from 2014-2018 (ABS, 2019), these alarming statistics therefore add to the urgent need for research data to identify the determinants of mental disorders, suicidality and self-harm among this population. One of many possible determinants of mental disorders, suicidality and self-harming behaviour among adolescents is thought to be bullying victimization (Ford et al., 2017; Hinduja and Patchin, 2010).

Bullying – acts of aggression that are intentional, repetitive and involve a power imbalance between a victim and a perpetrator (Kowalski and Limber, 2013; Olweus, 2013) – is now recognized as a serious issue among schoolchildren in developed countries including Australia (Baier et al., 2019; Kowalski and Limber, 2013). Bullying may be physical (e.g. assaults, theft), verbal (e.g. insults, threats) or relational (e.g. spreading rumors, social exclusion). However, a

* Corresponding Author.
E-mail addresses: irteja.islam@icddrb.org, mdirteja.islam@usq.edu.au (Md. I. Islam).

https://doi.org/10.1016/j.psychres.2020.113364
Received 16 February 2020; Received in revised form 27 July 2020; Accepted 2 August 2020
Available online 03 August 2020
0165-1781/ © 2020 Elsevier B.V. All rights reserved.

phenomenon recently termed cyberbullying has emerged with the advent of electronic forms of contact (e.g. social networking, text messaging) via the augmented use of mobile phones and the internet (Bannink et al., 2014; Ortega et al., 2012). That is, cyberbullying offers the perpetrator the advantage of not needing any face-to-face interaction and as such, it is thought to be more pervasive than traditional bullying (Sampasa-Kanyinga et al., 2014). Despite the efforts made by schools to control bullying, it continues to be prevalent around the world (Perren et al., 2010; Sampasa-Kanyinga et al., 2014). Studies conducted in Canada and Netherlands have indicated that about 10%-30% of schoolchildren are commonly involved in bullying as victims, perpetrators or both (Alavi et al., 2015; Klomek et al., 2010). In Australia, current estimates have shown that at least one in four schoolchildren have experienced bullying victimization within the past 12-months (Ford et al., 2017). A recent survey conducted in Victoria, Australia also reported that 11% of children experienced verbal bullying, 31% physical bullying and about 14%-18% experienced relational bullying (Ford et al., 2017; Thomas et al., 2016).

It is vital to investigate all forms of bullying simultaneously since the numbers of bullying victims are increasing and the detrimental effects of bullying on victims are of great concern (Sampasa-Kanyinga et al., 2014). Evidence suggests that bullying victimization precedes further negative impacts of mental health problems among schoolchildren which may lead to highly negative mental health consequences in adulthood (Jadambaa et al., 2020; Perren et al., 2010). Existing literature also indicates that bullying victims have often been found to be associated with internalizing symptoms - low self-esteem, depression and anxiety (Jadambaa et al., 2020; Perren et al., 2010). Several studies have shown an association between traditional bullying victimization and mental health problems (e.g. depression, self-harm) in high schoolchildren (Ford et al., 2017; John et al., 2018; Messias et al., 2014). However, research examining the effect of cyberbullying victimization on psychological outcomes is in its infancy, (Messias et al., 2014; Sampasa-Kanyinga et al., 2014). While some authors suggests that the consequences of the cyberbullying tend to be similar to traditional bullying, others think that cyberbullying may be associated with more distressing symptoms than traditional bullying (Ortega et al., 2012; Perren et al., 2010). In addition, studies have demonstrated that cyberbullying victims, who are often schoolchildren are not only found to be reporting higher level of stress symptoms but are also engaged in different types of problematic behaviour such as substance use and poor school performance (Cross et al., 2009; Perren et al., 2010). However, to resolve this debate recently an emerging body of research has begun to establish a link between cyberbullying and mental disorders, and cyberbullying and suicidality and self-harm among schoolchildren (Klomek et al., 2010; Sampasa-Kanyinga et al., 2014). Moreover, traditional bullying and cyberbullying often co-occur within same individual, though the extent of overlapping of these bullying are not well understood (Del Rey et al., 2012; Slonje and Smith, 2008). For example, Waasdorp and Bradshaw (2015) reported high level of overlap between traditional and cyber bullying; while other study found significant overlapping only among boys (Baldry et al., 2017), which needs to be investigated.

Evidences mostly from the international literatures, has documented the association of bullying victimization with depression and bullying victimization with suicidality (Bauman et al., 2013; Sampasa-Kanyinga et al., 2014). However, none of them have included both types of bullying (traditional bullying and cyberbullying), self-harm and other mental health disorders such as attention-deficit-hyperactivity-disorder (ADHD), conduct disorder, social phobia, separation anxiety disorder, generalized anxiety disorder or obsessive-compulsive disorder involving high schoolchildren in their analysis. Moreover, their analysis was not adjusted for potential covariates reported in the previous studies to be linked with bullying victimization and/or mental disorders and/or suicidality/self-harm such as family characteristics and conflicts (Abd Razak et al., 2019; Klomek et al., 2010), substance use (Jadambaa et al., 2020; Litwiller and Brausch, 2013), sedentary activities (internet use and playing electronic games) (Hinduja and Patchin, 2008; Messias et al., 2011). In Australia, the majority of the studies have been state-wide, focused on single types of bullying or risk-factors or psychological problems (Hemphill et al., 2015; Jadambaa et al., 2019). Moreover, to the best of our knowledge, only one study (Ford et al., 2017) provided population-based estimates of the association between bullying and mental health problems and suicidality among Australian aged 14-15 years. However, the authors only investigated the association by traditional bullying and did not consider cyberbullying, which is currently thought to be more prevalent among high schoolchildren. In addition, researchers only include depression and anxiety disorder in their analysis and did not include ADHD and conduct disorder, which might be associated with bullying. Thus, the independent effects (direct or indirect pathways) of different forms of bullying (traditional, cyberbullying or both bullying) on different mental disorders, suicidality and self-harm in relation to other potential covariates are not clear. This lack of clarity calls for an urgent need of understanding the interplay among bullying victimization, mental disorder and suicidality and self-harm from a policy perspective to help prevent the risk of mental disorders, suicide and self-harm among high schoolchildren.

This paper therefore aimed to examine the association of bullying victimization (traditional bullying, cyberbullying or both) with mental disorders (major depressive disorder, ADHD, conduct disorder and anxiety disorder), suicidality (ideation, plans and attempts) and self-harm among schoolchildren aged 12-17 years in Australia. We predicted that there may be higher likelihood of mental disorders, suicidality and self-harm among all forms of bullying victims (traditional, cyberbullying and both bullying), while controlling for sociodemographic covariates.

2. Methods

2.1. Data source

Cross-sectional data were analyzed from Young Minds Matter (YMM): the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. The YMM was conducted in a partnership between The University of Western Australia (UWA), Roy Morgan Research and the Australian Government Department of Health (AGDH) in 2013-14 involving children aged 4-17 years in Australia. The survey was ethically approved by the Human Research Ethics Committees of the AGDH and UWA (Hafekost et al., 2016; Lawrence et al., 2016). When more than one eligible child lived in the household, the survey randomly included a single child. Out of the initial 76,606 households approached, a total of 6310 parents/caregivers (55% of eligible households) of children aged 4-17 years old were willingly involved in the survey and interviewed face-to-face to complete the questionnaire. Further, 2967 children (89% percent of eligible households) aged 11-17 years completed a computer-based self-reported questionnaire privately at home to provide information on health risk-behaviours, suicidality and service use.

A multi-stage, area-based sampling technique was employed for the survey. Overall, 225 Statistical Area-1 areas (as defined by Australian Bureau of Statistics) were selected on the basis of 2011 Census of Population and Housing (Hafekost et al., 2016; Lawrence et al., 2016). Then the areas were stratified across the states/territories and by the metropolitan versus non-metropolitan cities (rural/regional) to guarantee the proportional representation of geographic areas throughout the Australia. However, few samples from most remote areas, homeless children, children from institutional care and from any household where interviews were not carried out in English were excluded from the survey. Details of the methods have been described elsewhere (Hafekost et al., 2016).

2.2. Measures

2.2.1. Mental disorders (outcome variable)

In the survey, seven modules of the diagnostic interview schedule for children -version IV (DISC-IV) were included to identify the presence of mental disorders in the previous 12-months (APA, 2013; Fisher et al., 1993). The broad categories of mental disorders were: major depressive disorders, attention-deficit hyperactivity disorder (ADHD), conduct disorder and anxiety disorder (including social phobia, separation anxiety disorder, generalized anxiety disorder and obsessive-compulsive disorder (Zubrick et al., 2016). Response options for each mental disorder included 'Yes' (coded as 1) or 'No' (coded as 0), where each mental disorder is used as a specific category in the analysis.

2.2.2. Suicidality and self-harm (outcome variable)

Items measuring suicidality (suicidal ideation, plan and attempt) were collected from the Standard High School questionnaires of the Youth Risk Behavior Survey (CDC, 2014). Note that questions were only answered by the children aged 12-17 years (self-reported), where all answers were kept confidential and not shared with consenting parents (Zubrick et al., 2016). Suicidal ideation was assessed with the question: '*During the past 12 months, did you ever seriously consider attempting suicide?*' Among ideators, *suicidal plan and suicidal attempt* were assessed with two questions, respectively; *'During the past 12 months, did you make a plan about how you would attempt suicide?'; 'Did you attempt suicide during the past 12 months?'* Responses to these questions were used to classify suicidality into three groups: (I) plan among ideators, (II) attempt among ideators, and (III) plan and attempt among ideators. Regarding self-harm, the following question were asked: *'Have you ever deliberately done something to yourself to cause harm or injury, without intending to end your own life?'* All response options were coded 1 for 'Yes' and 0 for 'No'.

2.2.3. Bullying (independent variable)

In the survey (only child data), children were directly asked about traditional bullying and cyberbullying victimization in the past 12-months. All the questions were drawn from the Olweus Bully–Victim Questionnaire and from the Cyber Friendly Schools Project at the time based at Edith Cowan University, and were modified to incorporate cyberbullying and questions to the children regarding bullying victimization (Cross et al., 2016; Thomas et al., 2017). In the survey, traditional bullying is considered "when people tease, threaten, spread rumours about, hit, shove, or hurt other people over and over again" and cyberbullying is considered "when people use mobile phones or the internet to send nasty or threatening emails or messages, post mean or nasty comments or pictures on websites like Facebook, or have someone pretend to be them online to hurt other people over and over again". It was not bullying when two people of similar strength or power tease or debate or fight each other in a friendly manner.

Regarding traditional bullying and cyberbullying victimization following questions were directly asked to the participants: '*In the past 12 months, have you ever been bullied or cyberbullied?*' with the following types of bullying listed: *'Hit, kicked, or pushed around', 'Made fun of or teased in a mean and hurtful way', 'Lies, rumours or nasty stories were spread', 'Threatened or made afraid', 'Deliberately ignored, left out on purpose or not allowed to join in', 'Other young people stole things or from me, or broke or damaged my things deliberately', 'Teased about my race, the colour of my skin or my religion', ' Sent nasty messages by email, mobile phone, or on the internet', 'Nasty messages or pictures were sent about me to other young people via mobile phone, internet or email', and 'Nasty comments or pictures were sent or posted about me on websites (e.g. Facebook or Twitter)'.* All response options were coded 1 for 'Yes' and 0 for 'No'.

In the analysis, from the responses of the questions, traditional bullying (Yes/No) and cyberbullying (Yes/No) were dichotomized. A new variable was created as both bullying with children who experienced both traditional bullying and cyberbullying, responses included 'Yes' (coded as 1) and 'No' (coded as 0).

2.2.4. Sociodemographic covariates

Demographic variables included age, gender (Boys vs. Girls), country of birth (Australia vs. Overseas), remoteness (major cities vs. regional/remote), grade (Grade 7 to Grade 12) and substance use (Yes vs. No). Family characteristics included household income/year (more than $130000 as high, $52000-$129999 as medium and less than $52000 as low), family type (children from original parents vs. children from other families such as step and blended) and parents' education (bachelor, diploma and year-10/11). Age was dichotomized into 'below 15 years' versus 'more than 15 years'. A binary variable was created for substance uses by the child and were measured by the following questions: *'Have you ever tried cigarette smoking, even one or two puffs?'; 'Have you ever had at least one drink of alcohol, other than a few sips?'; 'Have you ever tried cannabis/marijuana' and 'Have you ever used illegal drugs, or sniffed petrol, glue, aerosol, paints, solvents or nitrous?'*

Sedentary activities were assessed by two items. In a typical day, how much time do you usually spend (I) using internet on the computer, mobile or tablet, including accessing social media such as Face book or Twitter, emailing, looking at websites or chatting online, (II) playing electronic games, such as Xbox or similar console, online, on a handheld device, computer, or mobile phone. For each item, participants were asked to provide an average number of hours and/or minutes spent per day. Two categories were generated including: '<3 hours/day' (coded as 0), '$\geq$ hours/day' (coded as 1).

2.3. Statistical analysis

This study uses the following conditions to conduct analyses on the samples (n = 2166) obtained after combining self-reported child data and parent data to achieve study objectives.

- The analysis was restricted to children aged 12-17 years to maintain age comparability across the survey. This is because suicidality and self-harm related information were only available from self-reported child data and were limited to the age group 12-17 years.
- The 'Don't know' and 'Prefer not to say' responses were omitted.

All analyses were conducted with STATA (version 14.1,) and 'svy' command was used to take account for of the YMM's multi-stage and complex stratified sampling design. Initially, descriptive statistics on sociodemographic and risk behaviour correlates were calculated and stratified by bullying victimization (traditional and cyber) status among children aged 12-17 years. The chi-square test signified the strength of the bivariate relationships between these characteristics and reports of bullying victimization. Then, bivariate and multivariate logit models were used to investigate the associations between traditional bullying and cyberbullying and the outcome variables (i.e. mental disorders, suicidality and self-harm). Potential confounders included in the analysis were age, gender, remoteness, parents' education, household income, family type, and sedentary activities on a typical day (e.g. internet use and playing electronic games) and substance use by the children. The strength of the associations of bullying victimization with mental disorders, suicidality and self-harm was estimated by means of odds ratios (OR) and 95% confidence intervals.

3. Results

Table 1 reports the distribution of family and individual characteristics for the whole sample and among traditional bullying and cyberbullying victims. Of the 2166 participants included in the analyses, mean age of children was 14.83 years (SD = 1.70); 52.2% were boys, more than 85% were Australian by birth, about two-thirds (64.4%) were from major cities and children in higher grades were

Table 1
Sample distribution (aged 12-17-years old)

Characteristics	Total	Traditional bullying*		Cyberbullying^		Both Bullying	
	n (%)	n (%)	Chi-Square Test of Independence	n (%)	Chi-Square Test of Independence	n (%)	Chi-Square Test of Independence
Total	2166 (100.0)	622 (28.7)		255 (11.8)		243 (11.2)	
Age[a]	14.83	14.55		14.91		14.90	
Gender			χ^2 (1) = 6.4		χ^2 (1) = 37.4		χ^2 (1) = 37.4
Boys	1131 (52.2)	298 (47.9)	p = 0.011	88 (34.5)	p < 0.001	82 (33.7)	p < 0.001
Girls	1035 (47.8)	324 (52.1)		167 (65.5)		162 (66.3)	
Country of Birth			χ^2 (1) = 3.7		χ^2 (1) = 1.5		χ^2 (1) = 0.9
Australia	1855 (85.6)	547 (87.9)	p = 0.053	225 (88.2)	p = 0.209	213 (87.7)	p = 0.342
Overseas	311 (14.4)	75 (12.1)		30 (11.8)		30 (12.4)	
Remoteness			χ^2 (1) = 7.8		χ^2 (1) = 1.2		χ^2 (1) = 2.6
Cities	1394 (64.4)	372 (59.8)	p = 0.005	156 (61.2)	p = 0.259	145 (59.7)	p = 0.105
Regional/Remote	772 (35.6)	250 (40.2)		99 (38.8)		98 (40.3)	
Grade			χ^2 (5) = 28.2		χ^2 (5) = 19.1		χ^2 (5) = 15.1
Grade 7	265 (12.2)	97 (15.6)	p < 0.001	26 (10.2)	p = 0.002	25 (10.3)	p = 0.010
Grade 8	283 (13.1)	100 (16.1)		33 (12.9)		31 (12.8)	
Grade 9	286 (13.2)	80 (12.9)		33 (12.9)		33 (13.6)	
Grade 10	359 (16.5)	110 (17.7)		57 (22.4)		54 (22.2)	
Grade 11	467 (21.6)	126 (20.3)		68 (26.7)		62 (25.5)	
Grade 12	506 (23.4)	109 (17.5)		31 (14.9)		31 (15.6)	
Household income[b]			χ^2 (2) = 6.8		χ^2 (2) = 2.8		χ^2 (2) = 2.6
Low	503 (23.2)	167 (26.9)	p = 0.033	69 (27.1)	p = 0.235	65 (26.8)	p = 0.264
Medium	1014 (46.8)	283 (45.5)		118 (46.3)		114 (46.9)	
High	649 (30.0)	172 (27.6)		68 (26.6)		64 (26.3)	
Family type[c]			χ^2 (1) = 13.8		χ^2 (1) = 16.6		χ^2 (1) = 13.7
Original	1324 (61.1)	342 (55.0)	p < 0.001	126 (49.4)	p < 0.001	122 (50.2)	p < 0.001
Step/Blended/Others	842 (38.9)	280 (45.0)		129 (50.6)		121 (49.8)	
Family Functioning			χ^2 (1) = 0.0		χ^2 (1) = 1.1		χ^2 (1) = 2.0
Very good/Good	1800 (83.1)	517 (83.1)	p = 0.990	206 (80.8)	p = 0.293	194 (79.8)	p = 0.149
Fair/Poor	366 (16.9)	105 (16.9)		49 (19.2)		49 (20.2)	
Parents' education			χ^2 (2) = 5.7		χ^2 (2) = 8.9		χ^2 (2) = 10.0
Bachelor	699 (32.3)	178 (28.6)	p = 0.055	65 (25.5)	p = 0.011	59 (24.3)	p = 0.007
Diploma	800 (36.9)	248 (39.9)		114 (44.7)		110 (45.3)	
Year 10/11	667 (30.8)	196 (31.5)		76 (29.8)		74 (30.4)	
Internet Use[d]			χ^2 (1) = 7.9		χ^2 (1) = 18.4		χ^2 (1) = 18.0
<3 hours/day	889 (41.0)	226 (36.3)	p = 0.005	73 (28.6)	p < 0.001	69 (28.4)	p < 0.001
≥3 hours/day	1277 (59.0)	396 (63.7)		182 (71.4)		174 (71.6)	
Electronic games[e]			χ^2 (1) = 20.1		χ^2 (1) = 5.0		χ^2 (1) = 4.8
<3 hours/day	1721 (79.5)	456 (73.3)	p < 0.001	189 (74.1)	p = 0.025	180 (74.1)	p = 0.028
≥3 hours/day	445 (20.5)	166 (26.7)		66 (25.9)		63 (25.9)	
Substance use by the child[f]			χ^2 (1) = 4.5		χ^2 (1) = 37.3		χ^2 (1) = 40.3
Yes	867 (40.0)	272 (43.6)	p = 0.035	147 (57.7)	p < 0.001	143 (58.9)	p < 0.001
No	1299 (60.0)	351 (56.4)		108 (42.3)			

Note:

[a] aContinuous variable. Mean has been inserted in the cells

[b] Household income: Low (<$52000), Medium ($52000-$129999) and High (>$130000)

[c] Family type: original families means children are natural, adopted, or foster child of both parents, and no step child; other families include step, blended and children from families who are not natural, adopted, foster or step of either parent

[d] Time usually spent on the computer, mobile or tablet, including accessing social media such as Facebook or Twitter, emailing, looking at websites or chatting online on a typical weekday

[e] Playing an Xbox or similar console, online, on a handheld device, computer, or mobile phone on a typical weekday

[f] Ever seriously try cigarette smoking, drink alcohol, cannabis or any other illegal drugs

* Traditional bullying: Following questions were considered to code as 1 (Yes) and 0 (No), *"Hit, kicked, or pushed around; Made fun of or teased in a mean and hurtful way; Lies, rumours or nasty stories were spread; Threatened or made afraid; Deliberately ignored, left out on purpose or not allowed to join in; Other young people stole things or from me, or broke or damaged my things deliberately; Teased about my race, the colour of my skin or my religion."*

^ Cyberbullying: Following questions were considered to code as 1 (Yes) and 0 (No), *"Sent nasty messages by email, mobile phone, or on the internet; Nasty messages or pictures were sent about me to other young people via mobile phone, internet or email; Nasty comments or pictures were sent or posted about me on websites (e.g. Facebook or Twitter)."*

oversampled. Most of the children were from low-middle income families, 61.3% were lived with their original parents and 77% had employed parents.

In total, 28.7% of the schoolchildren were victims of traditional bullying, 11.8% were victims of cyberbullying and 11.2% were victims of both traditional bullying and cyberbullying. Girls were more likely to experience cyberbullying (65.5% vs. 34.5%, $p < 0.001$) and both bullying (66.3% vs. 33.7%, $p < 0.001$) victimization than boys. Children who were in higher grades and who were from low-middle income families were more likely to be victims of bullying – traditional, cyber or both types of bullying. Around 50% children victimized by traditional bullying ($\chi^2 = 13.8$, $p < 0.001$) cyberbullying ($\chi^2 = 16.6$, $p < 0.001$) and both bullying type ($\chi^2 = 13.7$, $p < 0.001$) were living with their original parents. Children who reported spending more hours on a typical day in internet browsing reported both bullying victimization (71.6%, ($\chi^2 = 18.0$, $p < 0.001$)) and traditional bullying victimization (63.7%, ($\chi^2 = 7.9$, $p = 0.005$)), more often than those who spent fewer hours in the internet. On the other hand, children who

Table 2
Prevalence of Mental disorders, Suicidality and Self-harm in the sample (n = 2166)

Mental Disorder	n (%)	Suicidality* and Self-harm^	n (%)
Major Depressive Disorder[a]	104 (4.8%)	Plan among Ideators[e]	126 (5.8%)
ADHD[b]	141 (6.5%)	Attempt among Ideators[f]	62 (2.9%)
Conduct disorder[c]	41 (1.9%)	Plan and Attempt among Ideators[g]	55 (2.5%)
Anxiety disorder[d]	154 (7.1%)	Self-harm	168 (7.8%)

Note: [a]Major Depressive Disorder - "Major depressive disorder is the presence of either depressed mood, loss of interest or pleasure or being grouchy, irritable and in a bad mood."

[b] ADHD (Attention-deficit/hyperactivity disorder) - "ADHD is a persistent pattern of inattention and/or hyperactivity-impulsivity more frequent and severe than in other individuals at a similar developmental stage."

[c] Conduct Disorder - "Conduct disorder is defined as repetitive and persistent behaviour to a degree that violates the basic rights of others, major societal norms or rules in the following areas: aggression towards people or animals, destruction of property, deceitfulness or theft and serious violation of rules."

[d] Anxiety Disorder - "'Anxiety disorders' refers to a group of conditions rather than a single disorder. It includes social phobia, separation anxiety, generalised anxiety and obsessive-compulsive disorder."

* Suicidality includes suicidal ideation, plan and attempt. Suicidal Ideation is the number (%) of children seriously considered attempting suicide in the past 12 months.

[e] Plan among Ideators - Among ideators, number (%) of children made a plan about attempting suicide in the past 12 months.

[f] Attempt among Ideators- Among ideators, number (%) of children attempted suicide in the past 12 months.

[g] Plan and attempt among Ideators - Among ideators, number (%) of children planned and attempted suicide in the past 12 months.

^ Self-harm - Number (%) of children deliberately done something to themselves to cause harm or injury, without intending to end their own life.

Available at: Telethon Kids Institute (2015) - (https://www.youngmindsmatter.telethonkids.org.au/siteassets/media-docs—young-minds-matter/survey-user-s-guide-final.pdf)

reported spending less time in playing electronic games on a typical day were more likely victims of traditional bullying (73.3%) compared to those who spent more hours in playing electronic games. Among the traditional bullying victims, about 44% of children (χ^2 = 4.5, p = 0.035) had a history of substance use, while, the percentage is higher among those who reported victimization from cyberbullying (57.7%) and both types of bullying (58.9%). Table 1 also indicated that 22% of children among traditional bullying victims had a mental disorder (χ^2 = 32.1, $p < 0.001$), and more than 25% of children among those who reported cyberbullying and both bullying victimization were suffering from a mental disorder.

Table 2 shows the prevalence of mental disorders, suicidality and self-harm in the sample. Overall, approximately 5%, 6%, 2% and 7% of children aged 12-17 years had major depressive disorder, ADHD, conduct disorder and anxiety disorder, respectively. The prevalence of suicidal ideation and self harm was 8% (data not shown) and.7.8%, respectively. Among the ideators; the likelihood of making a plan was 5.8%, an attempt was 2.9% and both plan and attempt was 2.5%. Girls were more likely to report suicidality and self-harm than boys.

3.1. Bivariate association of bullying victimization with mental disorders, suicidality and self-harm

The bivariate analysis between mental disorders and bullying victimization shows that children with mental disorders were the highest proportion of traditional bullying victim (Fig 1). More than 50% of the children with major depressive disorder or conduct disorder were the victim of traditional bullying. While, only around 20% of the children who reported of having any mental disorders were the victims of cyberbullying. Fig 2 illustrates that more than 60% of those who reported suicidality (plan among ideators, attempt among ideators, plan and attempt among ideators) and 58% of those who reported self-harm were the victims of traditional bullying, respectively. It also shows though the rate of cyberbullying victims respectively among the children who reported suicidality and self-harm were slightly lower compared to the rates of traditional bullying victims but it was still alarming. All the bivariate relationships in Fig 1 and Fig 2 were significant (p-value < 0.05), except ADHD with cyberbullying and both bullying type.

3.2. Multivariate association of bullying victimization with mental disorders, suicidality and self-harm

In Table 3, a binary logistic model was used to investigate the association of bullying victimization (traditional, cyberbullying and both bullying) with mental disorders, suicidality and self-harm. Table 3a shows children who experienced victimization associated with traditional bullying, cyberbullying and both types of bullying were respectively 2.56 (95% CI, 1.59-4.12), 2.01 (95% CI, 1.20-3.38) and 2.14 (95% CI, 1.27-3.61) times more likely to develop major depressive disorder compared to those who had not reported any bullying victimization. It also shows victims of traditional bullying is more likely to develop conduct disorder (OR 2.27, 95% CI: 1.05-4.91) compared to those who were not victim.

As expected, victims of traditional bullying, and cyberbullying incurred a significantly higher risk of ideation with plan (traditional bullying: OR 4.70, 95% CI: 2.91-7.63; cyberbullying: OR 8.42, 95% CI: 5.29-13.39), ideation with attempt (traditional bullying: OR 2.32, 95% CI: 1.25-4.31; cyberbullying: OR 4.69, 95% CI: 2.54-8.65), ideation with plan and attempt (traditional bullying: OR 2.57, 95% CI: 1.30-5.08; cyberbullying: OR 5.23, 95% CI: 2.72-10.07) and self-harm (traditional bullying: OR 3.31, 95% CI: 2.24-4.89; cyberbullying: OR 3.88, 95% CI: 2.58-5.86) compared to those school going children who had not reported such threats (Table 3b). In case of victims of both bullying types, the risk of suicidal ideation with plan (OR 8.85, 95% CI: 5.54-14.13), suicidal ideation with attempt (OR 4.82, 95% CI: 2.60-8.90), suicidal ideation with plan and attempt (OR 5.36, 95% CI: 2.78-10.33) and self-harm (OR 4.04, 95% CI: 2.67-6.13) increased significantly compared to those who did not report any types of bullying victimization (Table 3b). All the logistic models in Table 3 were adjusted for potential covariates such as age, gender, remoteness, grade, household income, family type, parents' education, and substance use by the child, the time spent on using internet and playing electronic games.

4. Discussion

This study expands previous research work by providing further evidence to support on the association of bullying victimization (traditional, cyber or both) with mental disorders (major depressive disorder, ADHD, conduct disorder and anxiety disorder), suicidality (ideation, plan and attempt) and non-suicidal self-harm among Australian high schoolchildren,. These findings substantiated and

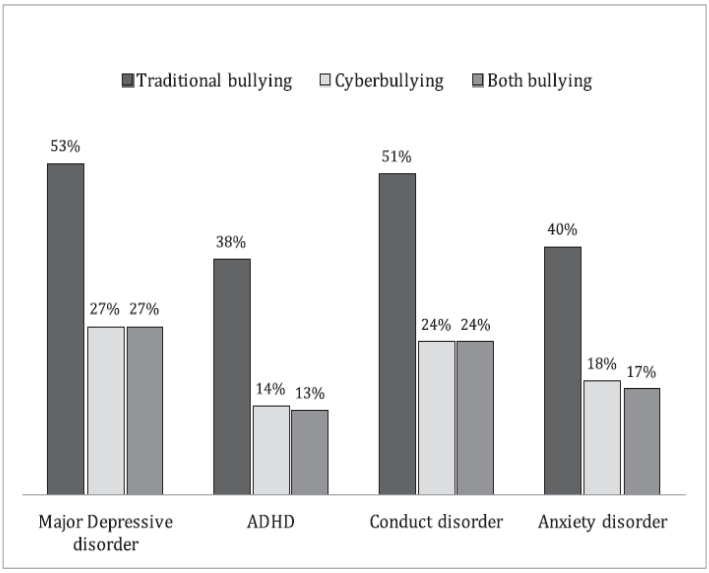


Fig. 1. Bullying vs Mental Disorders
Note: All the bivariate relationships in Fig 1 and Fig 2 were significant (p-value < 0.05), except ADHD with cyberbullying and both bullying type

extended those from previous studies conducted in the US and Canada (Goebert et al., 2011; Hinduja and Patchin, 2010; Schneider et al., 2012) and signified that victims of different forms of bullying are at risk of developing mental disorders, self-harm and suicidal behaviour.

The current study estimated that 28.7% of traditional bullying and 11.8% of cyberbullying victimization are similar to the prevalence rates from previous studies in Australia (Jadambaa et al., 2019; Thomas et al., 2017) and elsewhere (Litwiller and Brausch, 2013; Messias et al., 2014) using comparable definitions and time frames to investigate victimization linked to traditional bullying and cyberbullying, and the same group of children (i.e. high school students). These percentages not only show that traditional bullying victimization is still prevalent among high schoolchildren, and that cyberbullying also largely takes place within this age group but also support the demand for more attention and actions to protect children from being bullied.

The results showed gender differences in cyberbullying, but not such in traditional bullying victimization. Girls were more likely to endure cyberbullying victimization than boys, which is consistent with several other studies showing that cyberbullying is common in girls (Barzilay et al., 2017; Messias et al., 2014). This can be because cyberbullying is web-based and girls interact via text messages, social media and email more often than boys (Blair, 2003; Sampasa-Kanyinga et al., 2014). As expected, this study found that the more time spent on the internet, the greater the chance of cyberbullying victimization, and this is confirmed by Hinduja and Patchin (2008). Augmented internet exposure increases the likelihood of cyberbullying

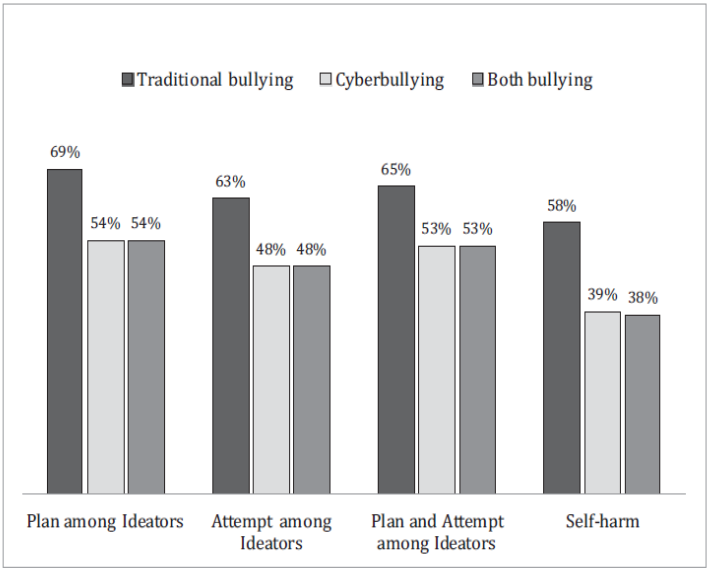


Fig. 2. Bullying vs Suicidality/Self-Harm
Figure Prevalence of bullying victimization (traditional, cyber and both) by mental disorders (Fig 1), and Suicidality and Self-harm (Fig 2)

Table 3
Binary logistics regression models for the odds of mental disorders, suicidality and self-harm by bullying victimization (traditional, cyber and both)

3a. Bullying victimization → Mental disorders

	Major Depressive disorder		ADHD		Conduct disorder		Anxiety disorder	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Traditional bullying (Ref. No)	2.56***	(1.59, 4.12)	1.34	(0.88, 2.03)	2.27*	(1.05, 4.91)	1.45	(0.99, 2.11)
Cyberbullying (Ref. No)	2.01**	(1.20, 3.38)	1.48	(0.82, 2.66)	2.40	(0.93, 6.19)	1.48	(0.95, 2.32)
Both bullying (Ref. No)	2.14**	(1.27, 3.61)	1.43	(0.78, 2.63)	2.50	(0.96,6.54)	1.48	(0.93, 2.36)

3b. Bullying victimization → Suicidality and Self-harm

	Plan among Ideators		Attempt among Ideators		Plan and Attempt among Ideators		Self-harm	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Traditional bullying (Ref. No)	4.70***	(2.91, 7.63)	2.32**	(1.25, 4.31)	2.57**	(1.30, 5.08)	3.31***	(2.24, 4.89)
Cyberbullying (Ref. No)	8.42***	(5.29, 13.39)	4.69***	(2.54, 8.65)	5.23***	(2.72, 10.07)	3.88***	(2.58, 5.86)
Both bullying (Ref. No)	8.85***	(5.54, 14.13)	4.82***	(2.60, 8.90)	5.36***	(2.78, 10.33)	4.04***	(2.67, 6.13)

Note: All models adjusted for sociodemographic factors (age, gender, remoteness, grade, household income, family type, parents' education, substance use by the child, the time spent on using internet and playing electronic games)
OR = odds ratio; CI = confidence interval
Survey weight adjusted
*** $p < 0.001$,
** $p < 0.01$
* $p < 0.05$ considered significant

victimization. In today's cyber life-style, it is nearly impossible to forbid access to internet exposure, and there can be no helpful intervention against cyberbullying, particularly among high schoolchildren. Instead, imposing limits on time spent on the use of internet may help reduce such threats. In addition, it is essential for parents and school teachers to learn how to safeguard children online may be by limiting the use of internet or by interacting with their peers. Not surprisingly, findings of this study also showed that substance use is common among bullying victims (Thomas et al., 2016; Thomas et al., 2017); this can be due to the fact that possible correlates of bullying victimization such as anxiety or depressive symptoms might influence children to use substances to deal with negative feelings (Litwiller and Brausch, 2013).

The association between bullying victimization and mental disorders is thought to be reciprocal. Bullying victimization may be associated with mental disorders among children, while many children may be at an increased risk for victimization due to mental disorders such as depression or anxiety. Longitudinal studies have revealed such reciprocal effects (Gámez-Guadix et al., 2013; Jadambaa et al., 2020). However, Sampasa-Kanyinga et al. (2014) and Bond et al. (2001) showed that the path from bullying victimization to mental disorders was stronger compared to the path from mental disorders to bullying victimization; which supports our hypothesis. Our findings suggested that all forms of bullying (traditional, cyber or both) are highly correlated with depressive disorders, which is consistent with past research (Chou et al., 2020; Ford et al., 2017; Jadambaa et al., 2020). In addition, in line with prior studies only traditional bullying is found to be significantly associated with conduct disorder (Husky et al., 2020; Vaughn et al., 2010). However, any types of bullying victimization are not associated with anxiety disorder and ADHD, which is also supported by previous research findings (Chou et al., 2020; Husky et al., 2020; Vaughn et al., 2010).

Consistent with existing data, victims of all forms of bullying are found to be significantly associated with greater risk of experiencing suicidality (ideation, plan and attempt) and self-harm (Ford et al., 2017; Forsyth et al., 2020; Tang et al., 2020). This is may be due to the fact that being-bullied is a traumatic event, which may lead to various psychopathological changes including serious depression and subsequently suicidal and self-harming behaviour (Baiden and Tadeo, 2020; Ford et al., 2017). A recent study reported that school bullying and cyberbullying victimization were significantly associated with suicidal ideation (Baiden and Tadeo, 2020); whereas, study by Kim and Chun (2020) found positive correlation only with suicidal plan but not with ideation. This finding also substantiates the call for providing suicide and self-harm prevention training to parents and school teachers of traditional and cyberbullying victims to assist them in detecting depressive symptoms or behavioural changes to prevent the risk for subsequent suicidal and self-harming behaviour.

Moreover, previous studies suggest that national estimates and collaborations on mental health are important for cross-national analyses and meta-analyses on bullying and its implications for schoolchildren (Smith et al., 2016; Thomas et al., 2017). These findings have significant implications for policy formulation, including the structured implementation and effectiveness of bullying prevention programmes globally and in Australia. It is critical to have a coordinated approach to address bullying among schoolchildren and to involve families in school settings by organizing regular meeting involving school teachers and parents of the children. Bullying is not restricted to one particular school (Shaw and Cross, 2012; Thomas et al., 2017), which emphasizes the fact that evidence-based intervention initiatives need to be enforced and implemented in all schools aiming at both traditional bullying and cyberbullying with a focus on reducing negative outcomes such as self-harm and suicidality among youths. For example, a randomized controlled trial of a school-based intervention conducted in Australia by Cross et al. (2016), found a minimal but significant reduction in cyberbullying at a 1-year follow-up. It is also recognized that better integration of preventive measures and greater teacher expertise in implementing reliable interventions at schools are important to increase the effectiveness of preventive strategies (Cross et al., 2016; Thomas et al., 2017). Since the empirical findings are fundamental to making effective decisions by policymakers, legislators, school teachers and families to address this issue, the following areas of research should be focused on: (i) documenting the determinants of bullying; (ii) gathering evidence for systems intervention in both community and school settings.

5. Limitations

Overall, the current study also has several limitations. Firstly, due to

the cross-sectional nature of the study, the temporality and causality of the observed relationship of the victimization associated with traditional bullying and cyberbullying and each outcome of mental disorders, suicidality and self-harm could not be ascertained. Secondly a significant limitation is the reliability of the gathered data. Self-reported data are valid indicators for bullying, suicidal and self-harming behaviours, though they can be influenced by social desirability bias (Cornell and Bandyopadhyay, 2009). There were a number of mental health related topics covered in this survey and, where possible, the response burden was kept to a minimum. However, global bullying questions have ample psychometric properties and are thus common in population-based studies (Solberg and Olweus, 2003).

6. Conclusion

Current population estimates have indicated the presence of strong and significant associations of all types of bullying victimization with major depressive disorder, suicidality and self-harm. An understanding of this association is critical for parents, teachers and clinicians who deal with children, and for those people who design and formulate plans at the policy level to reduce bullying and its associated harm. This evidence may also inform the design of prevention programs for minimizing the risk of mental disorders, suicidal and self-harming behaviour in adolescents worldwide.

CRediT Author statement

Md. Irteja Islam: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Visualization, Writing- Original draft preparation.

Rasheda Khanam: Investigation, Resources, Visualization, Writing-Reviewing and Editing, Supervision

Enamul Kabir: Visualization, Writing- Reviewing and Editing, Supervision

Conflict of interest

The authors (Md. Irteja Islam, Enamul Kabir and Rasheda Khanam) declare that they have no conflict of interest.

Acknowledgments

The paper is a part of the PhD programme of the first author, which was funded by the University of Southern Queensland, Australia. The authors would like to thank the University of Western Australia, Roy Morgan Research, the Australian Government Department of Health for conducting the survey, and the Australian Data Archive for giving access to the YMM survey dataset. The authors also would like to thank Dr Barbara Harmes for proofreading the manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2020.113364.

References

Abd Razak, M.A., Ahmad, N.A., Abd Aziz, F.A., Jamaluddin, R., Sidik, S.M., Awaluddin, S.M., Ibrahim, N., Tan, L., Sooryanarayana, R., 2019. Being bullied is associated with depression among Malaysian adolescents: findings from a cross-sectional study in Malaysia. Asia Pacific Journal of Public Health 31, 30S–37S. http://www.doi.org/10.1177%2F1010539519867796.

ABS, 2019. In: Causes of Death, Australia, 2018, Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/0/47E19CA15036B04BCA2577570014668B?Opendocument (accessed 07 January 2020).

AIHW, 2019. In: Deaths in Australia, Australian Institute of Health and Welfare, Canberra. https://www.aihw.gov.au/reports/life-expectancy-death/deaths-in-australia/contents/leading-causes-of-death (accessed 07 January 2020).

AIHW, 2019. In: Mental health services in Australia: in brief 2019, AIHW, Canberra. https://www.aihw.gov.au/reports/mental-health-services/mental-health-services-in-australia-in-brief-2019/contents/table-of-contents (accessed 20 July 2020).

Alavi, N., Roberts, N., Sutton, C., Axas, N., Repetti, L., 2015. Bullying victimization (being bullied) among adolescents referred for urgent psychiatric consultation: prevalence and association with suicidality. The Canadian Journal of Psychiatry 60, 427–431. http://www.dx.doi.org/10.1177%2F070674371506001003.

APA, 2013. Diagnostic and statistical manual of mental disorders. BMC Med 17, 133–137. https://www.psychiatry.org/psychiatrists/practice/dsm (accessed 25 December 2019).

Baiden, P., Tadeo, S.K., 2020. Investigating the association between bullying victimization and suicidal ideation among adolescents: evidence from the 2017 Youth Risk Behavior Survey. Child Abuse & Neglect 102, 104417. https://doi.org/10.1016/j.chiabu.2020.104417.

Baier, D., Hong, J.S., Kliem, S., Bergmann, M.C., 2019. Consequences of bullying on adolescents' mental health in Germany: Comparing face-to-face bullying and cyberbullying. Journal of Child and Family Studies 28, 2347–2357. https://doi.org/10.1007/s10826-018-1181-6.

Baldry, A.C., Farrington, D.P., Sorrentino, A., 2017. School bullying and cyberbullying among boys and girls: Roles and overlap. Journal of Aggression, Maltreatment & Trauma 26, 937–951. https://doi.org/10.1080/10926771.2017.1330793.

Bannink, R., Broeren, S., van de Looij–Jansen, P.M., de Waart, F.G., Raat, H., 2014. Cyber and traditional bullying victimization as a risk factor for mental health problems and suicidal ideation in adolescents. PloS one 9, e94026. https://doi.org/10.1371/journal.pone.0094026.

Barzilay, S., Klomek, A.B., Apter, A., Carli, V., Wasserman, C., Hadlaczky, G., Hoven, C.W., Sarchiapone, M., Balazs, J., et al., 2017. . Bullying victimization and suicide ideation and behavior among adolescents in Europe: A 10-country study. Journal of Adolescent Health 61, 179–186. https://doi.org/10.1016/j.jadohealth.2017.02.002.

Bauman, S., Toomey, R.B., Walker, J.L., 2013. Associations among bullying, cyberbullying, and suicide in high school students. Journal of adolescence 36, 341–350. https://doi.org/10.1016/j.adolescence.2012.12.001.

Blair, J., 2003. New breed of bullies torment their peers on the Internet. Education Week 22, 6. http://www.mskennedysclass.com/New_Breed_of_Bullies.pdf (accessed 08 January 2020).

Bond, L., Carlin, J.B., Thomas, L., Rubin, K., Patton, G., 2001. Does bullying cause emotional problems? A prospective study of young teenagers. Bmj 323, 480–484. https://doi.org/10.1136/bmj.323.7311.480.

CDC, 2014. In: Adolescent and School Health: YRBSS Questionnaires. Centers for Disease Control and Prevention.

Chou, W.-J., Wang, P.-W., Hsiao, R.C., Hu, H.-F., Yen, C.-F., 2020. Role of school bullying involvement in depression, anxiety, suicidality, and low self-esteem among adolescents with high-functioning autism spectrum disorder. Frontiers in psychiatry 11, 9. http://www.dx.doi.org/10.3389%2Ffpsyt.2020.00009.

Cornell, D., Bandyopadhyay, S., 2009. The assessment of bullying. The international handbook of school bullying. pp. 265–276.

Cross, D., Shaw, T., Hadwen, K., Cardoso, P., Slee, P., Roberts, C., Thomas, L., Barnes, A., 2016. Longitudinal impact of the Cyber Friendly Schools program on adolescents' cyberbullying behavior. Aggressive behavior 42, 166–180. https://doi.org/10.1002/ab.21609.

Cross, D., Shaw, T., Hearn, L., Epstein, M., Monks, H., Lester, L., Thomas, L., 2009. In: Australian Covert Bullying Prevalence Study (ACBPS), 2009. Child Health Promotion Research Centre, Edith Cowan University: Perth. https://ro.ecu.edu.au/cgi/viewcontent.cgi?article=7795&context=ecuworks.

Del Rey, R., Elipe, P., Ortega-Ruiz, R., 2012. Bullying and cyberbullying: Overlapping and predictive value of the co-occurrence. Psicothema 24, 608–613. https://pubmed.ncbi.nlm.nih.gov/23079359/.

Fisher, P.W., Shaffer, D., Piacentini, J.C., Lapkin, J., Kafantaris, V., Leonard, H., Herzog, D.B., 1993. Sensitivity of the Diagnostic Interview Schedule for Children, (DISC-2.1) for specific diagnoses of children and adolescents. Journal of the American Academy of Child & Adolescent Psychiatry 32, 666–673. http://doi.org/10.1097/00004583-199305000-00026.

Ford, R., King, T., Priest, N., Kavanagh, A., 2017. Bullying and mental health and suicidal behaviour among 14-to 15-year-olds in a representative sample of Australian children. Australian & New Zealand Journal of Psychiatry 51, 897–908. http://doi.org/10.1177/0004867417700275.

Forsyth, C.J., Biggar Jr, R.W., Chen, J., 2020. Bullied youth: suicide attempts, planning, ideation, and pre-ideation. Criminal Justice Studies 33, 170–177. https://doi.org/10.1080/1478601X.2019.1628437.

Gámez-Guadix, M., Orue, I., Smith, P.K., Calvete, E., 2013. Longitudinal and reciprocal relations of cyberbullying with depression, substance use, and problematic internet use among adolescents. Journal of Adolescent Health 53, 446–452. https://doi.org/10.1016/j.jadohealth.2013.03.030.

Goebert, D., Else, I., Matsu, C., Chung-Do, J., Chang, J.Y., 2011. The impact of cyberbullying on substance use and mental health in a multiethnic sample. Maternal and child health journal 15, 1282–1286. https://doi.org/10.1007/s10995-010-0672-x.

Hafekost, J., Lawrence, D., Boterhoven de Haan, K., Johnson, S.E., Saw, S., Buckingham, W.J., Sawyer, M.G., Ainley, J., Zubrick, S.R., 2016. Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry 50, 866–875. https://www.doi.org/10.1177%2F0004867415622270.

Hemphill, S.A., Kotevski, A., Heerde, J.A., 2015. Longitudinal associations between cyber-bullying perpetration and victimization and problem behavior and mental health problems in young Australians. International journal of public health 60, 227–237. https://doi.org/10.1007/s00038-014-0644-9.

Hinduja, S., Patchin, J.W., 2008. Personal information of adolescents on the Internet: A quantitative content analysis of MySpace. Journal of adolescence 31, 125–146. https://doi.org/10.1016/j.adolescence.2007.05.004.
Hinduja, S., Patchin, J.W., 2010. Bullying, cyberbullying, and suicide. Archives of suicide research 14, 206–221. https://doi.org/10.1080/13811118.2010.494133.
Husky, M.M., Delbasty, E., Bitfoi, A., Carta, M.G., Goelitz, D., Koç, C., Lesinskiene, S., Mihova, Z., Otten, R., et al., 2020. . Bullying involvement and self-reported mental health in elementary school children across Europe. Child abuse & neglect 107, 104601. https://doi.org/10.1016/j.chiabu.2020.104601.
Islam, M.I., Kabir, E., Khanam, R., 2020. Suicidality, Mental Disorder and the Utilization of Mental Health Services among Australian Adolescents. Children and Youth Services Review, 104821. https://doi.org/10.1016/j.childyouth.2020.104821.
Jadambaa, A., Thomas, H.J., Scott, J.G., Graves, N., Brain, D., Pacella, R., 2019. Prevalence of traditional bullying and cyberbullying among children and adolescents in Australia: A systematic review and meta-analysis. Australian & New Zealand Journal of Psychiatry, 0004867419846393. https://doi.org/10.1177/0004867419846393.
Jadambaa, A., Thomas, H.J., Scott, J.G., Graves, N., Brain, D., Pacella, R., 2020. The contribution of bullying victimisation to the burden of anxiety and depressive disorders in Australia. Epidemiology and psychiatric sciences 29. https://doi.org/10.1017/s2045796019000489.
John, A., Glendenning, A.C., Marchant, A., Montgomery, P., Stewart, A., Wood, S., Lloyd, K., Hawton, K., 2018. Self-harm, suicidal behaviours, and cyberbullying in children and young people: Systematic review. Journal of medical internet research 20, e129. https://doi.org/10.2196/jmir.9044.
Kim, H.H.-s., Chun, J., 2020. Bullying victimization, school environment, and suicide ideation and plan: focusing on youth in low-and middle-income countries. Journal of Adolescent Health 66, 115–122. https://doi.org/10.1016/j.jadohealth.2019.07.006.
Kinchin, I., Doran, C., 2018. The cost of youth suicide in Australia. International journal of environmental research and public health 15, 672. https://doi.org/10.3390/ijerph15040672.
Klomek, A.B., Sourander, A., Gould, M., 2010. The association of suicide and bullying in childhood to young adulthood: A review of cross-sectional and longitudinal research findings. The Canadian Journal of Psychiatry 55, 282–288. https://doi.org/10.1177/070674371005500503.
Kowalski, R.M., Limber, S.P., 2013. Psychological, physical, and academic correlates of cyberbullying and traditional bullying. Journal of Adolescent Health 53, S13–S20. https://doi.org/10.1016/j.jadohealth.2012.09.018.
Lawrence, D., Hafekost, J., Johnson, S.E., Saw, S., Buckingham, W.J., Sawyer, M.G., Ainley, J., Zubrick, S.R., 2016. Key findings from the second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry 50, 876–886. https://doi.org/10.1177/0004867415617836.
Litwiller, B.J., Brausch, A.M., 2013. Cyber bullying and physical bullying in adolescent suicide: the role of violent behavior and substance use. Journal of youth and adolescence 42, 675–684. https://doi.org/10.1007/s10964-013-9925-5.
Messias, E., Castro, J., Saini, A., Usman, M., Peeples, D., 2011. Sadness, suicide, and their association with video game and internet overuse among teens: results from the youth risk behavior survey 2007 and 2009. Suicide and Life-Threatening Behavior 41, 307–315. https://doi.org/10.1111/j.1943-278x.2011.00030.x.
Messias, E., Kindrick, K., Castro, J., 2014. School bullying, cyberbullying, or both: correlates of teen suicidality in the 2011 CDC Youth Risk Behavior Survey. Comprehensive psychiatry 55, 1063–1068. https://doi.org/10.1016/j.comppsych.2014.02.005.
Olweus, D., 2013. School bullying: Development and some important challenges. Annual review of clinical psychology 9, 751–780. https://doi.org/10.1146/annurev-clinpsy-050212-185516.
Ortega, R., Elipe, P., Mora-Merchán, J.A., Genta, M.L., Brighi, A., Guarini, A., Smith, P.K., Thompson, F., Tippett, N., 2012. The emotional impact of bullying and cyberbullying on victims: A European cross-national study. Aggressive behavior 38, 342–356. https://doi.org/10.1002/ab.21440.
Patton, G.C., Sawyer, S.M., Santelli, J.S., Ross, D.A., Afifi, R., Allen, N.B., Arora, M., Azzopardi, P., Baldwin, W., et al., 2016. . Our future: a Lancet commission on adolescent health and wellbeing. The Lancet 387, 2423–2478. https://doi.org/10.1016/S0140-6736(16)00579-1.
Perren, S., Dooley, J., Shaw, T., Cross, D., 2010. Bullying in school and cyberspace: Associations with depressive symptoms in Swiss and Australian adolescents. Child and adolescent psychiatry and mental health 4, 28. https://doi.org/10.1186/1753-2000-4-28.
Sampasa-Kanyinga, H., Roumeliotis, P., Xu, H., 2014. Associations between cyberbullying and school bullying victimization and suicidal ideation, plans and attempts among Canadian schoolchildren. PloS one 9, e102145. https://doi.org/10.1371/journal.pone.0102145.
Schneider, S.K., O'donnell, L., Stueve, A., Coulter, R.W., 2012. Cyberbullying, school bullying, and psychological distress: A regional census of high school students. American journal of public health 102, 171–177. http://www.dx.doi.org/10.2105%2FAJPH.2011.300308.
Shaw, T., Cross, D., 2012. The clustering of bullying and cyberbullying behaviour within Australian schools. Australian Journal of Education 56, 142–162. http://www.doi.org/10.1177%2F000494411205600204.
Slonje, R., Smith, P.K., 2008. Cyberbullying: Another main type of bullying? Scandinavian journal of psychology 49, 147–154. https://doi.org/10.1111/j.1467-9450.2007.00611.x.
Smith, P.K., Robinson, S., Marchi, B., 2016. Cross-national data on victims of bullying: What is really being measured? International Journal of Developmental Science 10, 9–19. https://eric.ed.gov/?id=EJ1142026.
Solberg, M.E., Olweus, D., 2003. Prevalence estimation of school bullying with the Olweus Bully/Victim Questionnaire. Aggressive Behavior: Official Journal of the International Society for Research on Aggression 29, 239–268. https://psycnet.apa.org/doi/10.1002/ab.10047.
Tang, J.J., Yu, Y., Wilcox, H.C., Kang, C., Wang, K., Wang, C., Wu, Y., Chen, R., 2020. Global risks of suicidal behaviours and being bullied and their association in adolescents: School-based health survey in 83 countries. EClinicalMedicine 19, 100253. https://doi.org/10.1016/j.eclinm.2019.100253.
Thomas, H.J., Chan, G.C., Scott, J.G., Connor, J.P., Kelly, A.B., Williams, J., 2016. Association of different forms of bullying victimisation with adolescents' psychological distress and reduced emotional wellbeing. Australian & New Zealand Journal of Psychiatry 50, 371–379. http://www.doi.org/10.1177/0004867415600076.
Thomas, H.J., Connor, J.P., Lawrence, D.M., Hafekost, J.M., Zubrick, S.R., Scott, J.G., 2017. Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. Australian & New Zealand Journal of Psychiatry 51, 909–920. https://www.doi.org/10.1177/0004867417707819.
Vaughn, M.G., Fu, Q., Bender, K., DeLisi, M., Beaver, K.M., Perron, B.E., Howard, M.O., 2010. Psychiatric correlates of bullying in the United States: Findings from a national sample. Psychiatric Quarterly 81, 183–195. https://doi.org/10.1007/s11126-010-9128-0.
Vu, X.-B.B., Biswas, R.K., Khanam, R., Rahman, M., 2018. Mental health service use in Australia: The role of family structure and socio-economic status. Children and Youth Services Review 93, 378–389. https://doi.org/10.1016/j.childyouth.2018.08.001.
Waasdorp, T.E., Bradshaw, C.P., 2015. The overlap between cyberbullying and traditional bullying. Journal of Adolescent Health 56, 483–488. https://doi.org/10.1016/j.jadohealth.2014.12.002.
Zubrick, S.R., Hafekost, J., Johnson, S.E., Lawrence, D., Saw, S., Sawyer, M., Ainley, J., Buckingham, W.J., 2016. Suicidal behaviours: prevalence estimates from the second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry 50, 899–910. https://www.doi.org/10.1177%2F0004867415622563.

2.3 Study 3 - Effect of mental disorders on the association between bullying victimization, suicidal ideation, and self-harm in Australian adolescents: A mediation analysis (Under 2nd Review in the Journal of Affective Disorders, Q1, IF: 4.226, SNIP: 1.673, Publisher: Elsevier)

Abstract

Purpose

The mechanism underlying the correlation between bullying victimization, suicidal ideation and self-harm are not well understood. This study, therefore, aimed to investigate whether mental disorders (major depressive disorder, ADHD, conduct disorder and anxiety disorder) have mediating effect on the association between bullying victimization (traditional, cyber and both), suicidal ideation and self-harm.

Methods

Overall, 2522 Australian adolescents aged 12–17-year-olds (M =14.83; SD =1.72; 51.6% boys) were analysed from a nationally representative cross-sectional survey: Young Minds Matter (YMM). A series of logistic regressions were employed using Baron and Kenny's approach to test the mediating effect of each mental disorder on the relationship between bullying victimization, suicidal ideation, and self-harm. Further, the Sobel test used to estimate the indirect effect.

Results

About 18.3%, 0.5% and 12.3% of adolescents respectively experienced traditional, cyber and both bullying victimizations. The relationship between bullying victimizations (traditional only and both), suicidal ideation and self-harm were mediated by major depressive disorder ($p<0.05$). Anxiety disorder mediated the association between traditional only and suicidal ideation ($p<0.05$). While ADHD and conduct disorder had no mediating effect on the association between bullying victimization (traditional, cyber and both), suicidal ideation and self-harm.

Conclusion

Depression and anxiety disorder play a mediating role in the association between bullying victimization, suicidal and non-suicidal self-harming behaviour. Thus,

addressing such mental disorders among bullying victims is worthwhile to prevent suicidality and self-harm and ultimately suicide.

Keywords

Traditional bullying; Cyberbullying; Mental disorder; Suicidal ideation; Self-harm

1. Background

Suicidal ideation and non-suicidal self-harm in adolescents are a serious public health concern and has contributed heavily to the burden of disease globally and in Australia (Ford, King, Priest, & Kavanagh, 2017; Kinchin & Doran, 2018; Patton et al., 2016). For instance, recent estimates showed that suicide rates among 10-24 year-olds risen 56% in 2017 from 2007, and suicide is the second leading cause of death among this age group in the US (Curtin & Heron, 2019). While in Australia it is the topmost cause of death among 15-24 year-olds age group (AIHW, 2019; Kinchin & Doran, 2018). In Australia, the prevalence of suicidal ideation and non-suicidal self-harm in the past-12 months among 12-17-year-olds was last nationally estimated to be 7.5% and 8%, respectively (Zubrick et al., 2016a, 2016b). Since the rates of suicide and self-harm have not changed significantly in the 5-year period between 2014 and 2018 in Australia (ABS, 2019), these troubling statistics add to the urgent need to provide research evidence to determine the determinants of suicidal ideation and self-harm among the population. Evidence from previous research suggests that one of many potential predictors of suicidal ideation and self-harm in young adolescents is bullying victimization (Alavi, Roberts, Sutton, Axas, & Repetti, 2015; Bannink, Broeren, van de Looij–Jansen, de Waart, & Raat, 2014; Barzilay et al., 2017; Ford et al., 2017; Forsyth, Biggar Jr, & Chen, 2020; Hinduja & Patchin, 2010; John et al., 2018; Thomas et al., 2016). For example, a recent study involving 83 countries reported that bullying victimization is one of the key determinants suicidal behaviours among school going children and adolescents (Tang et al., 2020).

Bullying may be traditional (e.g., physical, verbal, relational) and cyber; is a repetitive and deliberately harmful act of aggression involving a power imbalance between perpetrator and victim (Barzilay et al., 2017; Espelage & Holt, 2013; Hinduja & Patchin, 2010; Kowalski & Limber, 2013). Childhood bullying victimization is recognized as a major public health issue in developed worlds including Australia because of its high prevalence and its enduring contribution to mental health problems (Alavi et al., 2015; Forsyth et al., 2020; Goebert, Else, Matsu, Chung-Do, & Chang, 2011; Oexle et al., 2020; Schneider, O'donnell, Stueve, & Coulter, 2012). Studies in Canada and the Netherlands found that

approximately 10-30% of adolescents are frequently abused as victims, perpetrators, or both (Alavi et al., 2015; Klomek, Sourander, & Gould, 2010). A study conducted in Australia reported that more than 13% of adolescents experienced bullying victimization (Thomas et al., 2017); while latest figures indicate that in the past 12 months at least one in four adolescents experienced bullying victimization throughout Australia (Ford et al., 2017). Given the increasing number of bullying victims, the harmful effects of bullying on victims needs to be investigated (Sampasa-Kanyinga, Roumeliotis, & Xu, 2014).

However, the psychological mechanisms underlying the causal link between bullying victimization and suicidal ideation and non-suicidal self-harm are not clear. According to Agnew's theory of deviance in social psychology, social ties and incidents cause an individual to commit acts of deviation such as suicidal ideation and self-harm (Agnew, 1992). Bullying victimization is one of the sources of strain, which can anger and upset the victim and thus make them more likely to be unearthed (Patchin & Hinduja, 2011; Wallace, Patchin, & May, 2005). It means that the victims of bullying are more vulnerable to suicide and to self-harm than dealing with their bullying. Since depression and mental illnesses are well-known risk factors for suicide and non-suicidal self-harm (Quintana-Orts, Rey, Mérida-López, & Extremera, 2019; Zubrick et al., 2016a, 2016b), the bullying victims may first undergo episodes of mental health problems before moving into suicidal and self-harming behaviours (Figure 1).

There is evidence that bullying precedes more adverse impacts on children with mental health issues, which may lead to extremely negative effects on mental wellbeing at adulthood (Jadambaa et al., 2020; Perren, Dooley, Shaw, & Cross, 2010; Solberg & Olweus, 2003). Evidence has also shown that bullying victims were often associated with low self-esteem, depression, anxiety and violent behaviours (Alavi et al., 2015; Barzilay et al., 2017; Forsyth et al., 2020; Jadambaa et al., 2020; Oexle et al., 2020). Several studies have also reported the association between traditional bullying, suicidal and self-harming behaviours in children and adolescents (Baiden & Tadeo, 2020; Bannink et al., 2014; Forsyth et al., 2020; John et al., 2018). However, not much research has been done so far to examine the effect of cyberbullying on psychological outcomes involving adolescents

(Messias, Kindrick, & Castro, 2014; Sampasa-Kanyinga et al., 2014). Some researchers suggest that cyberbullying tends to have similar consequences as traditional bullying; others believe cyberbullying can be more stressful than traditional one (Extremera, Quintana-Orts, Mérida-López, & Rey, 2018; Perren et al., 2010). Not Long Ago, an emerging research body has begun to relate cyberbullying with its psychopathology and negative outcomes such as suicidal ideation and self-harm in children and adolescents to understand the underlying mechanism (Extremera et al., 2018; Sampasa-Kanyinga et al., 2014). For example, few studies (Extremera et al., 2018; Goebert et al., 2011; Hemphill, Kotevski, & Heerde, 2015; Litwiller & Brausch, 2013; Schneider et al., 2012) reported that cyberbullying is associated with depression, anxiety, substance use, suicidal and self-harming behaviours among adolescents.

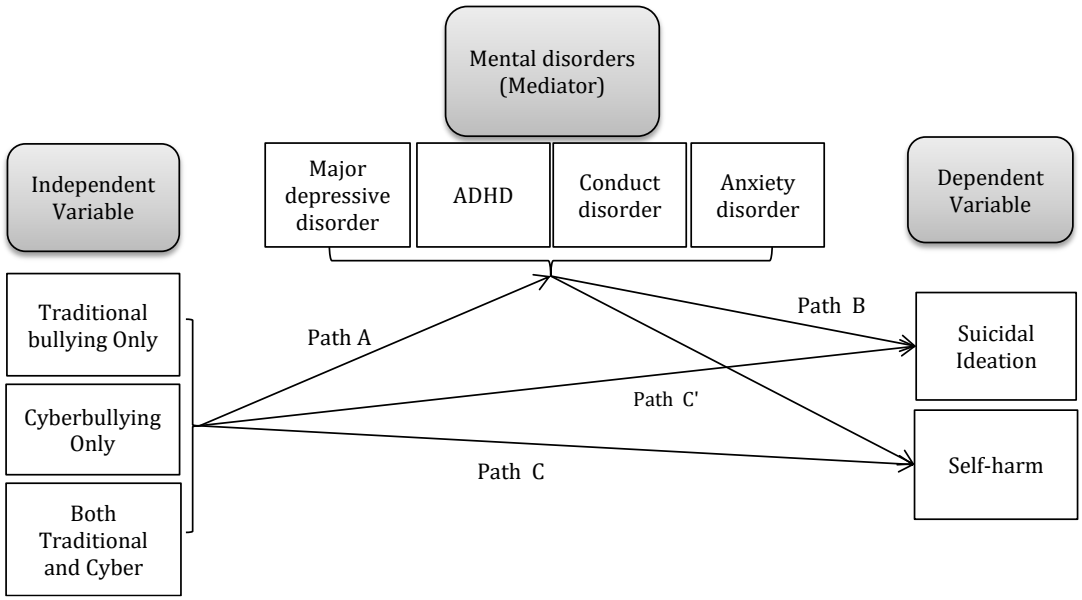


Figure 1 Hypothesized mediational model to study the mediating effect of mental disorders on the relationship between bullying victimization, suicidal ideation, and self-harm.

Evidence mostly from the international literatures, has only documented the mediating role of depression on the relationship between traditional bullying victimization and suicidal behaviours (Bauman, Toomey, & Walker, 2013; Quintana-Orts et al., 2019). However, none of them have included both types of bullying (traditional and cyber), non-suicidal self-harm and other mental health disorders such as attention-deficit-hyperactivity-disorder (ADHD), conduct disorder and anxiety disorders as a mediator in their analysis. In Australia, studies mostly were state-wide focusing on individual types of bullying, risk

factors or mental health issues (Ford et al., 2017; Hemphill et al., 2015; Jadambaa et al., 2019). In addition, only a few studies presented Australian population-based estimates regarding the association of bullying with mental health problems includes mental disorders, suicidal behaviours and self-harm in adolescents (Ford et al., 2017; Hemphill et al., 2015; Jadambaa et al., 2020). However, no study has investigated the mediating effect of mental disorders on the association between bullying victimization and health risk behaviours (i.e., suicidal ideation and self-harm) among Australian adolescent population. Thus, the effects of different types of bullying (traditional and cyber) victimization on suicidal ideation and self-harm concerning mental disorders in adolescent population are not clear. This research gap shows an urgent need for understanding the interplay of bullying victimization, mental disorder, and health risk behaviours (suicidal ideation and self-harm) from policy perspective to prevent the risk of adolescent suicide.

This paper is therefore, aimed to examine separately whether each mental disorder (major depressive disorder, ADHD, conduct disorder and anxiety disorder) is one of the mechanisms via which bullying affects suicidal ideation and self-harm in adolescents. In the current study, we tested a hypothesized mediation model (Figure 1) and predicted that certain mental disorders would mediate these relationships, while adjusting for potential sociodemographic covariates.

2. Methods

2.1. Data source

This study analyzed a nationwide cross-sectional data from Young Minds Matter (YMM): the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. The YMM survey was conducted in collaboration between The University of Western Australia (UWA), Roy Morgan Research and the Australian Government Department of Health (AGDH). It was ethically approved respectively from the Human Research Ethics Committees of AGDH and UWA (Hafekost et al., 2016; Lawrence et al., 2016).

A multi-staged, area-based sampling technique was used in the survey to ensure the proportional distribution of geographic areas and representativeness of the households across Australia. In the survey, the study participants (parents and children) were selected from households after obtaining informed written and verbal consent; where if more than one qualifying child resided in the household, a single child was randomly sampled. Overall, 6310 parents of 4-17 years-aged (55% of qualifying households) and 2967 adolescents of 11-17 years were participated in the study. Data were collected through face-to-face interviews by trained interviewers from parents using a structured questionnaire; while adolescents completed a computer-based self-reported questionnaire privately at home to provide information related to health-risk behaviours (e.g., bullying, mental disorders, suicidal ideation, self-harm, substance use, service use. A more detailed of the methods have been described elsewhere (Hafekost et al., 2016).

2.2. Measures

2.2.1 Suicidal ideation and self-harm (Outcome variables)

In the YMM survey, the Standard High School questionnaires of the Youth Risk Behavior Survey (CDC, 2014) were utilized to asses suicidal behaviours (ideation) and self-harm only among 12-17 years aged adolescents (self-reported data), where all answers were kept confidential (Zubrick et al., 2016b). Suicidal ideation was assessed with the question: 'During the past 12 months, did you ever seriously consider attempting suicide?'. While, regarding self-harm, the following question was asked: 'Have you ever deliberately done something to yourself to cause harm or injury, without intending to end your own life?' (Zubrick et al., 2016a, 2016b). All response options were coded 1 for 'Yes' and 0 for 'No'.

2.2.2 Bullying (Independent variable)

Items measuring bullying were collected from the Olweus Bully–Victim Questionnaire and from the Cyber Friendly Schools Project at Edith Cowan University, and were modified according to the YMM survey objectives (Cross et al., 2016; Thomas et al., 2017). Traditional bullying was considered 'when people tease, threaten, spread rumours about, hit, shove, or hurt other people

repeatedly' and cyberbullying was measured 'when people use mobile phones or the internet to send nasty or threatening emails or messages, post mean or nasty comments or pictures on websites like Facebook, or have someone pretend to be them online to hurt other people repeatedly'. It was not considered bullying when two individuals of equal intensity or power discuss or battle each other amicably (Thomas et al., 2017).

Adolescents were directly asked about traditional bullying and cyberbullying victimization using the following question: 'In the past 12 months, have you ever been bullied or cyberbullied?' with the listed bullying types: 'Hit, kicked, or pushed around', 'Made fun of or teased in a mean and hurtful way', 'Lies, rumors or nasty stories were spread', 'Threatened or made afraid', 'Deliberately ignored, left out on purpose or not allowed to join in', 'Other young people stole things or from me, or broke or damaged my things deliberately', 'Teased about my race, the colour of my skin or my religion', 'Sent nasty messages by email, mobile phone, or on the internet', 'Nasty messages or pictures were sent about me to other young people via mobile phone, internet or email', and 'Nasty comments or pictures were sent or posted about me on websites (e.g. Facebook or Twitter)' (Thomas et al., 2017). From the responses of the above questions, three dichotomous variables (Yes/No) were created for bullying victimization-traditional bullying only, cyberbullying only, and both traditional and cyber bullying, and coded as 0 for 'No' and 1 for 'Yes'.

2.2.3 Sociodemographic covariates

The following socio-demographic covariates were included in the study: age (12 to <15 and ≤15 to 17 years), gender (Boys/Girls), country of birth (Australia/Overseas), and location (major cities/regional and remote), attending school (Yes/No), family type (children from original biological parents/children from other parents like a step or blended), household income (<$52000 as low/$52000-$129999 as medium/>$130000 as high). For substance use, a dichotomous variable (Yes/No) was created and were measured using the questions: 'Have you ever tried cigarette smoking, even one or two puffs?'; 'Have you ever had at least one drink of alcohol, other than a few sips?'; 'Have you ever

used illegal drugs, or sniffed petrol, glue, aerosol, paints, solvents or nitrous?' (Lawrence et al., 2016).

2.2.4 Mental disorders (Mediator)

The Diagnostic Interview Schedule for Children IV (DISC-IV) were selected for the inclusion of mental disorders in the survey (APA, 2013; Fisher et al., 1993). Both parent-reported and child-reported module of YMM survey dataset were considered to identify the presence of mental disorders in the 12-months prior the survey. Mental disorders included: major depressive disorders, attention-deficit hyperactivity disorder (ADHD), conduct disorder and anxiety disorder (i.e., covers modules for social phobia, separation anxiety disorder, generalized anxiety disorder and obsessive-compulsive disorder) (Hafekost et al., 2016; Lawrence et al., 2016). Response options for each category included 'Yes' (coded as 1) or 'No' (coded as 0).

2.3. Statistical analysis

In this study, the analysis was restricted to adolescents aged 12-17 years due to paucity of information on the outcome variable. Also, the 'Don't know' and 'Prefer not to say' responses were omitted. Finally, a total of 2166 adolescents were included in the analysis after combining self-reported child data and parent data to achieve study objectives.

Data were analyzed using Stata/SE 14.1. Descriptive statistics were reported, and the significance of difference was calculated using the Pearson Chi-square test, which signified the strength of the bivariate relationships between these characteristics and reports of bullying victimization. Then, a series of multivariate logistic models were used to investigate the role of mediator (each mental disorder) on the associations of independent variables (traditional, cyber and both bullying victimization) with the outcome variables (suicidal ideation and self-harm). Potential confounders included in the analysis were age, gender, location, school grade, family type, household income, time spent on internet use and electronic gameplay and substance use by the child. It should be noted that survey weight was used in the analysis to adjust for the non-response or missing data on sociodemographic covariates.

2.3.1 Test for mediation

The mediating role of mental disorders on the associations of bullying victimization with suicidal ideation and self-harm was examined using Barron and Kenny's four-step approach [120], in which a series of regression analyses were conducted and significance of the odds was examined at each step. Figure 1 shows the hypothesized mediation model for the study of the relationship between bullying victimization and suicidal ideation and self-harm. This is to note that in the mediation analysis, we only considered traditional bullying only and both bullying (traditional and cyber) victimization, and omitted cyberbullying only victimization as in this group no one reported suicidal ideation. The conditions necessary to investigate such a mediating relationship require: (i) a significant association between independent variables (traditional only and both bullying victimization) and dependent variables (suicidal ideation and self-harm) (Step 1 - Path C, Fig 1); (ii) a significant relationship between independent variables and assumed mediator (each mental disorder) (Step 2 - Path A, Fig 1); and (iii) a significant association between the assumed mediator and dependent variables (Step 3 - Path B, Fig 1), adjusting the potential covariates except specific mental disorder for the model. Based on the significant findings from Steps 1-3, the final regression model was carried out. In Step 4 (Path C'), the inclusion of a mediator (specific mental disorder) as control, resulting in the reduction of the significance or magnitude of the relationship between independent variables (traditional only and both bullying victimization) and dependent variables (suicidal ideation and self-harm) indicates that it is the mental disorder that triggers suicidal ideation (rather than direct effects of bullying). That is, bullying affects suicidal ideation and self-harm via a mental disorder.

However, since the Baron and Kenny's approach tends to miss some true mediation effect such as Type II errors (MacKinnon, Fairchild, & Fritz, 2007), it is suggested to calculate the indirect effect and test it for significance. In this study, the Sobel test (Sobel, 1982) was used to estimate the indirect effect of bullying victimization on suicidal ideation and self-harm through a mental disorder and for its significance. In this study, according to the Sobel approach, a product is

formed by multiplying two coefficients together, the partial regression effect for assumed mediator (mental disorder) predicting dependent variable (suicidal ideation and self-harm), and the simple coefficient for the independent variable (bullying victimization) predicting assumed mediator (mental disorder). The strength of the associations between the bullying victimization, suicidal ideation and self-harm was estimated by means of adjusted odds ratios (AOR) and 95% confidence intervals.

3. Results

3.1 General information

Table 1 shows the sample distribution of socio-demographic characteristics among bullying victimizations (traditional bullying victims only, cyberbullying victims only and both bullying victims). Of the 2522 sample participants, 18.3% experienced traditional bullying victimization only (N=461), 0.5% reported cyberbullying only (N=13) and 12.3% (N=310) reported both bullying victimization (Traditional and Cyber) in the past 12 months. A higher proportion of girls (16.9%) experienced both bullying victimizations, while the percentage among boys was 8.1%, and children from both age groups experienced traditional bullying only compared to other bullying groups. Children from regional/remote areas were more likely to be victims of traditional bullying only, and 15.6% of children from step/blended families were reported to be a victim of both bullying. A higher proportion of children who had a history of substance use (17.6%, <0.001) experienced both bullying victimizations compared to traditional bullying victims only and cyberbullying victims only. Country of birth, schooling, the family income had no relation with any types of bullying victimizations.

3.2 Mental disorder, Suicidal ideation, and Self-harm

Figure 2 presents the prevalence of each mental disorder, suicidal ideation, and self-harm by each bullying victimization group (traditional only, cyber only and both). Among the children who experienced both bullying, nearly 45% reported suicidal ideation, almost 29% reported self-harm and 35% diagnosed with major depressive disorder followed by anxiety disorder (12.9%), ADHD (8.1%) and

conduct disorder (3.6%). While in the traditional bullying victims only, the prevalence of mental disorders, suicidal ideation and self-harm were comparatively lower. However, surprisingly, no one reported suicidal ideation in the cyberbullying victims, and the percentages of ADHD (15.4%) and anxiety disorder (15.4%) was high among those who only reported cyberbullying victimization.

Table 1 Sample distribution (Adolescents aged 12-17-year-olds)

Characteristics	Total n (%)	Traditional Bullying Only* (%)	Cyberbullying Only^ (%)	Both Traditional & Cyber (%)
Total	2522 (100.0)	461 (18.3)	13 (0.5)	310 (12.3)
Age				
12 to <15	1247 (49.4)	22.5	0.4	12.3
≥15 to 17	1275 (50.6)	14.2	0.6	12.2
p-value		<0.001	0.427	0.930
Gender				
Boys	1301 (51.6)	19.7	0.5	8.1
Girls	1221 (48.4)	16.8	0.6	16.9
p-value		0.061	0.694	<0.001
Country of Birth				
Australia	2168 (85.9)	18.5	0.6	12.6
Overseas	354 (14.1)	16.7	0.0	10.5
p-value		0.397	0.144	0.255
Location				
Cities	1627 (64.5)	17.0	0.7	11.7
Regional/Remote	895 (35.5)	20.6	0.1	13.4
p-value		0.028	0.036	0.206
Schooling				
No	210 (8.3)	16.7	0.5	14.8
Yes	2312 (91.7)	18.4	0.5	12.1
p-value		0.528	0.934	0.255
Family type[a]				
Original	1493 (59.2)	17.4	0.3	10.1
Step/Blended/Others	1029 (40.8)	19.5	0.9	15.6
p-value		0.176	0.037	<0.001
Family income[b]				
Low	589 (23.4)	20.4	0.7	14.4
Medium	1183 (46.9)	18.1	0.4	12.2
High	750 (29.7)	16.9	0.5	10.8
p-value		0.264	0.775	0.131
Substance use by the child[c]				
No	1399 (55.5)	20.4	0.6	8.1
Yes	1123 (44.5)	15.7	0.5	17.6
p-value		0.002	0.659	<0.001

Notes:
- [a]Family type: original families mean children are natural, adopted, or foster child of both parents, and no stepchild; other families include step, blended and children from families who are not natural, adopted, foster or step of either parent.
- [b]Household income: Low (<$52,000), Medium ($52,000-$129,999) and High (>$130,000).
- [c]Ever seriously try cigarette smoking, drink alcohol, cannabis, or any other illegal drugs.
- *Traditional bullying: Following questions were considered to code as 1 (Yes) and 0 (No), "Hit, kicked, or pushed around; Made fun of or teased in a mean and hurtful way; Lies, rumours or nasty stories were spread; Threatened or made afraid; Deliberately ignored, left out on purpose or not allowed to join in;

Characteristics	Total n (%)	Traditional Bullying Only* (%)	Cyberbullying Only^ (%)	Both Traditional & Cyber (%)
Other young people stole things or from me, or broke or damaged my things deliberately; Teased about my race, the colour of my skin or my religion."; - ^Cyberbullying: Following questions were considered to code as 1 (Yes) and 0 (No), "Sent nasty messages by email, mobile phone, or on the internet; Nasty messages or pictures were sent about me to other young people via mobile phone, internet or email; Nasty comments or pictures were sent or posted about me on websites (e.g., Facebook or Twitter)"				

3.3 Crude association between bullying victimization (traditional, cyber and both), suicidal ideation and self-harm

Table 2 depicts crude associations between bullying victimization (traditional only, cyber only and both) with suicidal ideation and self-harm. Victims of traditional bullying only and both bullying incurred a significantly higher risk of suicidal ideation (traditional bullying only: COR 1.42, 95% CI: 1.07-1.89; both bullying: COR 7.30, 95% CI: 5.51-9.68), and self-harm (traditional bullying only: COR 1.17, 95% CI: 0.81-1.70; both bullying: COR 6.15, 95% CI: 4.48-8.45) compared to those adolescents who had not reported such threats.

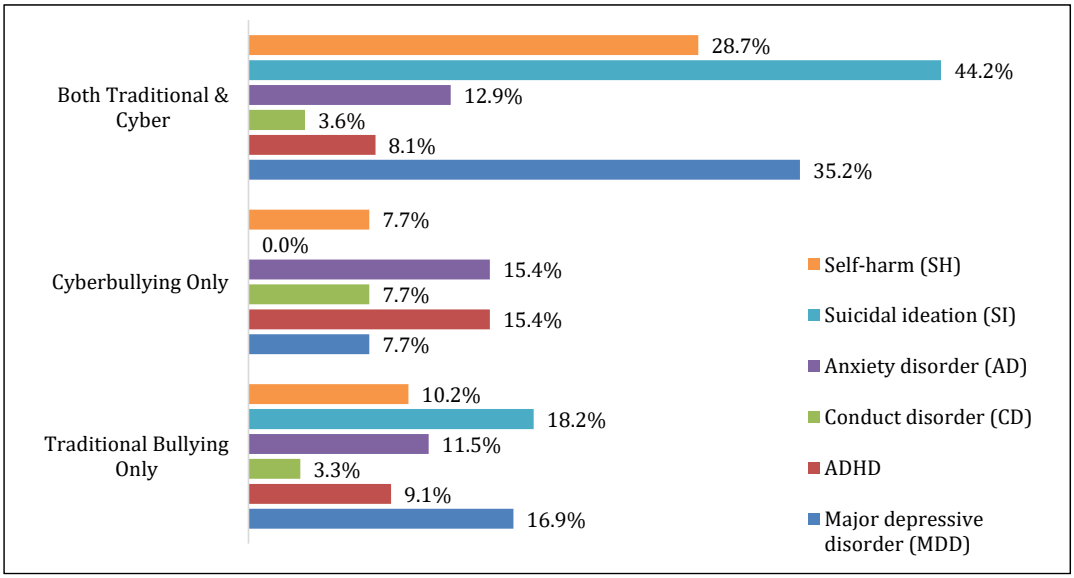


Figure 2 Prevalence (%) of mental disorders, suicidal ideation, and self-harm among bullying victims

3.4 Mediation analysis

A series of multivariate logistic regression analyses were performed, controlling potential covariates (age, gender, location, family type, substance use by the child) and the findings related to only mediation were summarized in Table 3.

Table 2 Crude associations of bullying victimization (traditional, cyber and both bullying) with suicidal ideation and self-harm.

	COR (95% CI)	*p*-value
Traditional bullying Only		
Suicidal ideation	1.42 (1.07, 1.89)	0.013
Self-harm	1.17 (0.81, 1.70)	0.391
Cyberbullying		
Suicidal ideation	-	-
Self-harm	0.41 (0.06, 2.72)	0.357
Both Traditional & Cyber		
Suicidal ideation	7.30 (5.51, 9.68)	<0.001
Self-harm	6.15 (4.48, 8.45)	<0.001
COR = Crude odds ratio; CI = confidence interval		

The regression odd ratio of the Path C between the independent variables (traditional bullying victimization only and both bullying victimization), and suicidal ideation was significant ($p<0.01$), while self-harm only found to be significantly ($p<0.001$) associated with both bullying victims. In Path B, among four mental disorders (mediator), only major depressive disorder and anxiety disorder found to be significantly associated with suicidal ideation and self-harm. Moreover, Path A in Table 3 shows that children who reported both bullying victimization and traditional bullying victimization only were respectively 3.40 (95% CI, 2.48-4.66) and 1.47 (95% CI, 1.04-2.08) times more likely to develop a major depressive disorder than those who had not reported any bullying victimizations. Anxiety disorder was only found to significantly associated with traditional bullying victims only (AOR 1.46, 95% CI, 1.02-2.09). Finally, the main effect of traditional bullying only and both bullying victimization on suicidal ideation and self-harm (not for traditional only victims) was significantly decreased in only most of the cases after controlling for specific mental disorders (Path C', Table 3). Hence, according to the criteria of Baron and Kenny's approach, we can conclude from the Table 3 that major depressive disorder has the mediating effect on the relationship of bullying victimization (traditional victims only and both bullying) with suicidal ideation and self-harming behaviours. Further, anxiety disorder found to be a significant mediator on the association between traditional bullying victims only and suicidal ideation. While ADHD and conduct disorder has no mediating effect on the association between bullying victimization, suicidal ideation, and self-harm.

Table 3 Mediation analyses using Baron and Kenny's approach

Path A (BV → MDs)	Traditional bullying Only AOR (95% CI)	Both (Traditional + Cyber) AOR (95% CI)		
MDD	1.47* (1.04, 2.08)	3.40*** (2.48, 4.66)		
ADHD	1.29 (0.85, 1.94)	1.40 (0.83, 2.38)		
CD	1.72 (0.80, 3.68)	1.85 (0.73, 4.66)		
AD	1.46* (1.02, 2.09)	1.39 (0.95, 2.04)		
Path B (MDs → SI & SH)	Major depressive disorder AOR (95% CI)	ADHD AOR (95% CI)	Conduct disorder AOR (95% CI)	Anxiety disorder AOR (95% CI)
Suicidal ideation	8.39*** (6.25, 11.28)	1.21 (0.71, 2.05)	1.55 (0.73, 3.32)	2.22*** (1.56, 3.16)
Self-harm	8.83*** (6.38, 12.22)	0.96 (0.51, 1.84)	1.00 (0.37, 2.71)	2.15*** (1.40, 3.30)
Path C (BV → SI & SH)	Traditional bullying Only AOR (95% CI)	Both (Traditional + Cyber) AOR (95% CI)		
Suicidal ideation	1.65** (1.22, 2.22)	5.16*** (3.83, 6.94)		
Self-harm	1.46 (0.98, 2.18)	3.85*** (2.72, 5.44)		
Path C' (BV → SI & SH)	Traditional bullying Only AOR (95% CI)	Both (Traditional + Cyber) AOR (95% CI)		
Suicidal ideation				
SIa	1.54** (1.09, 2.18)	4.18*** (2.90, 5.87)		
SIb	1.64** (1.21, 2.21)	5.14*** (3.82, 6.92)		
SIc	1.63** (1.21, 2.20)	5.14*** (3.81, 6.92)		
SId	1.62** (1.20, 2.18)	5.12*** (3.78, 6.94)		
Self-harm				
SHa	1.35 (0.87, 2.07)	2.65*** (1.79, 3.93)		
SHb	1.46 (0.98, 2.18)	3.86*** (2.72, 5.46)		
SHc	1.47 (0.98, 2.19)	3.85*** (2.72, 5.44)		
SHd	1.43 (0.96, 2.14)	3.77*** (2.65, 5.34)		
Sobel Test†	**p-value**			
Traditional BV → MDD → SI	0.026			
Both BV → MDD → SI	<0.001			
Traditional BV → MDD → SH	0.027			
Both BV → MDD → SH	<0.001			
Traditional BV → AD → SI	0.012			

Notes: - BV= Bullying Victimization; MDs= Mental disorders (MDD, ADHD, CD and AD); SI= Suicidal Ideation; SH= Self-harm; AOR = Adjusted odds ratio; CI = Confidence interval.
- All Model adjusted for age, gender, location, family type, substance use by the child.
- Path A: BV (Traditional only and Both) is the independent variable and specific MDs (Major depressive disorder/ADHD/Conduct disorder/Anxiety disorder) is the outcome variable.
- Path B: MDs (Major depressive disorder/ADHD/Conduct disorder/Anxiety disorder) is the independent variable, and SI and SH is the outcome variable.
- Path C: BV (Traditional only and Both) is the independent variable, and SI and SH is the outcome variable.
- Path C': BV (Traditional only and Both) is the independent variable, and SI and SH is the outcome variable; Here, OR from regression model adjusted for the specific MDs (Major depressive disorder/ADHD/Conduct disorder/Anxiety disorder)
- SIa. Estimating the mediating effect of major depressive disorder on the relationship between BV and SI
- SIb. Estimating the mediating effect of ADHD on the relationship between BV and SI
- SIc. Estimating the mediating effect of conduct disorder on the relationship between BV and SI
- SId. Estimating the mediating effect of anxiety disorder on the relationship between BV and SI
- SHa. Estimating the mediating effect of major depressive disorder on the relationship between BV and SH
- SHb. Estimating the mediating effect of ADHD on the relationship between BV and SH
- SHc. Estimating the mediating effect of conduct disorder on the relationship between BV and SH
- SHd. Estimating the mediating effect of anxiety disorder on the relationship between BV and SH
- †Sobel test: Indirect effect of mediation and its significance was estimated by multiplying two regression coefficients together, the partial regression effect for MDs (Major depressive disorder/ADHD/Conduct disorder/Anxiety disorder) predicting SI and SH, and the simple coefficient for BV predicting MDs. Note that the Sobel test was performed only for those variables who fulfilled all the criteria of Baron and Kenny's approach.
- Survey weight-adjusted
- ***p<0.001, **p<0.01, *p<0.05 considered significant

Finally, the Sobel test was performed only for those variables who fulfilled all the criteria of Baron and Kenny's approach to test the indirect effect of mediation (Type II error) and found a significant mediatory role of major depressive

disorder ($p<0.05$) on the association between bullying victimization (traditional only and both) suicidal ideation and self-harm among 12-17-year-olds children. The mediation analysis also revealed that traditional bullying victimization affects suicidal ideation and self-harm via anxiety disorder ($p<0.05$).

4. Discussion

This research validated and expanded findings found in previous US and Canadian studies (Goebert et al., 2011; Hinduja & Patchin, 2010; Schneider et al., 2012) and indicated that bullying victims (traditional only or both traditional and cyber) are at risk of certain mental disorders such as major depressive disorder and anxiety disorder, which in turn initiates suicidal and self-harming behaviours among children and adolescents.

In Australia, the prevalence of traditional bullying only, cyberbullying only and both bullying was respectively around 19%, 0.5% and 12% in children aged 12-17 years, which corroborated the previous studies conducted in other developed countries, including Australia (Ford et al., 2017; Jadambaa et al., 2019; Litwiller & Brausch, 2013; Messias et al., 2014; Thomas et al., 2017). In consistent with past research, the study found that girls were more likely to be cyber bullied compared to boys; as cyberbullying is web-based and girls may communicate with each other more frequently than boys through text, social media, and email (Barzilay et al., 2017; Messias et al., 2014; Sampasa-Kanyinga et al., 2014). Like other studies, substance use among bullying victims found to be congruent (Litwiller & Brausch, 2013; Thomas et al., 2016).

The present study also estimated that the prevalence of major depressive disorder (35.2%), ADHD (8.1%), anxiety disorder (12.9%), conduct disorder (3.6%), suicidal ideation (44.2%) and non-suicidal self-harm (28.7%) in adolescents who experienced both traditional bullying and cyberbullying victimization, and found that the figures were consistent with previous studies (Bannink et al., 2014; Ford et al., 2017; Jadambaa et al., 2019; Thomas et al., 2016; Thomas et al., 2017). Although, research suggests that major depressive disorder and anxiety disorder were among the most commonly diagnosed mental disorder in bullying victims in Australia (Jadambaa et al., 2020; Slade et al., 2007), surprisingly, our study found that ADHD also commonly occurs among

cyberbullying victims only. However, the rates of mental disorders were found to be less frequent among the cyberbullied adolescents than only traditionally bullied victims (Bonanno & Hymel, 2013). Moreover, traditionally bullying victims only were found to be more involved in suicidal ideation and self-harming behaviours compared to cyberbullying victims only, although several studies reported that cyberbullying victimization may have more chances to be involved in suicidal ideation and self-harm than traditional bullying victimization (Alavi et al., 2015; Klomek et al., 2010).

In accordance with existing research, the results showed that being bullied (traditional only and both bullying, not cyber only) is significantly associated with the higher risk of developing suicidal ideation and non-suicidal self-harm among adolescents (Hong, Kral, & Sterzing, 2015; Tang et al., 2020). This can be due to the fact that being bullied is stressful, which can cause multiple psychopathological changes, including extreme depression, consequently suicidal ideation and/or self-harm (Baiden & Tadeo, 2020; Ford et al., 2017).

In the current study, the mediating role of major depressive disorder on the association of traditional bullying only and both bullying victimization with suicidal ideation and self-harm is found to be congruent with previous studies (Baiden, Stewart, & Fallon, 2017; Bauman et al., 2013; Sampasa-Kanyinga et al., 2014). This may be because depressive symptoms may affect moods, interpersonal relationships and performance in school or among peers, which triggers the risk of suicide and /or self-harm (Hong et al., 2015; Lewinsohn, Rohde, & Seeley, 1994). However, Espelage and Holt (2013) found minimal effect of depression on the association between bullying victimization and suicidal ideation and/or self-harm among the US children. Another study involving 10-countries in Europe reported those depressive disorder alone does not have any mediating effect on the association between bullying victimization and suicidal ideation and/or self-harm (Barzilay et al., 2017).

Although only a few studies consider other mental disorders such as anxiety disorder, ADHD and conduct disorder as a mediator (Barzilay et al., 2017; Kim, Koh, & Leventhal, 2005); this study found that the effect of only traditional bullying victimization on suicidal ideation was mediated by anxiety disorder,

which was consistent with previous research findings (Hong et al., 2015). This is may be due to the fact that the associations between bullying, anxiety, suicidal ideation remain elusive and traditional bullying victims only are vulnerable to anxiety which can lead to suicidal behaviours (Hong et al., 2015). Interestingly, the study did not find any mediating effect of ADHD and/or conduct disorder on the relationship between bullying victimization, suicidal ideation and self-harming behaviours, although previous studies claimed that ADHD and conduct disorder alone can be a potential risk factor for suicidal ideation and self-harm (Chen, Chen, & Gau, 2019). While another study involving 10-countries in Europe reported that depressive disorder and/or anxiety alone do not have any mediating effect on the association between bullying victimization, suicidal ideation and self-harm (Barzilay et al., 2017).

Since there are limited empirical evidence why bullying victimization (traditional only, cyber only or both) enhances the risk of suicidal ideation and self-harm among adolescents (Litwiller & Brausch, 2013); findings of the current study has some important implications for clinicians, psychologists, social workers, mental health practitioners and policy makers for preventing health risk behaviours such as suicidal ideation and self-harm not only in Australia but also globally. Assessment of adolescents with mental disorders can include a brief evaluation to determine any history of bullying; as it is acknowledged that the better integration of preventive measures in reliable measures is important if preventive strategies are to be effective (Cross et al., 2016; Thomas et al., 2017).

The current study has some shortcomings. First, the cross-sectional study design limits to establish the temporal and causal relationship between bullying victimization, suicidal ideation and self-harm. Second, although self-reported data are strong indicators for risk behaviours such as bullying, suicidal and self-harming behaviours; measurement error and social desirability bias are more likely to occur (Cornell & Bandyopadhyay, 2009). The survey covered a variety of subjects related to mental health and kept the response burden to a minimum, as much as possible. However, global bullying issues have enough psychometric properties and are often popular in population studies (Solberg & Olweus, 2003).

In conclusion, current population estimates demonstrate major depressive disorder has mediating effect on the relationship between bullying victimization (traditional only and both), suicidal ideation and self-harm among adolescents. Further, anxiety disorder mediated the association between traditional bullying victims only and suicidal ideation. Findings also suggest that understanding these relationships are pivotal for parents, teachers, practitioners, and policymakers to combat bullying and its related harm from policy perspectives. Results also emphasize the global need to address mental disorders among bullying victims to help prevent the risk of suicidality and self-harm in adolescents.

References

ABS. (2019). Causes of Death, Australia, 2018. Retrieved from https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/3303.0~2018~Main%20Features~Intentional%20self-harm,%20key%20characteristics~3

Agnew, R. (1992). Foundation for a general strain theory of crime and delinquency. *Criminology, 30*(1), 47-88.

AIHW. (2019). Deaths in Australia. Retrieved from https://www.aihw.gov.au/reports/life-expectancy-death/deaths-in-australia

Alavi, N., Roberts, N., Sutton, C., Axas, N., & Repetti, L. (2015). Bullying victimization (being bullied) among adolescents referred for urgent psychiatric consultation: prevalence and association with suicidality. *The Canadian Journal of Psychiatry, 60*(10), 427-431.

APA. (2013). Diagnostic and statistical manual of mental disorders. *BMC Med, 17*, 133-137.

Baiden, P., Stewart, S. L., & Fallon, B. (2017). The mediating effect of depressive symptoms on the relationship between bullying victimization and non-suicidal self-injury among adolescents: Findings from community and inpatient mental health settings in Ontario, Canada. *Psychiatry Research, 255*, 238-247.

Baiden, P., & Tadeo, S. K. (2020). Investigating the association between bullying victimization and suicidal ideation among adolescents: evidence from the 2017 Youth Risk Behavior Survey. *Child Abuse & Neglect, 102*, 104417.

Bannink, R., Broeren, S., van de Looij–Jansen, P. M., de Waart, F. G., & Raat, H. (2014). Cyber and traditional bullying victimization as a risk factor for mental health problems and suicidal ideation in adolescents. *PloS one, 9*(4), e94026.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology, 51*(6), 1173.

Barzilay, S., Klomek, A. B., Apter, A., Carli, V., Wasserman, C., Hadlaczky, G., . . . Kereszteny, A. (2017). Bullying victimization and suicide ideation and

behavior among adolescents in Europe: A 10-country study. *Journal of Adolescent Health, 61*(2), 179-186.

Bauman, S., Toomey, R. B., & Walker, J. L. (2013). Associations among bullying, cyberbullying, and suicide in high school students. *Journal of adolescence, 36*(2), 341-350.

Bonanno, R. A., & Hymel, S. (2013). Cyber bullying and internalizing difficulties: Above and beyond the impact of traditional forms of bullying. *Journal of youth and adolescence, 42*(5), 685-697.

CDC. (2014). Adolescent and School Health: YRBSS Questionnaires. Retrieved from https://www.cdc.gov/healthyyouth/data/yrbs/questionnaires.htm

Chen, Y.-Y., Chen, Y.-L., & Gau, S. S.-F. (2019). Attention-deficit hyperactivity disorder and suicidality: the mediating effects of psychiatric comorbidities and family function. *Journal of affective disorders, 242*, 96-104.

Cornell, D., & Bandyopadhyay, S. (2009). The assessment of bullying. *The international handbook of school bullying*, 265-276.

Cross, D., Shaw, T., Hadwen, K., Cardoso, P., Slee, P., Roberts, C., . . . Barnes, A. (2016). Longitudinal impact of the Cyber Friendly Schools program on adolescents' cyberbullying behavior. *Aggressive behavior, 42*(2), 166-180.

Curtin, S. C., & Heron, M. P. (2019). Death rates due to suicide and homicide among persons aged 10–24: United States, 2000–2017.

Espelage, D. L., & Holt, M. K. (2013). Suicidal ideation and school bullying experiences after controlling for depression and delinquency. *Journal of Adolescent Health, 53*(1), S27-S31.

Extremera, N., Quintana-Orts, C., Mérida-López, S., & Rey, L. (2018). Cyberbullying victimization, self-esteem and suicidal ideation in adolescence: does emotional intelligence play a buffering role? *Frontiers in psychology, 9*, 367.

Fisher, P. W., Shaffer, D., Piacentini, J. C., Lapkin, J., Kafantaris, V., Leonard, H., & Herzog, D. B. (1993). Sensitivity of the Diagnostic Interview Schedule for Children, (DISC-2.1) for specific diagnoses of children and adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry, 32*(3), 666-673.

Ford, R., King, T., Priest, N., & Kavanagh, A. (2017). Bullying and mental health and suicidal behaviour among 14-to 15-year-olds in a representative sample of Australian children. *Australian & New Zealand Journal of Psychiatry, 51*(9), 897-908.

Forsyth, C. J., Biggar Jr, R. W., & Chen, J. (2020). Bullied youth: suicide attempts, planning, ideation, and pre-ideation. *Criminal Justice Studies, 33*(2), 170-177.

Goebert, D., Else, I., Matsu, C., Chung-Do, J., & Chang, J. Y. (2011). The impact of cyberbullying on substance use and mental health in a multiethnic sample. *Maternal and child health journal, 15*(8), 1282-1286.

Hafekost, J., Lawrence, D., Boterhoven de Haan, K., Johnson, S. E., Saw, S., Buckingham, W. J., . . . Zubrick, S. R. (2016). Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 866-875.

Hemphill, S. A., Kotevski, A., & Heerde, J. A. (2015). Longitudinal associations between cyber-bullying perpetration and victimization and problem behavior and mental health problems in young Australians. *International journal of public health, 60*(2), 227-237.

Hinduja, S., & Patchin, J. W. (2010). Bullying, cyberbullying, and suicide. *Archives of suicide research, 14*(3), 206-221.

Hong, J. S., Kral, M. J., & Sterzing, P. R. (2015). Pathways from bullying perpetration, victimization, and bully victimization to suicidality among school-aged youth: A review of the potential mediators and a call for further investigation. *Trauma, Violence, & Abuse, 16*(4), 379-390.

Jadambaa, A., Thomas, H. J., Scott, J. G., Graves, N., Brain, D., & Pacella, R. (2019). Prevalence of traditional bullying and cyberbullying among children and adolescents in Australia: A systematic review and meta-analysis. *Australian & New Zealand Journal of Psychiatry*, 0004867419846393.

Jadambaa, A., Thomas, H. J., Scott, J. G., Graves, N., Brain, D., & Pacella, R. (2020). The contribution of bullying victimisation to the burden of anxiety and depressive disorders in Australia. *Epidemiology and psychiatric sciences, 29*.

John, A., Glendenning, A. C., Marchant, A., Montgomery, P., Stewart, A., Wood, S., . . . Hawton, K. (2018). Self-harm, suicidal behaviours, and cyberbullying in children and young people: Systematic review. *Journal of medical internet research, 20*(4), e129.

Kim, Y. S., Koh, Y.-J., & Leventhal, B. (2005). School bullying and suicidal risk in Korean middle school students. *Pediatrics, 115*(2), 357-363.

Kinchin, I., & Doran, C. (2018). The cost of youth suicide in Australia. *International journal of environmental research and public health, 15*(4), 672.

Klomek, A. B., Sourander, A., & Gould, M. (2010). The association of suicide and bullying in childhood to young adulthood: A review of cross-sectional and longitudinal research findings. *The Canadian Journal of Psychiatry, 55*(5), 282-288.

Kowalski, R. M., & Limber, S. P. (2013). Psychological, physical, and academic correlates of cyberbullying and traditional bullying. *Journal of Adolescent Health, 53*(1), S13-S20.

Lawrence, D., Hafekost, J., Johnson, S. E., Saw, S., Buckingham, W. J., Sawyer, M. G., . . . Zubrick, S. R. (2016). Key findings from the second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 876-886.

Lewinsohn, P. M., Rohde, P., & Seeley, J. R. (1994). Psychosocial risk factors for future adolescent suicide attempts. *Journal of consulting and clinical psychology, 62*(2), 297.

Litwiller, B. J., & Brausch, A. M. (2013). Cyber bullying and physical bullying in adolescent suicide: the role of violent behavior and substance use. *Journal of youth and adolescence, 42*(5), 675-684.

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. *Annu. Rev. Psychol., 58*, 593-614.

Messias, E., Kindrick, K., & Castro, J. (2014). School bullying, cyberbullying, or both: correlates of teen suicidality in the 2011 CDC Youth Risk Behavior Survey. *Comprehensive psychiatry, 55*(5), 1063-1068.

Oexle, N., Ribeiro, W., Fisher, H. L., Gronholm, P. C., Laurens, K. R., Pan, P., . . . Evans-Lacko, S. (2020). Childhood bullying victimization, self-labelling,

and help-seeking for mental health problems. *Social psychiatry and psychiatric epidemiology, 55*(1), 81-88.

Patchin, J. W., & Hinduja, S. (2011). Traditional and nontraditional bullying among youth: A test of general strain theory. *Youth & Society, 43*(2), 727-751.

Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., . . . Bonell, C. (2016). Our future: a Lancet commission on adolescent health and wellbeing. *The Lancet, 387*(10036), 2423-2478.

Perren, S., Dooley, J., Shaw, T., & Cross, D. (2010). Bullying in school and cyberspace: Associations with depressive symptoms in Swiss and Australian adolescents. *Child and adolescent psychiatry and mental health, 4*(1), 28.

Quintana-Orts, C., Rey, L., Mérida-López, S., & Extremera, N. (2019). What bridges the gap between emotional intelligence and suicide risk in victims of bullying? A moderated mediation study. *Journal of affective disorders, 245*, 798-805.

Sampasa-Kanyinga, H., Roumeliotis, P., & Xu, H. (2014). Associations between cyberbullying and school bullying victimization and suicidal ideation, plans and attempts among Canadian schoolchildren. *PloS one, 9*(7), e102145.

Schneider, S. K., O'donnell, L., Stueve, A., & Coulter, R. W. (2012). Cyberbullying, school bullying, and psychological distress: A regional census of high school students. *American journal of public health, 102*(1), 171-177.

Slade, T., Johnston, A., Teesson, M., Whiteford, H., Burgess, P., Pirkis, J., & Saw, S. (2007). The mental health of Australians 2. *Report on the, 20*(07).

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological methodology, 13*, 290-312.

Solberg, M. E., & Olweus, D. (2003). Prevalence estimation of school bullying with the Olweus Bully/Victim Questionnaire. *Aggressive Behavior: Official Journal of the International Society for Research on Aggression, 29*(3), 239-268.

Tang, J. J., Yu, Y., Wilcox, H. C., Kang, C., Wang, K., Wang, C., . . . Chen, R. (2020). Global risks of suicidal behaviours and being bullied and their association

in adolescents: School-based health survey in 83 countries. *EClinicalMedicine, 19*, 100253.

Thomas, H. J., Chan, G. C., Scott, J. G., Connor, J. P., Kelly, A. B., & Williams, J. (2016). Association of different forms of bullying victimisation with adolescents' psychological distress and reduced emotional wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(4), 371-379.

Thomas, H. J., Connor, J. P., Lawrence, D. M., Hafekost, J. M., Zubrick, S. R., & Scott, J. G. (2017). Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. *Australian & New Zealand Journal of Psychiatry, 51*(9), 909-920.

Wallace, L. H., Patchin, J. W., & May, J. D. (2005). Reactions of Victimized Youth: Strain as an Explanation of School Delinquency. *Western criminology review, 6*(1).

Zubrick, S. R., Hafekost, J., Johnson, S. E., Lawrence, D., Saw, S., Sawyer, M., . . . Buckingham, W. J. (2016a). Self-harm: prevalence estimates from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 911-921.

Zubrick, S. R., Hafekost, J., Johnson, S. E., Lawrence, D., Saw, S., Sawyer, M., . . . Buckingham, W. J. (2016b). Suicidal behaviours: prevalence estimates from the second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 899-910.

CHAPTER 3 – RESEARCH THEME II

3.0 Overview

Research Theme II - Assessing mental health services utilization among adolescents with behavioural and mental health issues, is described in Chapter 3 of this PhD thesis. Three studies *(Study 4-6)* are included in *Research Theme II*, which, assessed the effect of social determinants (demographic, socioeconomic, behavioural, psychological, biological etc.), bullying victimization and mental health problems (mental disorders, self-harm, and suicidality) in the utilization of mental health services among adolescents in Australia. Outline of each included studies in this theme are given below,

- *Study 4* explored whether traditional bullying and cyberbullying victims had access to mental health services, and estimated the effect of interaction between bullying, mental illness, self-harm, and suicidality on each service among children and adolescents. Results showed a significant association between bullying victimization and mental health services access; however, the number of users was limited. Surprisingly, only school service was only found to be significantly associated with the interaction between traditional bullying, self-harm and suicidality. This study indicated the need for future research on mental health services among children and adolescents with behavioural and mental health problems.
- *Study 5* identified the factors associated with mental health services in children and adolescents with mental disorder and suicidality. Findings of this study showed that children and adolescents who reported suicidality accessed more mental health services compared to those who diagnosed with a mental disorder, although the proportion of accessing mental health services is less than 50%. *Study 5* also found girls, older age-group, children, and adolescents from low socioeconomic status and those who had a history of substance use accessed more services than their counterparts. In conclusion, this study suggests the need for future longitudinal research to address barriers that might restrict the use of mental health services in children with mental disorder and suicidality.

- *Study 6* examined the relationship between suicidality and the use of mental health services by Australian children and adolescents, and whether service use influenced by the simultaneous presence of suicidality and mental illnesses. Findings of this study found that health services and online services were mostly preferred, while school and telephone services were among the least used services. This study also found that a small number of children and adolescents with suicidal behaviour are using mental health services, which is alarming for suicide prevention. *Study 6* concludes that researchers and policymakers should focus the children and adolescents who reported suicidal behaviour for the promotion of effective suicide prevention and intervention program.

Details of the above-conducted studies under *Research Theme II* are illustrated in the next pages of this Chapter 3.

3.1 Study 4 – Mental health services use among adolescent bullying victims in Australia: Results from a nationwide survey (Under 2nd review in the Children and Youth Services Review, Q1, IF: 1.870, SNIP: 1.104, Publisher – Elsevier)

Abstract

Background:

Research supports a robust association between bullying, mental disorder, self-harm, and suicidal ideation in adolescence; however, the relation between bullying victimization and access to mental health services is incompletely understood. This study investigated whether traditional and cyberbullying victimization were associated with access to mental health services in adolescents, and to test the interaction between bullying victimization with a mental disorder, self-harm, and suicidality on each service.

Methods:

Data analyses were conducted on 2218 Australian adolescents aged 12-17 years using the Young Minds Matter survey. Binary logistic regression models were employed to assess the odds of using mental health services (health, school, telephone and online) separately among traditional bullying and cyberbullying victims. Interaction terms – 'bullying victimization and mental disorder', 'bullying victimization and self-harm', and 'bullying victimization and suicidal ideation', were included in the regression models to examine whether and to what extent service use is affected respectively among traditionally bullied and cyberbullied sample.

Results:

Overall, 27.6% and 11.2% of adolescents experienced traditional bullying and cyberbullying, respectively. Also, the percentages of any mental disorder (20.4%) and health-risk behaviours (self-harm - 7.6% and suicidal ideation - 8.3%) were significant among the sample. Although many bullying victims did not use any services, both bivariate and multivariate analyses showed a strong and significant association between bullying victimization (traditional and cyber) and access to mental health services. Adolescents who reported both traditional

bullying victimization and self-harm were found to be significantly associated with school service ($p<0.05$). School service was also significantly ($p<0.05$) used among those who experienced both traditional bullying victimization and suicidal ideation. Surprisingly, other interaction terms did not show any significant change on the service use among bullying victims.

Conclusion:

A limited number of bullying victims with or without mental health problems (mental disorder, self-harm and suicidal ideation) use mental health services. Further research is warranted to identify the barriers to service use and to promote service utilization in adolescent bullying victims in a way which prevents the effects of bullying timely.

Keywords

Traditional bullying; Cyberbullying; Mental disorder; Self-harm; Suicidal ideation; Mental health services

Introduction

Bullying is a repetitive detrimental intentional insisted act between victim and perpetrator, which typically involves an imbalance in power (1, 2). It may be physical (threats and hitting), relational (social exclusion and spreading rumours), verbal (teasing, name-calling) and cyber (3, 4). Bullying in children and adolescents has been associated with various adverse consequences on social, physical and mental well-being, even in adulthood (5-7). Recent studies have identified bullying (traditional and cyber) victimization as a risk factor for mental disorders, suicidal behaviour and deliberate self-harm in children and adolescents (8-10). For example, Jadambaa, Thomas (8) reported that bullying victimization significantly contributes to the burden of mental disorders such as depression and anxiety disorder. Other studies estimated a threefold increase in suicidality among bullying victims compared to non-victims even after controlling the effects of depression and delinquency (11). Studies have reported that, besides traditional form of bullying, cyberbullying was also found to be positively associated with poor mental health including suicidality and self-harm in children and adolescents (12, 13). A meta-analysis found that cyberbullying victimization is an important factor for suicidality than in traditional bullying victimization (16). In addition, studies claimed that cyberbullying victims experience more distressing symptoms compared to traditional bullying victims (12, 17).

Bullying (traditional and cyber) constitutes a serious public health concern mostly in high-income countries, due to its high prevalence and its persistent contribution to mental health problems in children and adolescents (10, 18, 19). Several studies reported gender variation in experiencing different forms of bullying. For instance, boys were more involved in physical forms of bullying (e.g., hitting and shoving) while girls oppressed with relational social discriminations (e.g., social exclusion and rumours) (3, 20, 21). However, bullying in the form of name-calling, teasing, and intentional exclusion was commonly experienced by boys and girls (21). While a recent meta-analysis reported girls experience cyberbullying victimization more than the boys experience (22). The occurrence of bullying often follows a normal bell curve

across countries, starting in early elementary school age, peaking in the early secondary school age, and starting to decline in late adolescence (23-25). A study reported that about 32% of school-aged children across 38 European countries experienced bullying victimization (26) and another study in the UK reported that 21% of schoolchildren were being bullied (27). A meta-analysis using 80 studies reported 36% bullying prevalence in children and adolescents (28), and shed light on the most effective timing for launching preventive initiatives.

In Australia, a study conducted in Victoria reported that 31% of Victorian adolescents experienced verbal bullying, 11% experienced physical bullying, 14% experienced social exclusion, and 18% oppressed of humour (29). Another study carried out in New South Wales and Victoria revealed a positive association between bullying at the age of 13 years and substance use at the age of 15 years (30). Other studies in Australia reported that about one in seven adolescents and one in four school-going children experienced frequent bullying (22, 31). Since a majority of the research on bullying in Australia is generated using state-level data by focusing specific forms of bullying and its associated risk factors such as cyberbullying, relational bullying, school environments, and intrinsic or extrinsic factors (32-35), it clearly demands population-based estimates.

There are several ways to help children and adolescents to cope with bullying. For example, several studies reported parental monitoring, connectedness, and peer support as potential approaches to reduce suicidality and self-harm due to bullying (36-38). However, other studies suggested gender-specific approaches (39) as research reported gender variation on experiencing different forms of bullying (3, 20). Other studies revealed that peer and family support may not be adequate to recover adolescents from their mental health traumas due to bullying, and suggested that children and adolescents involved in bullying should be regularly monitored to provide timely intervention from schools and/or community for mental health problems, suicidality and deliberate self-harm (40, 41). In Australia, there are several active services such as health services, school services, telephone counselling services, and online services, which are provided to the adolescent who is victimized by bullying (42). A recent study in Australia reported that only 12.9% of adolescents who experienced suicidality had used

health services, and the proportion was even lower among adolescents with any of the four common mental health disorders – anxiety disorder, major depressive disorder, attention-deficit-hyperactivity disorder (ADHD) and conduct disorder (43, 44).

However, little is known about the service access among bullied (traditional and cyber) children and adolescents; moreover, to the best of our knowledge, no study has investigated such use of services among Australian adolescents bullying victims. Therefore, this study, which used the second Australian Child and Adolescent Survey of Mental Health and Wellbeing - Young Minds Matter (YMM), is timely in its examination of the probability of using mental health services among adolescents who experienced traditional bullying and cyberbullying victimization. Moreover, the study tested whether service use in bullying victims (traditional and cyber) affected by three interaction terms (i.e., bullying victimization with a mental disorder, bullying victimization with self-harm and bullying victimization with suicidal ideation). In line with previous research findings (18, 44, 45), this study hypothesized that being a victim of bullying (traditional or cyber) is associated with the increased use of mental health services compared to non-bullying victims. Also hypothesized that simultaneous presence of poor health conditions (such as any mental disorder, self-harm, or suicidal ideation) and bullying victimization is associated with increased service use.

Methods

Data description

The sample for this study is drawn from Young Minds Matter (YMM): the 2nd Australian Child and Adolescent Mental Health and Wellbeing Survey. YMM was a nationwide cross-sectional survey, conducted by Telethon Kids Institute in collaboration between the University of Western Australia (UWA), Roy Morgan Research and the Australian Government Department of Health in 2013-14. Since, previous research studies (46, 47) suggested that a huge proportion of adult populations with mental health problems had first onset of symptoms during childhood and/or adolescence; YMM tried to capture and provide updated comprehensive information on common mental health problems and changes in

service use among children and adolescents aged 4-17 years involving both parents and children (48-50).

YMM applied a multi-stage, area-based random sampling technique to survey households of 4-17-year-olds in Australia. Initially, based on the 2011 Census of Population and Housing, 225 Statistical Area 1 (as specified by the Australian Bureau of Statistics) areas were chosen. Then to ensure proportional representation of geographic areas across Australia, areas were stratified by state/territory and metropolitan versus non-metropolitan (rural/regional) (48, 51). In the survey, 6310 parents (55% of eligible households) of 4-17 aged children and adolescents were interviewed face-to-face to complete a structured Computer-Assisted Personal Interview (CAPI) questionnaire about one randomly selected child in the household. In addition, 2967 adolescents of 11-17 years (89% of eligible households) voluntarily participated in the survey and completed Computer-Assisted Self Interview (CASI) questionnaire privately at home to provide detailed information regarding health risk behaviours such as substance use, bullying, self-harm, suicidality, and service use (48, 49). However, the survey excluded children and adolescents from the most remote areas, homeless children/adolescents, and children/adolescents living in any organizational care, and households where the interviews were not possible in English (48, 49). All study participants provided written informed consent before completing the validated questionnaires used in the survey. Moreover, the YMM survey followed the Deville and Sarndal (52) generalised ranking strategy for data weighting to not only represent the nationwide resident population for the age group 4-17 years in Australia but also to address potential response biases. A detailed description of the survey methodology can be found elsewhere (48-51).

Ethics

The YMM survey was ethically approved by the respective Human Research Ethics Committees of the UWA and the Australian Government Department of Health (Project 17/2012). Since the YMM survey datasets and supporting documentations are stored by the Australian Data Archive (ADA) Dataverse repository (53), the author of this study obtained data access approval from ADA.

In addition, the author took ethical approval from the Human Research Ethics Committee (HREC) of the University of Southern Queensland (USQ), Australia for using YMM dataset for research and publications (HREC Approval No. H16REA205).

The following variables were considered in the analysis to achieve the study objectives:

Explanatory variables

- Bullying – Bullying victimization was assessed using items from the Olweus Bully–Victim Questionnaire and the Cyber Friendly Schools Project conducted by the Edith Cowan University, and was modified according to the YMM survey purpose to incorporate bullying (traditional and cyber) victimization in adolescents aged 11-17 years (25, 44). Traditional bullying was described as *"when people tease, threaten, spread, rumours about, hit, shove, or hurt other people over and over again"* and cyberbullying was defined as *"when people use mobile phones or the internet to send nasty or threatening emails or messages, post mean or nasty comments or pictures on websites like Facebook, or have someone pretend to be them online to hurt other people over and over again".* It was not considered as bullying when two individuals of similar power or command tease or pleasantly argue with each other.

The adolescents were asked directly about whether they had been bullied over the past 12 months using following questions: *"In the past 12 months, have you ever been bullied or cyberbullied?" with the bullying types listed below, "Hit, kicked, or pushed around", "Made fun of or teased in a mean and hurtful way", "Lies, rumours or nasty stories were spread", "Threatened or made afraid", "Deliberately ignored, left out on purpose or not allowed to join in", "Other young people stole things or from me, or broke or damaged my things deliberately", "Teased about my race, the colour of my skin or my religion", "Sent nasty messages by email, mobile phone, or on the internet", "Nasty messages or pictures were sent about me to other young people via mobile phone, internet or email", and "Nasty comments or pictures were sent or posted about me on websites (e.g. Facebook or Twitter)"*. For the analysis purpose, two distinct binary variables were created based on the responses of the questions related to traditional bullying victimization (coded as

1 for Yes and coded as 0 for No) and cyberbullying victimization (coded as 1 for Yes and coded as 0 for No).

- Mental disorders – Presence of any mental disorders among adolescents in the previous 12 months before the survey was assessed by the diagnostic interview schedule for children and adolescents -version IV (DISC-IV) (45, 46). Mental disorders included: major depressive disorder, attention-deficit hyperactivity disorder (ADHD), conduct disorder and anxiety disorder (includes social phobia, obsessive-compulsive disorder, separation and generalized anxiety) (43). In this paper, all response options for each disorder were combined to create a binary variable as the presence of any mental disorder – Yes (coded as 1) and No (coded as 0).
- Self-harm and Suicidal ideation – Questions measuring self-harm and suicidal ideation were collected from the Standard High School questionnaires of the Youth Risk Behaviour Survey (47). Self-harm was assessed with "Have you ever deliberately done something to yourself to cause harm or injury, without intending to end your own life?" – Yes (coded as 1) and No (coded as 0); suicidality was examined with the question: "During the past 12 months, did you ever seriously consider attempting suicide?" – Yes (coded as 1) and No (coded as 0) (48, 49).

Outcome variable

- Mental health service use – All consenting (both written and verbal) participants (parents and children) were interviewed about service use regarding behavioural and emotional problems in the previous 12 months (39, 40). For this paper, we combined both parent data and self-reported child data to create a dichotomous variable for each service, and responses were coded as '1' for Yes and '0' for No. Services included: (i) health service – provided by general practitioners, psychiatrists, psychologists, counsellors, psychotherapists, mental health nurses and/or social workers in any hospital or any mental healthcare facility, (ii) school service – provided at school or in any educational institution, (iii) telephone counselling service, (iv) online service.

Table 1 Sample characteristics, and by gender (n =2218)

Variables	Total N=2218 %	Boys n=1153 %	Girls n=1065 %	p-value* (χ^2)
Age (Mean= 14.96, SD=1.74)				
≥15 years	61.8	51.1	48.9	0.306
Country of Birth				
Australian	85.2	52.5	47.5	0.208
Area of residence				
Regional/Remote	35.2	54.7	45.3	0.055
Attending school				
Yes	91.9	52.1	47.9	0.634
Parental education				
Diploma	36.9	50.8	49.2	0.598
Year10/11	31.3	53.5	46.5	
Parental occupation				
Unemployed	23.5	50.3	49.7	0.376
Household income[1]				
Medium	46.4	51.5	48.5	0.908
High	29.9	52.6	47.4	
Internet Use[2]				
>2 hours/day	59.3	50.1	49.9	0.033
Electronic games-play[3]				
>2 hours/day	20.7	75.0	25.0	<0.001
Substance use[4]				
Yes	42.7	52.1	47.9	0.951
Bullying victims				
Traditional bullying[5]	27.6	46.5	53.5	0.001
Cyberbullying[6]	11.2	33.1	66.9	<0.001
Mental disorder[7]				
Yes	20.4	49.3	50.7	0.207
Self-harm[8]				
Yes	7.6	25.4	74.6	<0.001
Suicidal ideation[9]				
Yes	8.3	31.2	68.9	<0.001

Notes: *Pearson χ^2 test performed to examine gender differences
[1]Household income: Low (<$52000), Medium ($52000-$129999) and High (>$130000)
[2]Time usually spent on the computer, mobile or tablet, including accessing social media such as Facebook or Twitter, emailing, looking at websites or chatting online on a typical weekday;
[3]Playing an Xbox or similar console, online, on a handheld device, computer, or mobile phone on a typical weekday;
[4]Ever seriously try cigarette smoking, drink alcohol, cannabis or any other illegal drugs;
[5]Traditional bullying victimization includes - Hit, kicked, or pushed around; Made fun of or teased in a mean and hurtful way; Lies, rumours or nasty stories were spread; Threatened or made afraid; Deliberately ignored, left out on purpose or not allowed to join in; Other young people stole things or broke or damaged things deliberately; Teased about race, the colour of skin or religion;
[6]Cyberbullying victimization includes - Sent nasty messages or photos by email, mobile phone, or using the internet; Nasty texts, comments or pictures were sent or posted in the social media such as Facebook or Twitter;
[7]It is the number (%) of children diagnosed with any of the following mental disorders - Attention Deficit Hyperactivity Disorder (ADHD) or Major depressive disorder or Anxiety disorder or Conduct disorder;
[8]Self-harm is number (%) of children deliberately done something to themselves to cause harm or injury, without intending to end their own life;
[9]Suicidal ideation is the number (%) of children seriously considered attempting suicide in the past 12 months.

Covariates

Age (<15 years vs. 15 years or older), gender (Boys vs. Girls), Country of Birth (Australia vs. Overseas), area of residence (Cities vs. Regional/Remote), Attending school (No vs. Yes), internet use (≤2 hours/day vs. >2 hours/day), electronic gameplay (≤2 hours/day vs. >2 hours/day), substance use by the child (No vs. Yes) were incorporated as potential confounders in this study.

Statistical analysis

The following criteria were used for evaluating the samples (n = 2218) collected after the self-reported child data and the parent data have been merged to achieve study objectives.

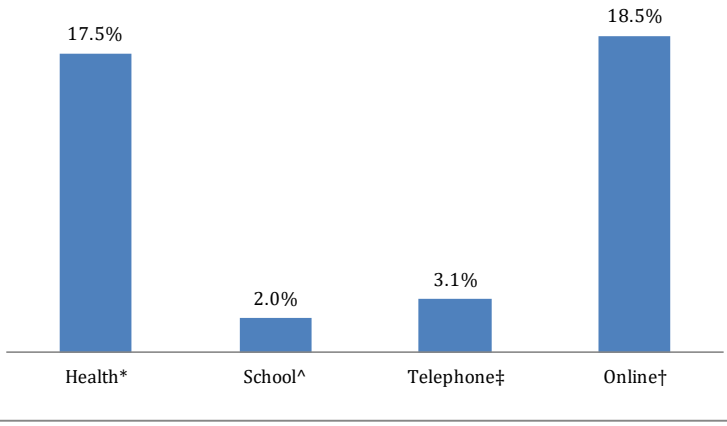
- The analysis was restricted to adolescents 12–17-year-olds to maintain age comparability across the survey as information related to suicidality/self-harm was restricted to 12-17 years age-group.
- 'Do not know' and 'Prefer not to say' response categories were omitted during analyses.

Descriptive statistics were used to describe the samples' general characteristics of the study population. Differences in age, ethnicity, area of residence, schooling, internet use, electronic gameplay, substance use, bullying victimization (traditional and cyber), mental disorder, self-harm and suicidal ideation between boys and girls were estimated using the Pearson chi-square tests. Distribution of mental health services use was calculated using the total sample and chi-square tests were also conducted to test the significance of the association between main explanatory variable (bullying victimization – traditional and cyber) and the outcome variable (mental health services).

Furthermore, binary logistic regression analysis was used to examine the association between bullying victimization (traditional and cyber) and mental health services use. Model 1 tested the association between bullying victimization (traditional and cyber) and mental health services, adjusting for covariates (i.e., age, gender, ethnicity, area of residence, internet use, electronic gameplay, and substance use). In Model 2, Model 3 and Model 4, mental disorder, self-harm, and suicidal ideation were respectively added to Model 1 to see the

changes in the odds of accessing mental health services among those who were traditionally bullied and cyberbullied. In addition, differences in services use for the two types of bullying (traditional and cyber) victimization were tested by adding three interaction terms – 'bullying victimization and mental disorder' in Model 2a, 'bullying victimization and self-harm' in Model 3a, and 'bullying victimization and suicidal ideation in Model 4a to Model 2, Model 3 and Model 4, respectively.

In addition, a correlation coefficient matrix of independent variables was estimated and the variance inflation factor (VIF) test was employed to detect the multicollinearity among the independent variables. Further, the model performance and assumption of each regression model was assessed by 'McKelvey & Zavoina Pseudo-R^2', one of the best estimator for the true R^2 of the binary logit models (60), and by 'Hosmer-Lemeshow Goodness-of-fit test' (61), respectively. Lastly, for each logit model 'Link test' (62) was performed for testing the model specification. All analyses were conducted with Stata/SE Version 14.1. Odds ratios (OR) and their corresponding 95% CI were calculated.



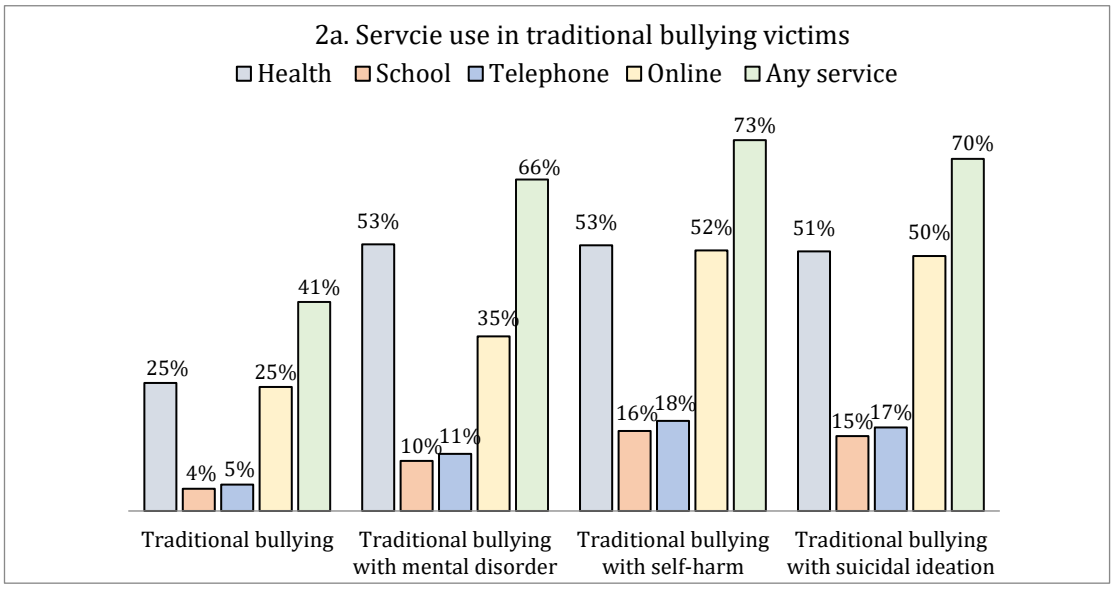
Notes:
*Health service: When chidlren recieved any services from private, hospital, CAMHS, public mental health, headspace centre, community and/or any health professional in last 12 months;
^School service: When children accessed any mental health realted counselling services in the school or in any educational institute
‡Telephone service: When children recieved any service through phone or mobile
†Online service: When children used online services to recieve mental health support or counselling or to participae in a personalised assessment program
** The 'Don't know' responses were omitted.

Figure 1 Distribution of mental health services (n=2218)

Results

Descriptive statistics

The mean age of the sampled adolescents (n=2218) was 14.96 (SD 1.74); 51.1% were boys and 85.2% was of Australian ethnicity (Table 1). In total, 27.6% of the adolescent was a traditional bullying victim and 11.2% was a victim of cyberbullying. Girls were more likely to report bullying victimization than boys (traditional bullying: 53.5%, p=0.001 and cyberbullying: 66.9%, p<0.001). Compared with boys, girls significantly experienced more self-harm ($\chi 2=51.62$; $p<0.002$) and suicidal ideation ($\chi 2=34.69$; $p<0.001$).



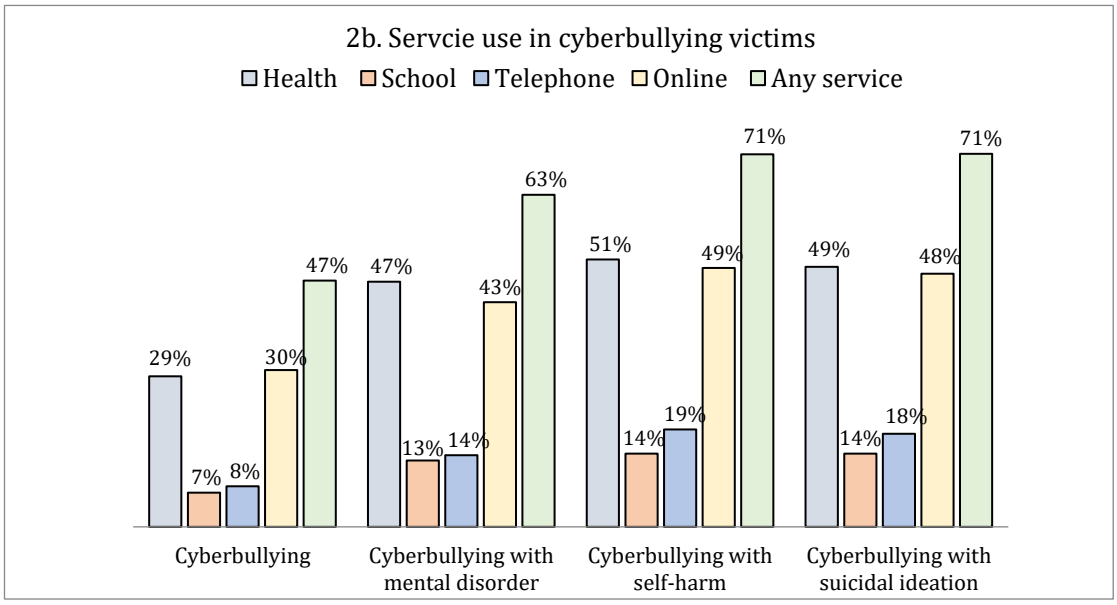


Figure 2 Mental health services use in bullying victims

Distribution of mental health services

Figure 1 illustrates that approximately 18.5% of adolescents aged 12 to 17 years accessed online services, which was highest; followed by health services use (17.5%). While only 3.1% of the same aged children accessed telephone counselling services. Also, shows that school services were the least used service by children.

Relationship between bullying victimization and mental health services

The bivariate analysis between the use of mental health services and bullying victimization shows that children of cyberbullying victims were the highest proportion of those who used any mental health services compared to traditional bullying victims (47%, $p<0.001$ vs. 41.3%, $p<0.001$; Figure 2); which means a significant proportion (more than 50%) of only bullying victims had not used any services. In both bullying forms (traditional or cyber), around 50% of children who reported bullying victimization with a mental disorder, self-harm or suicidal ideation accessed health services, a percentage which was higher compared to other services. As expected, online services were more commonly used by cyberbullying victims compared to traditional bullying victims. Further, school services and telephone services were found to be the least used services among bullying victims regardless of reporting with a mental disorder, self-harm, or suicidal ideation. Figure 2 also shows that nearly 30% of those who reported the bullying (traditional or cyber) with a mental disorder, self-harm or suicidal ideation had not accessed any services, which is alarming. All the bivariate relationships in Figure 2 were significant with $p<0.05$.

Multivariate associations between bullying victimization and mental health services

A range of potential sociodemographic covariates such as age, gender, ethnicity, area of residence, schooling, household income, parental education, parental occupation, internet use, electronic gameplay and substance use, were adjusted in all the regression models to investigate the association between bullying (traditional and cyber) victimization and the use of mental health services. However, we only reported the results of our main variables of interests: bullying

victimization, mental disorder, self-harm, suicidal ideation and interaction terms - 'bullying victimization and mental disorder', 'bullying victimization and self-harm', and 'bullying victimization and suicidal ideation', respectively in Table 2 for traditional bullying and Table 3 for cyberbullying victims.

Table 2. Odds of mental health service use among traditional bullying victims (Binary regression)

	Health Service	School Service	Telephone Service	Online Service	Any Service
	AOR[1] (95% CI[2])	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
[3]Model 1					
Traditional bullying (ref. No)	2.05**** (1.59, 2.63)	4.10**** (2.08, 8.08)	2.52** (1.45, 4.39)	1.76**** (1.36, 2.28)	1.76**** (1.41, 2.19)
^McKelvey & Zavoina Pseudo-R^2	0.987	0.994	0.994	0.989	0.991
¥Hosmer-Lemeshow statistic (p-value)	0.227	0.161	0.963	0.648	0.978
#Link test (OR for hat of service)	4.10****	10.03***	2.81*	1.72*	2.59****
[4]Model 2					
Traditional bullying (ref. No)	1.54*** (1.18, 2.02)	3.06*** (1.57, 5.96)	1.79* (1.02, 3.15)	1.58**** (1.22, 2.05)	1.83**** (1.46, 2.29)
Mental disorder (ref. No)	6.51**** (4.96, 8.54)	5.20**** (2.63, 10.27)	4.85*** (2.76, 8.44)	1.86**** (1.46, 2.42)	4.06**** (2.82, 5.84)
McKelvey & Zavoina Pseudo-R^2	0.994	0.996	0.996	0.990	0.998
Hosmer-Lemeshow statistic (p-value)	0.532	0.626	0.798	0.756	0.417
Link test (OR for hat of service)	3.36****	3.95**	2.30*	2.31***	2.76****
[5]Model 3					
Traditional bullying (ref. No)	1.67**** (1.28, 2.19)	2.98*** (1.52, 5.86)	1.76 (0.97, 3.19)	1.49*** (1.14, 1.95)	1.79**** (1.43, 2.25)
Self-harm (ref. No)	4.84**** (3.63, 6.98)	6.49**** (3.24, 12.97)	5.04*** (2.68, 9.48)	3.29**** (2.28, 4.77)	3.85**** (2.61, 5.67)
McKelvey & Zavoina Pseudo-R^2	0.990	0.994	0.994	0.990	0.988
Hosmer-Lemeshow statistic (p-value)	0.862	0.397	0.896	0.798	0.208
Link test (OR for hat of service)	3.02****	4.99***	2.93**	2.62****	2.66****
[6]Model 4					
Traditional bullying (ref. No)	1.65**** (1.26, 2.17)	2.93*** (1.47, 5.81)	1.61 (0.85, 2.97)	1.40** (1.06, 1.85)	1.79*** (1.43, 2.25)
Suicidal ideation (ref. No)	4.06**** (2.82, 5.86)	6.65**** (3.59, 12.31)	6.49*** (3.28, 12.83)	4.20**** (2.85, 6.19)	3.98*** (2.72, 5.82)
McKelvey & Zavoina Pseudo-R^2	0.989	0.995	0.994	0.991	
Hosmer-Lemeshow statistic (p-value)	0.881	0.117	0.767	0.687	
Link test (OR for hat of service)	3.18***	7.67****	2.29*	2.30****	
Interaction terms					
[7]Model 2a					
Traditional bullying (ref. No)	1.35 (0.94, 1.94)	2.01 (0.71, 5.62)	1.67 (0.73, 3.87)	1.56*** (1.14, 2.14.)	1.62*** (1.23, 2.12)
Mental disorder (ref. No)	5.77**** (4.16, 7.99)	3.31** (1.02, 10.69)	4.61*** (2.31, 9.17)	1.82*** (1.28, 2.60)	3.58**** (2.61, 4.90)
Traditional bullying*Mental disorder (ref. No traditional bullying and/or mental disorder)	1.36 (0.80, 2.31)	2.24 (0.53, 9.48)	1.11 (0.36, 3.38)	1.05 (0.60, 1.85)	1.33 (0.81, 2.24)

	Health Service	School Service	Telephone Service	Online Service	Any Service
	AOR[1] (95% CI[2])	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
McKelvey & Zavoina Pseudo-R^2	0.994	0.995	0.995	0.990	0.991
Hosmer-Lemeshow statistic (p-value)	0.957	0.888	0.740	0.771	0.946
Link test (OR for hat of service)	3.06****	3.03*	2.19*	2.29****	2.52****
[8]Model 3a					
Traditional bullying (ref. No)	1.50*** (1.12, 2.00)	1.79 (0.76, 4.23)	1.56 (0.77, 3.16)	1.37** (1.02, 1.85)	1.69**** (1.34, 2.13)
Self-harm (ref. No)	3.54**** (2.39, 5.22)	1.85 (0.51, 6.63)	6.75*** (3.26, 13.96)	3.79**** (2.52, 5.71)	3.38**** (2.29, 4.98)
Traditional bullying*Self-harm (ref. No traditional bullying and/or self-harm)	1.51 (0.85, 2.68)	7.29** (1.53, 34.6)	0.94 (0.37, 2.39)	0.99 (0.51, 1.92)	1.37 (0.75, 2.51)
McKelvey & Zavoina Pseudo-R^2	0.990	0.994	0.995	0.991	0.989
Hosmer-Lemeshow statistic (p-value)	0.918	0.983	0.881	0.353	0.200
Link test (OR for hat of service)	2.97****	2.68*	2.49**	2.49***	2.71****
[9]Model 4a					
Traditional bullying (ref. No)	1.60*** (1.21, 2.14)	1.75 (0.72, 4.26)	1.47 (0.69, 3.15)	1.31* (0.97, 1.78)	1.73*** (1.36, 2.18)
Suicidality (ref. No)	4.21**** (2.78, 6.37)	1.48 (0.28, 7.75)	6.34*** (3.28, 12.21)	3.39*** (2.25, 5.09)	3.62*** (2.44, 5.39)
Traditional bullying*Suicidal ideation (ref. No traditional bullying and/or suicidal ideation)	0.95 (0.53, 1.68)	9.21** (1.42, 59.54)	1.11 (0.43, 2.92)	1.30 (0.68, 2.45)	1.10 (0.60, 2.01)
McKelvey & Zavoina Pseudo-R^2	0.990	0.994	0.995	0.991	0.989
Hosmer-Lemeshow statistic (p-value)	0.989	0.525	0.850	0.164	0.675
Link test (OR for hat of service)	3.22****	4.13***	2.43*	2.43****	2.74****

	Health Service	School Service	Telephone Service	Online Service	Any Service
	AOR[1] (95% CI[2])	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)

Notes: [1]AOR= Adjusted odds ratio, [2]CI= Confidence interval
[3]Model 1 is adjusted for sociodemographic factors; traditional bullying is the independent variable and mental health services are the outcome variables.
[4]Model 2 is the same as Model 1, but also adjusted for Mental disorder
[5]Model 3 is the same as Model 1, but also adjusted for Self-harm
[6]Model 4 is the same as Model 1, but also adjusted for Suicidal ideation
[7]Model 2a is the same as Model 2, but also includes Mental disorder*Traditional bullying interaction term (Presence of mental disorder and history of traditional bullying victimization in an individual)
[8]Model 3a is the same as Model 3, but also includes Self-harm*Traditional bullying interaction term (Presence of self-harming behaviour and history of traditional bullying victimization in an individual)
[9]Model 4a is the same as Model 4, but also includes Suicidal ideation*Traditional bullying interaction term (Presence of suicidal behaviour and history of traditional bullying victimization in an individual)
^McKelvey & Zavoina Pseudo-R^2, assess the fit of binary logit models. Range should be $0 \leq \text{Pseudo-}R^2 \leq 1$
¥Hosmer-Lemeshow statistic (Goodness-of-fit test) = p-value of <0.05 indicates poor fit and p-value closer to 1 indicate a good logistic regression model fit
#Link test (Model specification test) = OR for hat of service for each model should be significant to specify the model correctly
****p<0.001, ***p<0.01, **p<0.05, *p<0.1 considered significant; Survey weight adjusted

Table 2 shows in Model 1 that traditional bullying victims were respectively 2.05 (95% CI, 1.59-2.63), 4.10 (95% CI, 2.08-8.08), 2.52 (95% CI, 1.45-4.39) and 1.76 (95% CI, 1.36-2.28) times more likely to utilize health, school, telephone, and online services respectively compared to those who had not reported traditional bullying. Model 2 (i.e., mental disorders were adjusted with Model 1), Model 3 (i.e., self-harm was adjusted with Model 1) and Model 4 (i.e., suicidal ideation was adjusted with Model 1) also showed that traditional bullying, mental disorder, self-harm and suicidal ideation are significantly associated with the use of any specific services compared to others. In Model 2a, the simultaneous presence of traditional bullying and mental disorder on any service use was not found to be statistically significant most likely due to small numbers of adolescents who reported both traditional bullying victimization and mental disorder. However, the interaction of traditional bullying victimization with self-harm (in Model 3a) and with suicidal ideation (in Model 4a) was found to be significantly associated only with school services ($p<0.05$) compared to those who did not report traditional bullying victimization with self-harm and suicidal ideation, respectively.

Similar findings were revealed for cyberbullying victims in terms of using mental health services in Table 3. For example, Model 1 demonstrates that cyberbullying victims were 1.99 times (95% CI: 1.47, 2.67; $p<0.001$) more likely to use any mental health services compared to those who were not cyberbullied. No significant interaction was found in Model 2a, Model 3a and Model 4a in cyberbullying victims.

Evaluating logit models

A correlation coefficient matrix of independent variables shows weak positive correlation with a value of 0.20 and the VIF with mean 1.26 (lowest 1.06 and highest 1.51) indicates there is no evidence of multicollinearity. Table 2 and Table 3 shows the results obtained from model performance test and model fitness test to ensure precise estimation. For instance, the Hosmer–Lemeshow Goodness-of-fit tests for each model were not statistically significant ($p>0.05$), and McKelvey & Zavoina Pseudo-R^2 value for each model was less than 1,

indicates models were well fitted. Further, the Link test ensured that each binary logit model was properly specified.

Table 3. Odds of mental health service use among cyberbullying victims (Binary regression)

	Health Service	School Service	Telephone Service	Online Service	Any Service
	AOR[1] (95% CI[2])	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
[3]Model 1					
Cyberbullying (ref. No)	1.83*** (1.31, 2.54)	5.32**** (2.69, 10.50)	3.25*** (1.62, 6.54)	1.87*** (1.33, 2.62)	1.99**** (1.47, 2.67)
^McKelvey & Zavoina Pseudo-R²	0.984	0.993	0.994	0.988	0.979
¥Hosmer-Lemeshow statistic (p-value)	0.109	0.241	0.107	0.941	0.755
#Link test (OR for hat of service)	4.11***	17.38****	2.97*	2.25**	3.13****
[4]Model 2					
Cyberbullying (ref. No)	1.19 (0.80, 1.77)	3.72*** (1.84, 7.52)	2.09* (0.97, 4.51)	1.62** (1.16, 2.26)	1.50** (1.08, 2.08)
Mental disorder (ref. No)	6.84**** (5.18, 9.03)	5.20**** (2.55, 10.63)	4.75**** (2.62, 8.61)	1.91**** (1.48, 2.46)	4.18**** (3.27, 5.35)
McKelvey & Zavoina Pseudo-R²	0.994	0.995	0.995	0.989	0.991
Hosmer-Lemeshow statistic (p-value)	0.609	0.643	0.578	0.769	0.064
Link test (OR for hat of service)	3.01****	3.79**	2.06*	2.91****	2.52****
[5]Model 3					
Cyberbullying (ref. No)	1.28 (0.88, 1.88)	3.54*** (1.59, 7.86)	2.04* (0.95, 4.35)	1.44** (1.00, 2.09)	1.55*** (1.12, 2.16)
Self-harm (ref. No)	5.32**** (3.66, 7.73)	6.27**** (2.79, 14.09)	4.91**** (2.64, 9.09)	3.40*** (2.35, 4.95)	4.36**** (3.01, 6.32)
McKelvey & Zavoina Pseudo-R²	0.989	0.994	0.994	0.990	0.986
Hosmer-Lemeshow statistic (p-value)	0.178	0.985	0.988	0.151	0.678
Link test (OR for hat of service)	2.97****	3.22**	3.00**	2.79****	2.81****
[6]Model 4					
Cyberbullying (ref. No)	1.19 (0.81, 1.74)	3.10*** (1.41, 6.81)	1.66 (0.78, 3.53)	1.25 (0.86, 1.81)	1.42** (1.03, 1.95)
Suicidal ideation	4.53**** (3.14, 6.55)	6.07**** (3.03, 12.15)	6.36**** (3.35, 12.05)	4.40**** (2.97, 6.52)	4.14**** (2.81, 6.11)
McKelvey & Zavoina Pseudo-R²	0.988	0.994	0.994	0.991	0.986
Hosmer-Lemeshow statistic (p-value)	0.994	0.706	0.508	0.502	0.794
Link test (OR for hat of service)	3.31****	5.63***	2.62**	2.48****	2.85****
Interaction effects					
[7]Model 2a					
Cyberbullying (ref. No)	1.69** (1.03, 2.76)	2.98 (0.78, 11.35)	2.99* (0.98, 9.09)	1.16 (0.74, 1.82)	1.62** (1.09, 2.41)
Mental disorder (ref. No)	7.54**** (5.63, 10.11)	4.71**** (1.99, 11.16)	5.33**** (2.81, 10.17)	1.66*** (1.23, 2.23)	4.32**** (3.28, 5.69)
Cyberbullying*Mental disorder (ref. No cyberbullying and/or mental disorder)	0.53* (0.27, 1.07)	1.40 (0.29, 6.83)	0.60 (0.17, 2.13)	2.05 (0.97, 4.30)	0.82 (0.42, 1.62)

	Health Service	School Service	Telephone Service	Online Service	Any Service
	AOR[1] (95% CI[2])	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
McKelvey & Zavoina Pseudo-R^2	0.994	0.995	0.996	0.989	0.991
Hosmer-Lemeshow statistic (p-value)	0.260	0.773	0.796	0.542	0.190
Link test (OR for hat of service)	3.32****	3.35**	2.38*	2.31***	2.56****
[8]Model 3a					
Cyberbullying (ref. No)	1.04 (0.66, 1.64)	2.67 (1.01, 7.04)	1.58 (0.59, 4.23)	1.27 (0.86, 1.89)	1.35* (0.96, 1.91)
Self-harm (ref. No)	4.28**** (2.98, 6.15)	4.70*** (1.91, 11.51)	6.37**** (3.27, 12.41)	3.97**** (2.73, 5.78)	3.98**** (2.78, 5.69)
Cyberbullying*Self-harm (ref. No cyberbullying and/or self-harm)	1.45 (0.70, 2.99)	1.72 (0.51, 5.82)	1.13 (0.36, 3.51)	0.96 (0.45, 2.07)	1.15 (0.56, 2.41)
McKelvey & Zavoina Pseudo-R^2	0.989	0.994	0.995	0.991	0.987
Hosmer-Lemeshow statistic (p-value)	0.969	0.879	0.977	0.442	0.730
Link test (OR for hat of service)	3.13****	3.71***	2.76**	2.69****	2.85****
[9]Model 4a					
Cyberbullying (ref. No)	1.14 (0.72, 1.80)	2.41* (0.84, 6.91)	1.38 (0.46, 4.10)	1.16 (0.75, 1.78)	1.27 (0.87, 1.84)
Suicidality (ref. No)	4.52**** (3.10, 6.60)	4.33*** (1.61, 11.65)	6.06**** (3.18, 11.57)	3.71**** (2.57, 5.38)	3.71**** (2.58, 5.33)
Cyberbullying*Suicidal ideation (ref. No cyberbullying and/or suicidal ideation)	1.05 (0.53, 2.09)	1.96 (0.55, 6.98)	1.39 (0.42, 4.59)	1.29 (0.60, 2.79)	1.49 (0.71, 3.11)
McKelvey & Zavoina Pseudo-R^2	0.989	0.994	0.995	0.991	0.987
Hosmer-Lemeshow statistic (p-value)	0.960	0.871	0.972	0.186	0.958
Link test (OR for hat of service)	3.24****	4.02**	2.77**	2.61****	2.81****

	Health Service	School Service	Telephone Service	Online Service	Any Service
	AOR[1] (95% CI[2])	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)

Notes: [1]AOR= Adjusted odds ratio, [2]CI= Confidence interval

[3]Model 1 is adjusted for sociodemographic factors; Cyberbullying is the independent variable and mental health services are the outcome variables.

[4]Model 2 is the same as Model 1, but also adjusted for Mental disorder

[5]Model 3 is the same as Model 1, but also adjusted for Self-harm

[6]Model 4 is the same as Model 1, but also adjusted for Suicidal ideation

[7]Model 2a is the same as Model 2, but also includes Mental disorder*Cyberbullying interaction term (Presence of mental disorder and history of traditional bullying victimization in an individual)

[8]Model 3a is the same as Model 3, but also includes Self-harm*Cyberbullying interaction term (Presence of self-harming behaviour and history of traditional bullying victimization in an individual)

[9]Model 4a is the same as Model 4, but also includes Suicidal ideation*Cyberbullying interaction term (Presence of suicidal behaviour and history of traditional bullying victimization in an individual)

^McKelvey & Zavoina Pseudo-R^2, assess the fit of binary logit models. Range should be $0 \leq \text{Pseudo-}R^2 \leq 1$

¥Hosmer-Lemeshow statistic (Goodness-of-fit test) = p-value of <0.05 indicates poor fit and p-value closer to 1 indicate a good logistic regression model fit

#Link test (Model specification test) = OR for hat of service for each model should be significant to specify the model correctly

****p<0.001, ***p<0.01, **p<0.05, p<0.1 considered significant; Survey weight adjusted

Discussion

The Australian government has invested in large-scale mental health programs to combat mental health issues and its consequences among children and adolescents (63). This initiative was inspired by the fact that most Australian adolescents with mental disorders and health risk behaviours (self-harm and suicidal ideation) do not use mental health services as needed (43, 44). In addition, only a few studies in Australia have looked at the frequency and indicators of mental health services utilisation among adolescents with mental disorders and suicidality (42, 43, 64). Although prior research has linked traditional bullying and cyberbullying with mental disorder, self-harm, and suicidality among adolescents (8, 10, 12), data on the use of mental health services among adolescents who are bullied is scarce. Hence, the present study fills the gap in the literature by examining the relationship between bullying victimization (traditional and cyber) and mental health services use among adolescents in Australian context. Furthermore, this research studied whether the concurrent experience of bullying victimization and mental disorder/health-risk behaviours (self-harm and suicidality) in adolescents affect service use.

In the current study, the prevalence of traditional bullying and cyber-bullying among adolescents aged 12-17 years in Australia was found to be around 27% and 11% respectively, which was almost similar to the previous studies conducted in Australia (22, 65). Consistent with other studies, it found that not only were girls more likely to be bullied, with a wider gap was observed between girls and boys who were victimized online (52). A possible explanation is because girls are more likely to be victims of relational, indirect bullying or bullying that is less confrontational, all of which can occur easily using social media or electronic platforms used predominantly by girls (50).

In addition, results of the study suggested that adolescents with bullying (traditional or cyber) victimization were more likely to use health services and online service, which is corroborated by previous research studies (43, 68) conducted among adolescents with behavioural and mental health issues. The benefits of online mental health service include ease of access, reduction in stigma by promoting anonymity and confidentiality and increased emotional

safety amongst others (69, 70). A study among Australian schoolchildren experiencing psychological distress also revealed a preference for online counselling where they were more likely to discuss sensitive topics (71). Data also found that school service and telephone service were least used by adolescent bullying victims and/or with behavioural and mental health issues, which is similar to the past findings (42-44). Though evidence suggested school-based programmes provided children/adolescents with more resources by not only removing barriers to accessing service in the traditional system, but also by reducing the stigma associated with seeking mental health service, resulting in improved clinical outcomes (43, 72).

Furthermore, consistent with findings from previous studies (18, 45), our findings indicated that bullying (traditional and cyber) victimization significantly increases the use of mental health services compared to non-bullying victims, even after controlling for several potential covariates. This may be due to the fact that childhood or adolescence bullying victimization has some negative impacts on health and wellbeing such as mental disorders, self-harm and suicidal ideation, which can push people to use mental health services (45). While another study claimed that that formal help-seeking (e.g. from school and health care professionals) was rare among bullying victims, regardless of the presence or absence of health risk behaviours (self-harm and suicidal ideation) (73).

Moreover, the findings of the present study indicated that adolescents who simultaneously experienced traditional bullying victimization with self-harming and suicidal behaviour were respectively 7.29 times and 9.21 times more likely to use school service compared to adolescents with no traditional bullying and no self-harm or suicidal ideation. This finding was substantiated by previous studies, as school-based mental health services were found to be effective in preventing and treating mental health problems including bullying, mental disorder, self-harm and suicidality (43, 74, 75). For example, school-based mental health programs such as FRIENDS, The Youth Aware of Mental Health Program and Good Behaviour Game were found to be respectively efficacious in reducing mental disorders, self-harm/suicidality and behavioural problems in Australian adolescents (76). However, cyberbullied adolescents with experience

of mental disorder, self-harm or suicidal ideation did not show any statistically significant result in using any mental health services. In addition, results indicated that still a significant portion of adolescent bullying victims with mental disorder and health risk behaviours did not seek any service, which is alarming for prevention of serious consequences of bullying victimization including suicide.These findings reiterates the need of more evidence to affirm the effectiveness of mental health services among bullying victims with health risk behaviours.

Limitations

The current study uses a robust sampling technique to represent national sample for the age group 4-17 years in Australia; however, it has some limitations that are worth mentioning. First, data related to health risk behaviours (e.g. substance use, bullying, self-harm and suicidality) are mostly based on self-report and may be vulnerable to recall bias and response bias (85). Second, our sample included only the age-group 12-17 years and did not include Aboriginal adolescents as YMM was only conducted among non-Aboriginal children and adolescents in Australia. Thus, this result may not be generalizable to Aboriginal adolescents and other age-groups such as adults. Third, some important factors such as duration, waiting times, and previous encounters with accessed services, were not included in the study, which may be significant barriers to service use. Fourth, this research is also restricted in that it did not investigate whether service use enhanced adolescent mental health issues, academic performance, or social functioning. Finally, the cross-sectional nature of the data prohibits evaluation of temporality and causality of the observed association between bullying and mental health service use.

Conclusion

Bullying victimization and access to service use were intimately linked; however, many adolescents did not use any services despite being bullied with simultaneous experience of mental disorder, self-harm, or suicidality. In-depth research is warranted to understand the quality of service received by bullied adolescents with or without mental health problems. More study is needed among bullying victims for designing and promoting appropriate interventions

via online, telephone, and/or school-based programs so that the consequences of bullying victimization can be prevented timely among these high-risk adolescents.

Acknowledgement

The paper is part of the first author's PhD program - sponsored by the University of Southern Queensland in Australia. The authors would like to thank Roy Morgan Research, University of Western Australia, and the Australian Department for conducting the Young Minds Matter (YMM) survey, and the Australian Data Archive for providing access to the YMM survey dataset.

Disclosures and declarations

Competing interest

All authors of this paper declare that they have do not have any financial or non-financial competing interest.

Funding

This research is conducted as a part of the doctoral thesis of the first author of this paper that did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sector.

Availability of data and material

Young Minds Matter (YMM) survey dataset is available on request at the Australian Data Archive (ADA) repository. Further information about data accessibility is available on the ADA website (https://dataverse.ada.edu.au/).

Author Contribution

Md Irteja Islam: Conceptualization, Methodology, Resources, Software, Data curation, Formal Analysis, Validation, Visualization, Investigation, Writing-Original draft, Writing-Review & Editing; Fakir Md. Yunus: Writing-Original draft, Writing-Review & Editing; Shumona Sharmin Salam: Writing-Original draft, Writing-Review & Editing; Enamul Kabir: Supervision, Writing-Review & Editing; Rasheda Khanam: Supervision, Project administration, Writing-Review & Editing.

References

1. Juvonen J, Graham S. Bullying in schools: The power of bullies and the plight of victims. Annual review of psychology. 2014;65:159-85.
2. Olweus D. Cyberbullying: An overrated phenomenon? European journal of developmental psychology. 2012;9(5):520-38.
3. Barzilay S, Klomek AB, Apter A, Carli V, Wasserman C, Hadlaczky G, et al. Bullying victimization and suicide ideation and behavior among adolescents in Europe: A 10-country study. Journal of Adolescent Health. 2017;61(2):179-86.
4. Smith PK, Cowie H, Olafsson RF, Liefooghe AP. Definitions of bullying: A comparison of terms used, and age and gender differences, in a Fourteen–Country international comparison. Child development. 2002;73(4):1119-33.
5. Hertz MF, Donato I, Wright J. Bullying and suicide: a public health approach. Journal of Adolescent Health. 2013;53(1):S1-S3.
6. Sourander A, Helstelä L, Helenius H, Piha J. Persistence of bullying from childhood to adolescence—a longitudinal 8-year follow-up study. Child abuse & neglect. 2000;24(7):873-81.
7. Wolke D, Lereya S, Fisher H, Lewis G, Zammit S. Bullying in elementary school and psychotic experiences at 18 years: a longitudinal, population-based cohort study. Psychological medicine. 2014;44(10):2199.
8. Jadambaa A, Thomas HJ, Scott JG, Graves N, Brain D, Pacella R. The contribution of bullying victimisation to the burden of anxiety and depressive disorders in Australia. Epidemiology and psychiatric sciences. 2020;29.
9. Scott JG, Moore SE, Sly PD, Norman RE. Bullying in children and adolescents: a modifiable risk factor for mental illness. Australian & New Zealand Journal of Psychiatry. 2014;48(3):209-12.
10. Karanikola MN, Lyberg A, Holm A-L, Severinsson E. The association between deliberate self-harm and school bullying victimization and the mediating effect of depressive symptoms and self-stigma: A systematic review. BioMed research international. 2018;2018.
11. Espelage DL, Holt MK. Suicidal ideation and school bullying experiences after controlling for depression and delinquency. Journal of Adolescent Health. 2013;53(1):S27-S31.

12. Islam MI, Khanam R, Kabir E. Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data. Psychiatry Research. 2020:113364.
13. Messias E, Kindrick K, Castro J. School bullying, cyberbullying, or both: correlates of teen suicidality in the 2011 CDC Youth Risk Behavior Survey. Comprehensive psychiatry. 2014;55(5):1063-8.
14. Van Geel M, Vedder P, Tanilon J. Relationship between peer victimization, cyberbullying, and suicide in children and adolescents: a meta-analysis. JAMA pediatrics. 2014;168(5):435-42.
15. Oexle N, Ribeiro W, Fisher HL, Gronholm PC, Laurens KR, Pan P, et al. Childhood bullying victimization, self-labelling, and help-seeking for mental health problems. Social psychiatry and psychiatric epidemiology. 2020;55(1):81-8.
16. Srabstein JC, Leventhal BL. Prevention of bullying-related morbidity and mortality: a call for public health policies. SciELO Public Health; 2010.
17. Glew GM, Fan M-Y, Katon W, Rivara FP, Kernic MA. Bullying, psychosocial adjustment, and academic performance in elementary school. Archives of pediatrics & adolescent medicine. 2005;159(11):1026-31.
18. Rigby K. Effects of peer victimization in schools and perceived social support on adolescent well-being. Journal of adolescence. 2000;23(1):57-68.
19. Sapouna M, Wolke D. Resilience to bullying victimization: The role of individual, family and peer characteristics. Child abuse & neglect. 2013;37(11):997-1006.
20. Smith PK, Madsen KC, Moody JC. What causes the age decline in reports of being bullied at school? Towards a developmental analysis of risks of being bullied. Educational research. 1999;41(3):267-85.
21. Nansel TR, Overpeck M, Pilla RS, Ruan WJ, Simons-Morton B, Scheidt P. Bullying behaviors among US youth: Prevalence and association with psychosocial adjustment. Jama. 2001;285(16):2094-100.
22. Currie C, Zanotti C, Morgan A, Currie D, De Looze M, Roberts C, et al. Social determinants of health and well-being among young people: Health Behaviour in School-aged Children (HBSC) study: international report from the the 2009/2010 survey. Copenhegen: WHO Regional Office for Europe; 2012.

23. Przybylski AK, Bowes L. Cyberbullying and adolescent well-being in England: a population-based cross-sectional study. The Lancet Child & Adolescent Health. 2017;1(1):19-26.
24. Modecki KL, Minchin J, Harbaugh AG, Guerra NG, Runions KC. Bullying prevalence across contexts: A meta-analysis measuring cyber and traditional bullying. Journal of Adolescent Health. 2014;55(5):602-11.
25. Thomas HJ, Chan GC, Scott JG, Connor JP, Kelly AB, Williams J. Association of different forms of bullying victimisation with adolescents' psychological distress and reduced emotional wellbeing. Australian & New Zealand Journal of Psychiatry. 2016;50(4):371-9.
26. Kelly EV, Newton NC, Stapinski LA, Slade T, Barrett EL, Conrod PJ, et al. Concurrent and prospective associations between bullying victimization and substance use among Australian adolescents. Drug and alcohol dependence. 2015;154:63-8.
27. Cross D, Shaw T, Hearn L, Epstein M, Monks H, Lester L, et al. Australian Covert Bullying Prevalence Study (ACBPS). 2009. Child Health Promotion Research Centre, Edith Cowan University: Perth. 2009.
28. Jadambaa A, Thomas HJ, Scott JG, Graves N, Brain D, Pacella R. Prevalence of traditional bullying and cyberbullying among children and adolescents in Australia: A systematic review and meta-analysis. Australian & New Zealand Journal of Psychiatry. 2019:0004867419846393.
29. Hemphill SA, Kotevski A, Heerde JA. Longitudinal associations between cyber-bullying perpetration and victimization and problem behavior and mental health problems in young Australians. International journal of public health. 2015;60(2):227-37.
30. Kelly EV, Newton NC, Stapinski LA, Slade T, Barrett EL, Conrod PJ, et al. Suicidality, internalizing problems and externalizing problems among adolescent bullies, victims and bully-victims. Preventive medicine. 2015;73:100-5.
31. Turner I, Reynolds KJ, Lee E, Subasic E, Bromhead D. Well-being, school climate, and the social identity process: A latent growth model study of bullying perpetration and peer victimization. School psychology quarterly. 2014;29(3):320.

32. Zimmer-Gembeck MJ, Pronk RE. Relation of depression and anxiety to self-and peer-reported relational aggression. Aggressive behavior. 2012;38(1):16-30.
33. Borowsky IW, Taliaferro LA, McMorris BJ. Suicidal thinking and behavior among youth involved in verbal and social bullying: Risk and protective factors. Journal of adolescent health. 2013;53(1):S4-S12.
34. Jantzer V, Haffner J, Parzer P, Resch F, Kaess M. Does parental monitoring moderate the relationship between bullying and adolescent nonsuicidal self-injury and suicidal behavior? A community-based self-report study of adolescents in Germany. BMC public health. 2015;15(1):583.
35. Kendrick K, Jutengren G, Stattin H. The protective role of supportive friends against bullying perpetration and victimization. Journal of adolescence. 2012;35(4):1069-80.
36. Davidson LM, Demaray MK. Social support as a moderator between victimization and internalizing–externalizing distress from bullying. School psychology review. 2007;36(3):383-405.
37. Rothon C, Head J, Klineberg E, Stansfeld S. Can social support protect bullied adolescents from adverse outcomes? A prospective study on the effects of bullying on the educational achievement and mental health of adolescents at secondary schools in East London. Journal of adolescence. 2011;34(3):579-88.
38. Klomek AB, Sourander A, Gould M. The association of suicide and bullying in childhood to young adulthood: A review of cross-sectional and longitudinal research findings. The Canadian Journal of Psychiatry. 2010;55(5):282-8.
39. Johnson SE, Lawrence D, Hafekost J, Saw S, Buckingham WJ, Sawyer M, et al. Service use by Australian children for emotional and behavioural problems: Findings from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. Australian & New Zealand Journal of Psychiatry. 2016;50(9):887-98.
40. Islam MI, Kabir E, Khanam R. Suicidality, Mental Disorder and the Utilization of Mental Health Services among Australian Adolescents. Children and Youth Services Review. 2020:104821.

41. Islam MI, Khanam R, Kabir E. The use of mental health services by Australian adolescents with mental disorders and suicidality: Findings from a nationwide cross-sectional survey. Plos one. 2020;15(4):e0231180.

42. Hafekost J, Lawrence D, Boterhoven de Haan K, Johnson SE, Saw S, Buckingham WJ, et al. Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry. 2016;50(9):866-75.

43. Lawrence D, Hafekost J, Johnson SE, Saw S, Buckingham WJ, Sawyer MG, et al. Key findings from the second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry. 2016;50(9):876-86.

44. Cross D, Shaw T, Hadwen K, Cardoso P, Slee P, Roberts C, et al. Longitudinal impact of the Cyber Friendly Schools program on adolescents' cyberbullying behavior. Aggressive behavior. 2016;42(2):166-80.

45. APA. Diagnostic and statistical manual of mental disorders. BMC Med. 2013;17:133-7.

46. Fisher PW, Shaffer D, Piacentini JC, Lapkin J, Kafantaris V, Leonard H, et al. Sensitivity of the Diagnostic Interview Schedule for Children, (DISC-2.1) for specific diagnoses of children and adolescents. Journal of the American Academy of Child & Adolescent Psychiatry. 1993;32(3):666-73.

47. CDC. Adolescent and School Health: YRBSS Questionnaires: Centers for Disease Control and Prevention; 2014
[Available from: https://www.cdc.gov/healthyyouth/data/yrbs/questionnaires.htm.

48. Zubrick SR, Hafekost J, Johnson SE, Lawrence D, Saw S, Sawyer M, et al. Suicidal behaviours: prevalence estimates from the second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry. 2016;50(9):899-910.

49. Zubrick SR, Hafekost J, Johnson SE, Lawrence D, Saw S, Sawyer M, et al. Self-harm: prevalence estimates from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. Australian & New Zealand Journal of Psychiatry. 2016;50(9):911-21.

50. Schneider SK, O'donnell L, Stueve A, Coulter RW. Cyberbullying, school bullying, and psychological distress: A regional census of high school students. American journal of public health. 2012;102(1):171-7.

51. Thomas HJ, Connor JP, Lawrence DM, Hafekost JM, Zubrick SR, Scott JG. Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. Australian & New Zealand Journal of Psychiatry. 2017;51(9):909-20.

52. Kessel Schneider S, O'Donnell L, Smith E. Trends in cyberbullying and school bullying victimization in a regional census of high school students, 2006-2012. Journal of school health. 2015;85(9):611-20.

53. Baiden P, Tadeo SK. Investigating the association between bullying victimization and suicidal ideation among adolescents: evidence from the 2017 Youth Risk Behavior Survey. Child Abuse & Neglect. 2020;102:104417.

54. Ford R, King T, Priest N, Kavanagh A. Bullying and mental health and suicidal behaviour among 14-to 15-year-olds in a representative sample of Australian children. Australian & New Zealand Journal of Psychiatry. 2017;51(9):897-908.

55. Islam MI, Khanam R, Kabir E. Effect of mental disorders on the association between bullying, suicidality and self-harm among Australian adolescents: A mediation analysis using data from a nationwide survey. 2020 (Unpublished, In review).

56. Evans-Lacko S, Takizawa R, Brimblecombe N, King D, Knapp M, Maughan B, et al. Childhood bullying victimization is associated with use of mental health services over five decades: a longitudinal nationally representative cohort study. Psychol Med. 2017;47(1):127-35.

57. Kumpulainen K, Räsänen E, Puura K. Psychiatric disorders and the use of mental health services among children involved in bullying. Aggressive Behavior: Official Journal of the International Society for Research on Aggression. 2001;27(2):102-10.

58. Oliver C, Candappa M. Bullying and the politics of 'telling'. Oxford Review of Education. 2007;33(1):71-86.

59. Kitagawa Y, Shimodera S, Togo F, Okazaki Y, Nishida A, Sasaki T. Suicidal feelings interferes with help-seeking in bullied adolescents. PLoS one. 2014;9(9):e106031.
60. Eliot M, Cornell D, Gregory A, Fan X. Supportive school climate and student willingness to seek help for bullying and threats of violence. Journal of school psychology. 2010;48(6):533-53.
61. Hunter SC, Boyle JM, Warden D. Help seeking amongst child and adolescent victims of peer-aggression and bullying: The influence of school-stage, gender, victimisation, appraisal, and emotion. British Journal of Educational Psychology. 2004;74(3):375-90.
62. Moses T. Self-labeling and its effects among adolescents diagnosed with mental disorders. Social Science & Medicine. 2009;68(3):570-8.
63. Jorm AF, Griffiths KM, Christensen H, Parslow RA, Rogers B. Actions taken to cope with depression at different levels of severity: a community survey. Psychological medicine. 2004;34(2):293.
64. Brown JS, Evans-Lacko S, Aschan L, Henderson MJ, Hatch SL, Hotopf M. Seeking informal and formal help for mental health problems in the community: a secondary analysis from a psychiatric morbidity survey in South London. BMC psychiatry. 2014;14(1):275.
65. Fleisher WP, Schwartz L. Mental health sequelae of bullying: a review and case report. The Canadian child and adolescent psychiatry review = La revue canadienne de psychiatrie de l'enfant et de l'adolescent. 2003;12(1):13-7.
66. Leach LS, Rickwood DJ. The Impact of School Bullying on Adolescents' Psychosocial Resources and Help-Seeking Intentions. Advances in School Mental Health Promotion. 2009;2(2):30-9.
67. Rickwood D, Deane FP, Wilson CJ, Ciarrochi J. Young people's help-seeking for mental health problems. Australian e-journal for the Advancement of Mental health. 2005;4(3):218-51.
68. Fleisher WP, Schwartz L. Mental health sequelae of bullying: a review and case report. The Canadian child and adolescent psychiatry review. 2003;12(1):13.

69. Nabors LA, Weist MD, Reynolds MW. Overcoming challenges in outcome evaluations of school mental health programs. Journal of School Health. 2000;70(5):206-9.
70. Stephan SH, Weist M, Kataoka S, Adelsheim S, Mills C. Transformation of children's mental health services: The role of school mental health. Psychiatric Services. 2007;58(10):1330-8.
71. Mitchell C, McMillan B, Hagan T. Mental health help-seeking behaviours in young adults. The British journal of general practice : the journal of the Royal College of General Practitioners. 2017;67(654):8-9.
72. Bambling M, King R, Reid W, Wegner K. Online counselling: The experience of counsellors providing synchronous single-session counselling to young people. Counselling and Psychotherapy Research. 2008;8(2):110-6.
73. Kauer S, Mangan C, Sanci L. Do Online Mental Health Services Improve Help-Seeking for Young People? A Systematic Review. Journal of Medical Internet Research. 2014;16.
74. Pretorius C, Chambers D, Coyle D. Young People's Online Help-Seeking and Mental Health Difficulties: Systematic Narrative Review. J Med Internet Res. 2019;21(11):e13873.
75. Glasheen KJ, Shochet I, Campbell MA. Online counselling in secondary schools: would students seek help by this medium? British Journal of Guidance & Counselling. 2016;44(1):108-22.
76. Rosenman R, Tennekoon V, Hill LG. Measuring bias in self-reported data. International Journal of Behavioural and Healthcare Research. 2011;2(4):320-32.

3.2 Study 5 - The use of mental health services by Australian adolescents with mental disorders and suicidality: Findings from a nationwide cross-sectional survey (Published in PLOS One, Q1, IF: 2.740, SNIP: 1.2.05, Publisher - Public Library of Science)

PLOS ONE

RESEARCH ARTICLE

The use of mental health services by Australian adolescents with mental disorders and suicidality: Findings from a nationwide cross-sectional survey

Md. Irteja Islam[1,2]*, **Rasheda Khanam**[2], **Enamul Kabir**[2]

1 Maternal and Child Health Division, International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), Dhaka, Bangladesh, **2** Centre for Health, Informatics, and Economic Research and School of Commerce, University of Southern Queensland, Queensland, Australia

* irteja.islam@icddrb.org, mdirteja.islam@usq.edu.au

Check for updates

OPEN ACCESS

Citation: Islam M.I, Khanam R, Kabir E (2020) The use of mental health services by Australian adolescents with mental disorders and suicidality: Findings from a nationwide cross-sectional survey. PLoS ONE 15(4): e0231180. https://doi.org/10.1371/journal.pone.0231180

Editor: Mahfuzar Rahman, BRAC, BANGLADESH

Received: December 2, 2019

Accepted: March 17, 2020

Published: April 10, 2020

Copyright: © 2020 Islam et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: The datasets of Young Minds Matter (YMM) survey data is available at the Australian Data Archive (ADA) Dataverse. This is an open sources data-set, which is available on request at (https://dataverse.ada.edu.au/dataset.xhtml?persistentId=doi:10.4225/87/LCVEU3) due to potentially identifying information (https://ada.edu.au/accessing-data/). In order to get an access to YMM datasets, authors needs to do followings: 1. Create an account in the ADA Dataverse; 2. Login and agree to the term of data use; 3. Fill up the data application form with required information. However, The minimal

Abstract

Objectives

Mental disorders and suicidality among adolescents have been identified as a major public health concern worldwide; however, they often do not get the necessary attention from parents, school and health professional, and therefore are left untreated. This study aimed to investigate the factors associated with the use of mental health services among Australian adolescents aged 13–17 with mental disorders and/or suicidality.

Methods

Adolescents aged 13–17 (n = 2134) from Young Minds Matter (YMM): the Second Australian Child and Adolescent Survey of Mental Health and Wellbeing were included in this study. The YMM is a cross-sectional nationwide survey, in which information was collected from both parents and adolescents (aged 13–17 years). Both bivariate and multivariate analyses were conducted to identify the factors that have an impact on the use of mental health services (outcome variable) in two subsamples: (1) adolescents with mental disorder and (2) adolescents with suicidality.

Results

Overall, 740 (34.7%) and 168 (7.9%) adolescents reported a mental disorder and/or suicidality, respectively. The incidence of seeking any service was higher among adolescents with suicidality (approximately 50%) compared to those with a mental disorder (about 30%). Girls, older age-group (15–17), adolescents living with disadvantaged families (lower-income, less educated and unemployed parents), those who had multiple mental disorders and history of substance use were most likely to use mental health services regardless of mental disorder and suicidality. Health services and online services were the most popular type of mental health service among adolescents aged 13–17 across two subgroups, while, school and telephone services were less utilized.

dataset is available in the Supporting Information files.

Funding: The author(s) received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

Conclusions

Many adolescents with mental disorders and/or suicidality do not use mental health services. The findings indicate differences in factors associated with the use of mental health services among adolescents with mental disorder and suicidality. Further research is needed to address the specific barriers that limit the use of the services.

Introduction

Mental disorders and suicidality (ideation, plan or attempt) among adolescents is a major public health concern due to its high prevalence and the significant burden it places on society [1–4]. Not only are mental disorders and suicidality frequently correlated, but both are significant contributors to premature mortality and disabling conditions and are expensive worldwide [1–3, 5]. Globally, suicide is considered as one of the topmost causes of death among 10–24 year-olds [6, 7]. For example, recent studies in the United States suggest that the suicide rate among this age-group climbed 56% in 2017 from 2007 to rank it as the second leading cause of death [8]. It is also recognized as the leading cause of death among Australian aged 15–24 years [6, 9]; the Australian Bureau of Statistics recently reported that the age-specific suicide-rate in individuals aged 15–19 and 20–24 were respectively 12.3 and 14.5 deaths per 100,000 in 2018, which is higher compared to the rate reported in 2017 [10]. Further, the presence of a mental disorder is found to be significantly associated with suicidality with almost 20% of Australian adolescents aged 12–17 years who attempted suicide have a diagnosable mental disorder [11]. According to the most recent Australian mental health survey, one in 7 children and adolescents aged 4–17 years have at least one mental disorder [12], with the highest percentage of attention deficit hyperactivity disorder (ADHD), which is about 7.4%, followed by anxiety disorders (6.9%), major depressive disorder (2.8%) and conduct disorder (2.1%) [3, 12]. However, mental disorders and suicidality among children and adolescents are often unidentified by their parents and school teachers and left untreated by any health professionals [4, 13, 14].

In Australia, only 65% of adolescents aged 12–17 years with a mental disorder and/or suicidality have used mental health services [3, 15, 16]. With so many adolescents with mental disorder and/or suicidality not receiving mental health services [13, 17], there is an urgent need to investigate the factors associated with service utilization involving this group of people in particular.

Previous studies have found several factors that are associated with the service use [1, 3, 4, 18, 19]. For example, Cuffle et al. [18] indicated that gender may have significant impact on mental health service uses, while, other studies showed that gender may not be associated with service use when respondents were aged under-19 in particular [4, 18, 20]. Age is another important factor of mental health service use [3], with multiple studies claiming that children aged more than 11-years have a higher probability of mental health problems and potential of using mental health services [3, 21]. Previous studies also examined the impact of household income, education and occupation of parents' on service use for mental health problems [3, 4, 13, 14]. Steele et al. [22] showed that adolescents from low-income families were less likely to access services, while, few other studies found no relationship between household income and service use in adolescents [3, 23]. Similarly, several studies also showed that lower parental education was associated with lower use of mental health services [3, 24], while other studies [25] did not find such association between parental education and service use due to mental health problems. Previous research also suggested that other family-related factors such as

family type, family functioning and family stress may influence the use of mental health services [4, 26]. For instance, findings from a study in Australia showed that adolescents from blended-families were less likely to access mental health services compared to those from single-parent families [26]. Finally, co-morbid illness factors such as co-occuring mental disorders and suicidality in an individual are also found to be strong predictors of using mental health services among adolescents due to the fact that mental disorders and suicidality are closely interrelated [3, 13, 26]. For example, Brent et al. [27] reported that approximately 35–50% of adolescents with mental disorders attempted suicide. In Australia, these differences may be even stronger with the fact that policymakers, families and health care providers have struggled to understand how this critical public health problem can be handled [3, 13, 26].

Several studies have examined the factors associated with mental health service use among adolescents across countries [1, 14, 18, 24, 28], However, most of the studies have either investigated children as a group (up to age less than 18), adolescents with youth (age 10–24), or only adults (age more than 18). Similarly, Johnson et al. [26] and Vu et al. [3] examined the factors related to mental health service use among children aged 4–17 years in Australia. However, the authors of the studies [3, 26] did not examine the impact of mental disorder and/or suicidality in an adolescent on service use. Moreover, Johnson et al. [26] only investigated the differences in factors of only two types of mental health services (i.e. health and school service) and omitted telephone and online service, which are thought to be the recent preferred ones among adolescent. To our knowledge, no individual study in Australia has directly compared the differences in factors associated with service use among adolescents aged 13–17 years with mental disorders and/or suicidality. Therefore, this study aimed to examine the impact of different factors on mental health services use in adolescents aged 13–17 years, who were diagnosed with mental disorders and/or reported suicidality.

Methodology

Data source

Cross-sectional data were analyzed from Young Minds Matter (YMM): the Second Australian Child and Adolescent Survey of Mental Health and Wellbeing, which was conducted during 2013–2014 by the University of Western Australia (UWA) thorough the Telethon Kids Institute in collaboration with Roy Morgan Research and the Australian Government Department of Health [17, 29] Since the YMM was ethically approved by the Human Research Ethics Committee of the Australian Government Department of Health and by the Human Research Ethics Committee of the UWA [26, 29], ethical approval was not required for this paper as we only used data from the YMM survey.

In brief, YMM employed a multi-stage, area-based random sampling technique and designed to be representative of households with children and adolescents aged 4–17 years in Australia [15, 29]. If more than one qualifying child was present in the household, the sample randomly included a single child [29, 30]. In total, 6310 parents of children and adolescents aged 4–17 years (55% eligible households) participated voluntarily in the survey through a face-to-face interview using a structured questionnaire, and 2967 adolescents aged 11–17 years (89% eligible youth) completed computer-based self-reported questionnaires privately to provide information on risk behaviours (e.g. suicidality, self-harm, substance use, bullying) and service use [17, 29]. However, the survey excludes the most remote areas, homeless adolescents, adolescents living in any institutional care and in households where the interviews could not be conducted in English. A more detailed description of the methodology used for the survey will be found elsewhere [29].

Measures

Services. Different types of mental health services used by adolescents aged 13-17years were considered as an outcome variable in this study. All consenting parents were asked a series of questions regarding services used for emotional or behavioural problems in the past 12-months. Self-reported information of service use was restricted to adolescents aged 13–17 years to capture true important findings as adolescents' transitioned through puberty due to the perceived sensitive nature of the questions. The mental health services accessed by the adolescents included (I) health services, (II) school services, (III) telephone counselling services and (IV) online self-help services (only available in child-data). Health services included services provided by general medical practitioners including family physicians and paediatricians, psychiatrists, psychologists, counsellors, psychotherapists, mental health nurses and social workers in a mental health speciality setting or any setting such as hospital inpatient, outpatient and emergency department. Examples of school services included any school or educational institution-based programs that consisted of any special schools, special classes within a school, and school-based therapies that a child was attending [26]. Each service was a binary variable and responses were coded as '1' for Yes and '0' for No. Lastly, for both parent-data and child-data, all types of services were combined to create an additional variable 'Any service' in our analysis: whether the adolescent had ever accessed any of the four services for a mental disorder and/or a behavioural problem like suicidality. Responses included 'Yes' (coded as 1 if using at least one of these services) or 'No' (coded as 0 otherwise).

Mental disorders. Mental disorders in the 12-months preceding the survey among adolescents were assessed by the Diagnostic Interview Schedule for Children–Version IV (DISC-IV) [17], which implements the criteria for mental disorders set out in the Diagnostic and Statistical Manual of Mental Disorders–Version IV, formed by the American-Psychiatric-Association [31]. DISC-IV modules were completed by parents as well as by adolescents. Mental disorders included major depressive disorder, attention deficit hyperactivity disorder (ADHD), conduct disorder, and four types of anxiety disorders—social phobia, separation anxiety disorder, generalized anxiety disorder, and obsessive-compulsive disorder. In this paper, binary variables were created to identify the presence of any mental disorders using only parent-data, as it only provides information on the diagnosis of each type of mental disorder among children and adolescents. Initially, social phobia, separation anxiety disorder, generalized anxiety disorder and obsessive-compulsive disorder were categorized into one category—anxiety disorders. We then added a variable 'mental disorder' in our analysis: whether the adolescent has had any of the following types of mental disorder—anxiety disorders, major depressive disorder, ADHD and conduct disorder. Responses included 'Yes' (coded as 1 if a child experiences at least one of these disorders) or 'No' (coded as 0 if otherwise). In addition, a variable 'number of mental disorder' was included with two categories (single/multiple) in the analysis.

Suicidality. Items measuring suicidality (suicidal ideation, plans and attempts) were collected from the Standard High School questionnaires of the CDC 2009 YRBS [32]. However, due to perceived sensitive nature of the questions, suicidality was measured only in adolescents aged 12–17 years. All yes-no response options were coded 1 for 'Yes' and 0 for 'No'. Suicidal ideation was measured by the following question, *'During the past 12 months, did you ever seriously consider attempting suicide?'* For ideators, *suicide plans and attempts* were assessed with two questions, respectively; *'During the past 12 months, did you make a plan about how you would attempt suicide?'*; *'Did you attempt suicide during the past 12 months?'* Responses to these questions were used to classify ideators into two groups: (I) suicidal ideation without plan and attempt; (II) suicidal ideation with a plan and/or attempt. Note that information

regarding suicidality captured from only child-data, where confidentiality was maintained regarding all responses and not shared with consenting parents [11].

Sociodemographic factors. The source of information for all the sociodemographic factors was parent data except for substance use by the child which was taken from child-data. Covariates included—adolescents' age (13-≤15 vs. 15–17 years), gender (boys vs. girls), remoteness (cities vs. regional/remote), household income/year (more than $130000 as high, $52000-$129999 as medium and less than $52000 as low), parental education (bachelor, diploma and year-10/11), parental employment (employed vs. unemployed), family type (adolescents from original parents vs. adolescents from other families such as step and blended), family functioning (very good/good vs. fair/poor), The index of relative socio-economic advantage and disadvantage (IRSAD) quintile (lowest, second, third, fourth and highest), substance use by the child (yes vs. no).

Data analysis

The analysis in this paper uses the whole sample and several sub-samples as follows (Fig 1):

- When assessing service use the sample is restricted to adolescents aged 13–17 years across two datasets (self-reported child-data and parent-data) to maintain age comparability across the survey, the whole sample was used (n = 2134).
- When investigating service use by adolescents with mental disorders identified from parent-data on the DISC-IV, the analysis involved adolescents aged 13–17 years who had a mental disorder (n = 740).
- When examining service use by adolescents with suicidality, the analysis was undertaken on the adolescents aged 13–17 years who reported suicidality exclusively in the self-reported child-data (n = 168).
- The 'Don't know' responses were omitted

Initially, descriptive statistics on sociodemographic and risk-behaviour correlates were calculated and stratified by mental disorder and suicidality status among adolescents aged 13–17 years. Chi-square tests of significance were used to describe and compare the sample

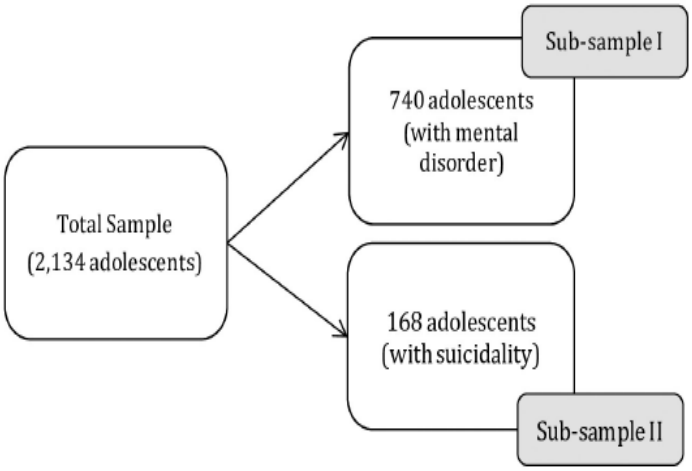


Fig 1. Flow-chart of selecting sample and sub-sample population for the analysis.

https://doi.org/10.1371/journal.pone.0231180.g001

characteristics of adolescents with mental disorder and suicidality. Bivariate associations also measured between the variables and their distributions over the outcome variables (various services used by the adolescents) among the adolescents with mental disorder and suicidality, separately. All associations yielding a P-value<0.05 were used to build a binary logistic regression model. Factors related to service use in adolescents with mental disorders and suicidality was assessed with regression methods using the Stata/SE 14.1. All the estimates were weighted to represent 13-17-year-olds in the Australian population, in which weights were calculated according to the Deville and Sarndal's generalized raking procedure [33]. The strength of the associations between the use of various mental health services and sociodemographic factors was estimated employing odds ratios (OR) and 95% confidence intervals.

Results

Table 1 provides the distribution of socio-demographic data and risk behaviour correlates for the whole sample and among adolescents with mental disorders and suicidality, separately. Of the 2134 adolescents included in the analyses, the mean age was 15.4, 52.1% were girls, and adolescents from cities were oversampled. More than 40% of adolescents were from other (step, blended and others) than original family and 42.1% were reported of using a substance. Of the total sample, 34.4% of adolescents had a mental disorder and 7.9% had experienced suicidal ideation. Adolescents who had a mental disorder were more likely from major cities (66.8%) and the low-medium-income household (74.3%) compared to a high-income household (25.7%). Girls were twice as likely (72.0% vs. 28%, $p<0.001$) to report suicidality as boys. Adolescents who reported suicidality were more likely to have a history of using any substances (79.2%, $p<0.001$).

Fig 2 depicts the distribution of mental health services in the whole sample and two subsamples (adolescents with mental disorders and adolescents with suicidality). According to the child data, online service was the preferred one in each group; followed by health services. While, parent data shows that health services were most likely to be accessed by the adolescents. Fig 2 also shows that school services were the least used service by adolescent with mental disorder and suicidality in both child data and parent data. In addition, it shows though the percentages is low compared to other services, however, the number of adolescents who used telephone counselling services was higher, as shown by child data compared to parent data.

Adolescents with mental disorders: Sociodemographic factors vs. mental health services

Table 2 demonstrates in both child and parent data that a greater proportion of older age-group (>15–17 years) tended to access all or at least one of the mental health services including online services compared to the younger group aged 13–15 years. Both data also reported that more girls used all types of mental health services than boys. Adolescents from low-medium income households utilized more health services, compared to adolescents from high-income households which may be due to that adolescents from low-medium income households are more likely to have a mental disorder. Educational background of the parents did not have such differentiated impact on the utilization of any services. Parents' employment found to have good impact on mental health service use among adolescents given that employed parents are more likely to be educated so they have better health information and more aware of the consequence of mental disorders and suicidality. Table 2 also shows that remoteness, family functioning and IRSAD quintile did not have a significant impact on most of the mental health services; except for health services in child data where IRSAD quintile found to have a significant impact. As expected, adolescents who had a history of substance use accessed more mental health services

Table 1. Sample characteristics (i.e. Adolescents aged 13–17 years).

Characteristics	Total	Mental Disorder[$]		Suicidality[¥]	
	n (%)	n (%)	*p*- value	n (%)	*p*- value
Total	2134 (100.0)	740 (34.7)		168 (7.9)	
Age (Mean = 15.4, SD = 1.39)					
13 to ≤15	891 (41.8)	328 (44.3)	0.079	51 (30.4)	0.002
>15 to 17	1243 (58.2)	412 (55.7)		117 (69.6)	
Gender					
Boys	1112 (52.1)	390 (52.7)	0.689	47 (28.0)	<0.001
Girls	1022 (47.9)	350 (47.3)		121 (72.0)	
Remoteness					
Cities	1372 (64.3)	494 (66.8)	0.083	102 (60.7)	0.211
Regional/Remote	762 (36.7)	246 (33.2)		66 (39.3)	
Household income^					
Low	493 (23.1)	208 (28.1)	<0.001	49 (29.2)	0.015
Medium	983 (46.1)	342 (46.2)		82 (48.8)	
High	658 (30.8)	190 (25.7)		37 (22.0)	
Parents' educational level					
Bachelor	684 (32.1)	198 (26.8)	0.001	46 (27.4)	0.362
Diploma	771 (36.1)	285 (38.5)		65 (38.7)	
Year 10/11	679 (31.8)	257 (34.7)		57 (33.9)	
Parents' employment status					
Employed	1631 (76.4)	531 (71.8)	<0.001	118 (70.2)	0.023
Unemployed	503 (23.6)	209 (28.2)		50 (29.8)	
Family type[J]					
Original	1275 (59.7)	404 (54.6)	<0.001	86 (51.2)	0.011
Other	859 (40.3)	336 (45.4)		82 (48.8)	
Family functioning					
Very good/Good	1758 (82.4)	564 (76.2)	<0.001	122 (72.6)	<0.001
Fair/Poor	376 (17.6)	176 (23.8)		46 (27.4)	
IRSAD quintile[£]					
Lowest	323 (15.1)	135 (18.2)	0.001	38 (22.6)	0.036
Second	370 (17.3)	147 (19.9)		28 (16.7)	
Third	454 (21.3)	157 (21.2)		38 (22.6)	
Fourth	474 (22.2)	151 (20.4)		28 (16.7)	
Highest	513 (24.0)	150 (20.3)		36 (21.4)	
Substance use by the child†					
No	1225 (57.4)	403 (54.5)	0.045	35 (20.8)	<0.001
Yes	909 (42.6)	337 (45.5)		133 (79.2)	

Data are shown as n (%)

P-value of association with different mental health services

[$]No. of children having any of the following mental disorders—ADHD or Major depressive disorder or Anxiety disorder (General anxiety/Separation anxiety/Obsessive Compulsive Disorder/Social phobia) or conduct disorder

[¥]No. of children seriously considered attempting suicide in the past 12 months

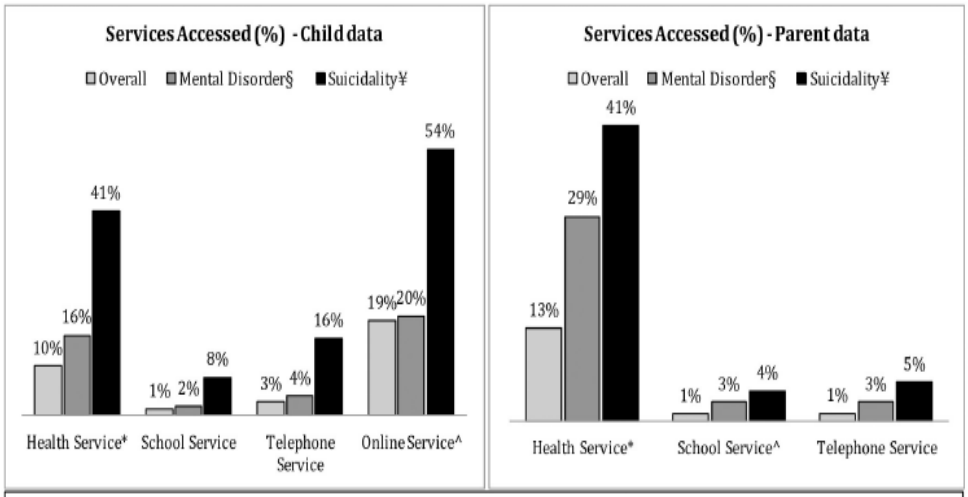
^Household income: Low (<$52000), Medium ($52000-$129999) and High (>$130000)

[J]Family type: original families means children are natural, adopted, or foster child of both parents, and no step child; other families include step, blended and children from families who are not natural, adopted, foster or step of either parent

[£]IRSAD: "The Index of Relative Socio-economic Advantage and Disadvantage (IRSAD): Summarizes information about the economic and social conditions of people and households within an area, including both relative advantage and disadvantage measures. Low indicates relatively greater disadvantage and a lack of advantage in general and high score indicates a relative lack of disadvantage and greater advantage in general."

[†]Ever seriously try cigarette smoking, drink alcohol, cannabis or any other illegal drugs

https://doi.org/10.1371/journal.pone.0231180.t001



Notes:
*Health services include private, hospital, Child and adolescent mental health services (CAMHS), public mental health, headspace centre (i.e. one-stop-shop for young people who need help with mental health, physical and sexula health, alcohol and other drugs), community clinics and any health professional that the children have accessed in last 12-months
^Counseling service provided by a school or by any educational institution
§No. of adolescentss having any of the following mental disorders - ADHD or Major depressive disorder or Anxiety disorder (General anxiety/Separation anxiety/Obsessive Compulsive Disorder/Social phobia) or conduct disorder
¥No. of adolescetns seriously considered attempting suicide in the past 12-months

Fig 2. Distribution of mental health services. *Health service include private, hospital, Child and adolescent mental health service (CAMHS), public mental health.

https://doi.org/10.1371/journal.pone.0231180.g002

compared to others, except for school services in parent data. Also, adolescents with multiple mental disorders were found to have a significant impact on the service use compared to those with a mental disorder, except for telephone services in child data.

A binary logistic model was used to investigate the factors associated with the use of various mental health services among adolescents with mental disorders (Table 3). According to child data, girls were respectively 2.62 (95% CI: 1.61–4.28), 2.50 (95% CI: 1.62–3.88) and 1.95 (95% CI: 1.31–2.91) times more likely to use health service, online service and any services compared to boys, however, parent data did not show such differences in gender. Child data also shows adolescents of unemployed parents' were 1.84 times (95% CI: 1.04–3.24) more likely to utilize health services compared to those from employed parents'. In parent data, it is found that adolescents born in middle-income families tended to utilize telephone services 5.54 times more compared to adolescents from low and high-income households and only health services or any services were significantly associated with family type. Both data shows that adolescents who had a history of substance use were significantly associated with all types of services compared to those who do not have any exposure to substances except for school service in parent data. Further, Table 3 shows that adolescents with more than one mental disorder were more likely to use health service, school service or any services compared to those with single disorder, as reported by child data and parent data.

Adolescents with suicidality: Sociodemographic factors vs. mental health services

The bivariate analysis between mental health service use and sociodemographic factors among adolescents with suicidality (child data and parent data, Table 4) illustrates that more girls

Table 2. Bivariate analysis between mental health services and sociodemographic factors in adolescents with mental disorders (n = 740).

Characteristics	Child data					Parent data			
	Health Service	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
Total	120 (16.2)	13 (1.8)	29 (3.9)	148 (20.0)	203 (27.4)	211 (28.5)	19 (2.6)	19 (2.6)	221 (29.9)
Age									
13 to £15	37 (30.8)	5 (38.5)	12 (41.4)	51 (34.5)	74 (36.4)	75 (35.5)	12 (63.2)	3 (15.8)	79 (35.7)
>15 to 17	83 (69.2)	8 (61.5)	17 (58.6)	97 (65.5)	129 (63.5)	136 (64.5)	7 (36.8)	16 (84.2)	142 (64.3)
p- value	0.001	0.668	0.745	0.007	0.008	0.002	0.094	0.011	0.002
Gender									
Boys	42 (35.0)	3 (23.1)	13 (44.8)	47 (31.8)	79 (38.9)	97 (46.0)	9 (47.4)	4 (21.0)	101 (45.7)
Girls	78 (65.0)	10 (76.9)	16 (55.2)	101 (68.2)	124 (69.0)	114 (54.0)	10 (52.6)	15 (79.0)	120 (54.3)
p- value	<0.001	0.031	0.386	<0.001	<0.001	0.021	0.637	0.005	0.013
Remoteness									
Cities	84 (70.0)	8 (61.5)	16 (55.2)	105 (71.0)	144 (70.9)	130 (61.6)	11 (57.9)	15 (78.9)	138 (62.4)
Regional/Remote	36 (30.0)	5 (38.5)	13 (44.8)	43 (29.0)	59 (29.1)	81 (38.4)	8 (42.1)	4 (21.1)	83 (37.6)
p- value	0.410	0.687	0.177	0.226	0.138	0.061	0.406	0.253	0.104
Household income									
Low	40 (33.3)	3 (23.1)	11 (37.9)	40 (27.0)	61 (30.0)	74 (35.1)	6 (31.6)	5 (26.3)	78 (35.3)
Medium	55 (45.9)	8 (61.5)	13 (44.8)	72 (48.7)	94 (46.3)	92 (43.6)	9 (47.4)	10 (52.6)	98 (44.3)
High	25 (20.8)	2 (15.4)	5 (17.3)	36 (24.3)	48 (23.7)	45 (21.3)	4 (21.0)	4 (21.1)	45 (20.3)
p- value	0.259	0.512	0.390	0.800	0.662	0.021	0.882	0.836	0.009
Parents' education									
Bachelor	32 (26.6)	4 (30.8)	4 (13.8)	41 (27.7)	57 (28.1)	55 (26.1)	8 (42.1)	4 (21.1)	58 (26.2)
Diploma	50 (41.7)	6 (46.1)	16 (55.2)	63 (42.6)	83 (40.9)	79 (37.4)	7 (36.8)	10 (52.6)	84 (38.0)
Year 10/11	38 (31.7)	3 (23.1)	9 (31.0)	44 (29.7)	63 (31.0)	77 (36.5)	4 (21.1)	5 (26.3)	79 (35.8)
p- value	0.685	0.671	0.123	0.336	0.429	0.817	0.249	0.440	0.930
Parents' employment									
Employed	74 (61.7)	10 (76.9)	20 (69.0)	103 (69.6)	138 (68.0)	137 (64.9)	14 (73.7)	13 (68.4)	144 (65.2)
Unemployed	46 (38.3)	3 (23.1)	9 (31.0)	45 (30.4)	65 (32.0)	74 (35.1)	5 (26.3)	6 (31.6)	77 (34.8)
p- value	0.007	0.676	0.733	0.514	0.161	0.009	0.850	0.744	0.009
Family type									
Original	56 (46.7)	5 (38.5)	13 (44.8)	76 (51.4)	103 (50.7)	93 (44.1)	9 (47.4)	7 (36.8)	99 (44.8)
Other	64 (53.3)	8 (61.5)	16 (55.2)	72 (48.6)	100 (49.3)	118 (55.9)	10 (52.6)	12 (63.2)	122 (55.2)
p- value	0.057	0.239	0.281	0.376	0.195	<0.001	0.522	0.115	<0.001
Family functioning									
Very good/Good	89 (74.2)	10 (76.9)	24 (82.8)	114 (77.0)	155 (76.4)	155 (73.5)	17 (89.5)	14 (73.7)	162 (73.3)
Fair/Poor	31 (25.8)	3 (23.1)	5 (17.2)	34 (23.0)	48 (23.6)	56 (26.5)	2 (10.5)	5 (26.3)	59 (26.7)
p- value	0.565	0.952	0.399	0.796	0.957	0.266	0.169	0.793	0.225
IRSAD quintile									
Lowest	21 (17.5)	3 (23.1)	7 (24.2)	25 (16.9)	34 (16.7)	39 (18.5)	2 (10.5)	4 (21.1)	41 (18.5)
Second	13 (10.9)	1 (7.7)	3 (10.3)	20 (13.5)	28 (13.8)	42 (19.9)	3 (15.8)	1 (5.2)	43 (19.5)
Third	36 (30.0)	4 (30.7)	10 (34.5)	33 (22.3)	51 (25.1)	53 (25.1)	5 (26.3)	7 (36.8)	57 (25.8)
Fourth	25 (20.8)	2 (15.4)	6 (20.7)	37 (25.0)	48 (23.7)	35 (16.6)	4 (21.1)	4 (21.1)	37 (16.7)
Highest	25 (20.8)	3 (23.1)	3 (10.3)	33 (22.3)	42 (20.7)	42 (19.9)	5 (26.3)	3 (15.8)	43 (19.5)
p- value	0.025	0.747	0.205	0.176	0.061	0.373	0.845	0.329	0.255
Substance Use by the child									
No	42 (35.0)	3 (23.0)	8 (27.6)	52 (35.1)	79 (38.9)	92 (43.6)	9 (47.4)	6 (31.6)	100 (45.3)
Yes	78 (65.0)	10 (76.9)	21 (72.4)	96 (64.9)	124 (61.1)	119 (56.4)	10 (52.6)	13 (68.4)	121 (54.7)

(*Continued*)

Table 2. (Continued)

Characteristics	Child data					Parent data			
	Health Service	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
p- value	<0.001	0.022	0.003	<0.001	<0.001	<0.001	0.529	0.042	0.001
No of mental disorders									
Single	58 (48.3)	4 (30.8)	16 (55.2)	90 (60.8)	121 (59.6)	101 (47.9)	6 (31.6)	5 (26.3)	107 (48.4)
Multiple	62 (51.7)	9 (69.2)	13 (44.8)	58 (39.2)	82 (40.4)	110 (52.1)	13 (68.4)	14 (73.7)	114 (51.6)
p- value	<0.001	0.003	0.103	0.017	0.001	<0.001	<0.001	<0.001	<0.001

Data are shown as n (%)

P-value of association with different mental health services

https://doi.org/10.1371/journal.pone.0231180.t002

accessed at least one of the health services than boys and older (>15–17) age-group use services more compared to younger (13-≤15) age-group. Online service, which was limited in child data, shows that76.7% of the adolescents who accessed online services were aged between >15–17 years, more girls (80%) use this service than boys and majority were from low-medium income families. Child data also shows that telephone service use is higher among adolescents from step/blended families compared to those living with their original parents. Parent data shows that adolescents with poor family functioning were less likely to utilize any services compared to those with good family functioning. As expected, both data shows among suicidal adolescents who reported of substance use accessed at least one service compared to those who did not use substances, and adolescents with a mental disorder used health services than by those without a mental disorder.

Table 5 highlights the mental health service use of among suicidal adolescents aged 13–17 years. Age of adolescents only had a significant impact on their use of telephone services in parent data. While gender was significantly associated with health service and online service use as reported in child data, and with any service as reported by parent data. Child data also shows that adolescents from unemployed parents' were 5.88 times (95% CI: 2.07–16.68) more likely to use health services compared to those from working parents'. Substance use among suicidal adolescents was only found to be significantly associated with health service use (OR 4.55, 95% CI: 1.34–15.44), as reported in child data. Both child data and parents reported that the most used service for suicidal adolescents with a mental disorder was health service compared to those who do not have any mental disorder. While, only according to the parents', any service was 2.38 times (95% CI: 1.09–5.17) more likely to be accessed by adolescents who reported suicidal ideation with planned and/or attempted compared to those who reported only ideation.

Discussion

Building on previous research on mental health service use in adolescents, the findings of this study suggest the differences in the factors influencing the service use among adolescents aged 13–17 with a mental disorder and/or suicidality.

Mental disorders and/or suicidality are frequent in adolescents aged 13–17; however, mental health services were less commonly accessed by these adolescents. The results suggest that service use in adolescents with a mental disorder was relatively low (about 27–30%) in comparison to previous study findings, which varies between 33–40% [26, 34–36]. In case of suicidal adolescents, a significant proportion (34.5% in child data and 57.1% in parent data) did not use any services, which is similar to the previous population-based studies in the US and

Table 3. Factors associated with mental health service uses in sub-sample I (binary regression).

Sociodemographic factors		Child data					Parent data			
		Health Service	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (Ref. 13 to ≤15)	>15 to 17	1.42 (0.80, 2.55)	0.42 (0.09, 1.91)	0.65 (0.22, 1.84)	1.14 (0.70, 1.85)	1.15 (0.75, 1.76)	0.99 (0.64, 1.53)	0.18*** (0.04, 0.85)	1.25 (0.23, 6.75)	0.99 (0.64, 1.51)
Gender (Ref. Boys)	Girls	2.62*(1.61, 4.28)	3.29 (0.75, 14.45)	1.15 (0.49, 2.69)	2.50*(1.62, 3.88)	1.95** (1.31, 2.91)	1.22 (0.82, 1.80)	1.25 (0.44, 3.51)	3.19 (0.84, 12.06)	1.22 (0.83, 1.80)
Remoteness (Ref. Cities)	Regional/ Remote	1.01 (0.56, 1.79)	2.27 (0.60, 8.56)	1.37 (0.54, 3.47)	0.85 (0.51, 1.40)	0.76 (0.48, 1.20)	1.17 (0.73, 1.89)	2.17 (0.51, 9.25)	1.22 (0.33, 4.47)	1.16 (0.72, 1.84)
Household income (Ref. Low)	Medium	0.85 (0.44, 1.62)	2.60 (0.53, 12.63)	0.53 (0.18, 1.51)	1.04 (0.55, 1.93)	0.83 (0.49, 1.41)	0.84 (0.49, 1.45)	0.98 (0.23, 4.11)	5.54***(1.07, 28.60)	0.89 (0.52, 1.52)
	High	0.63 (0.29, 1.33)	1.58 (0.16, 15.43)	0.40 (0.12, 1.32)	0.69 (0.32, 1.45)	0.59 (0.31, 1.13)	0.89 (0.45, 1.77)	0.54 (0.06, 4.44)	2.98 (0.46, 19.30)	0.81 (0.41, 1.58)
Parents' education (Ref. Bachelor)	Diploma	1.02 (0.56, 1.85)	0.66 (0.16, 2.63)	2.65 (0.78, 9.00)	0.98 (0.58, 1.65)	0.87 (0.52, 1.43)	0.61 (0.36, 1.05)	0.22 (0.05, 1.00)	0.74 (0.19, 2.78)	0.59 (0.35, 1.00)
	Year 10/11	0.58 (0.30, 1.12)	0.30 (0.07, 1.23)	1.01 (0.30, 3.41)	0.66 (0.32, 1.45)	0.59*** (0.31, 1.13)	0.66 (0.36, 1.21)	0.23*** (0.07, 0.72)	0.54 (0.17, 1.69)	0.61 (0.34, 1.10)
Parents' employment (Ref. Employed)	Unemployed	1.84*** (1.04, 3.24)	0.98 (0.27, 3.51)	0.91 (0.39, 2.14)	1.38 (0.80, 2.40)	1.50 (0.94, 2.39)	1.29 (0.82, 2.03)	2.33 (0.60, 8.97)	3.03 (0.84, 10.86)	1.36 (0.87, 2.13)
Family type (Ref. Original)	Other	1.40 (0.86, 2.27)	2.11 (0.59, 7.47)	1.39 (0.59, 3.27)	0.96 (0.60, 1.53)	1.07 (0.70, 1.64)	2.06** (1.33, 3.19)	0.88 (0.26, 2.95)	4.29 (0.97, 18.99)	1.96** (1.28, 3.01)
Family functioning (Ref. Very good/Good)	Fair/Poor	1.06 (0.61, 1.82)	1.31 (0.35, 4.89)	0.47 (0.16, 1.37)	0.93 (0.57, 1.53)	0.91 (0.58, 1.42)	1.02 (0.64, 1.60)	0.64 (0.13, 3.00)	0.63 (0.14, 2.69)	1.05 (0.67, 1.67)
IRSAD quintiles (Ref. Lowest)	Second	0.35*** (0.14, 0.83)	0.11 (0.00, 1.47)	0.53 (0.12, 2.35)	0.60 (0.27, 1.31)	0.60 (0.30, 1.17)	1.14 (0.56, 2.31)	0.39 (0.04, 3.45)	0.35 (0.02, 5.07)	1.17 (0.58, 2.35)
	Third	1.45 (0.64, 3.28)	0.79 (0.11, 5.49)	1.67 (0.46, 6.09)	0.96 (0.43, 2.13)	1.21 (0.62, 2.35)	1.29 (0.66, 2.52)	1.79 (0.41, 7.82)	2.57 (0.46, 14.22)	1.47 (0.75, 2.88)
	Fourth	1.24 (0.53, 2.90)	0.46 (0.08, 2.41)	0.88 (0.25, 3.07)	1.27 (0.60, 2.72)	1.37 (0.70, 2.65)	0.91 (0.45, 1.83)	1.77 (0.34, 9.13)	1.59 (0.29, 8.74)	1.05 (0.53, 2.07)
	Highest	1.10 (0.47, 2.57)	0.73 (0.13, 3.91)	0.62 (0.12, 3.16)	1.03 (0.46, 2.29)	0.94 (0.46, 1.90)	1.30 (0.61, 2.77)	1.91 (0.39, 9.31)	1.95 (0.31, 12.00)	1.34 (0.63, 2.83)
Substance Use (Ref. No)	Yes	1.74*** (0.99, 3.05)	5.16*** (1.01, 26.28)	4.56** (1.65, 12.56)	2.02** (1.23, 3.33)	1.82** (1.16, 2.87)	2.26** (1.40, 3.64)	2.77 (0.72, 10.63)	8.73***(1.02, 74.17)	2.08** (1.31, 3.23)
No of Mental disorders (Ref. Single)	Multiple	3.23*(1.98, 5.27)	6.46*** (1.58, 26.44)	1.18 (0.51, 2.73)	1.37 (0.89, 2.11)	1.78** (1.18, 2.69)	3.34*(2.16, 5.18)	9.96*(3.14, 31.53)	3.90 (0.93, 16.28)	3.35*(2.17, 5.18)

OR = odds ratio; CI = confidence interval

Level of Significance Considered: P<0.05***, P<0.01**, P<0.001*

Survey weight adjusted

https://doi.org/10.1371/journal.pone.0231180.t003

Canada[13, 37]. This ongoing disparity may be explained by the shortage of mental health resources and the lack of training of health professionals in the detection of mental health problems among adolescents [4, 13]. Though, it is important to note that the quality of the mental health care provided was not measured in this study.

The findings of the study shows that several factors were significantly associated with the service use in adolescents aged 13–17 with mental disorders and/or suicidality. Older age group (>15 to 17 years) tended to use more mental health services than to younger group (13 to ≤15 years). One explanation for this may be that older age-group is more likely to be in

Table 4. Bivariate analysis between mental health services and sociodemographic factors in adolescents with suicidality (n = 168).

Characteristics	Child data					Parent data			
	Health Service	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
Total	69 (41.1)	13 (7.7)	26 (15.5)	90 (53.6)	110 (65.5)	69 (41.1)	7 (4.2)	9 (5.4)	72 (42.9)
Age									
13 to ≤15	19 (27.5)	6 (46.2)	8 (30.8)	21 (23.3)	27 (24.5)	16 (23.2)	5 (71.4)	1 (11.1)	18 (25.0)
>15 to 17	50 (72.5)	7 (53.8)	18 (69.2)	69 (76.7)	83 (75.5)	53 (76.8)	2 (28.6)	8 (88.9)	54 (75.0)
p- value	0.507	0.197	0.096	0.033	0.024	0.092	0.016	0.197	0.191
Gender									
Boys	12 (17.4)	2 (15.4)	5 (19.2)	18 (20.0)	24 (21.8)	13 (18.8)	1 (14.3)	1 (11.1)	13 (18.1)
Girls	57 (82.6)	11 (84.6)	21 (80.8)	72 (80.0)	86 (78.2)	56 (81.2)	6 (85.7)	8 (88.9)	59 (81.6)
p- value	0.011	0.292	0.280	0.013	0.014	0.028	0.410	0.247	0.013
Remoteness									
Cities	48 (69.6)	10 (76.9)	15 (57.7)	59 (65.5)	71 (64.5)	47 (68.1)	3 (42.9)	7 (77.8)	49 (68.0)
Regional/Remote	21 (30.4)	3 (23.1)	11 (42.3)	31 (34.4)	39 (35.5)	22 (31.9)	4 (57.1)	2 (22.2)	23 (31.9)
p- value	0.050	0.213	0.731	0.168	0.161	0.101	0.323	0.281	0.092
Household income									
Low	25 (36.2)	3 (23.1)	13 (50.0)	20 (22.2)	31 (28.2)	19 (27.5)	3 (42.9)	2 (22.2)	19 (26.4)
Medium	31 (44.9)	7 (53.8)	9 (34.6)	45 (50.0)	52 (47.3)	35 (50.7)	3 (42.9)	6 (66.7)	36 (50.0)
High	13 (18.9)	3 (23.1)	4 (15.4)	25 (27.8)	27 (24.5)	15 (21.8)	1 (14.2)	1 (11.1)	17 (23.6)
p- value	0.234	0.878	0.040	0.046	0.554	0.905	0.697	0.524	0.773
Parents' education									
Bachelor	15 (21.7)	3 (23.0)	6 (23.0)	26 928.9)	28 (25.4)	17 (24.7)	2 (28.6)	2 (22.2)	19 (26.4)
Diploma	30 (43.5)	5 (38.5)	10 (38.5)	33 (36.7)	42 (38.2)	29 (42.0)	3 (42.8)	4 (44.5)	30 (41.7)
Year 10/11	24 (34.8)	5 (38.5)	10 (38.5)	31 (34.4)	40 (36.4)	23 (33.3)	2 (28.6)	3 (33.3)	23 (31.9)
p- value	0.353	0.914	0.821	0.826	0.604	0.715	0.952	0.916	0.787
Parents' employment									
Employed	37 (53.6)	10 (76.9)	14 (53.8)	64 (71.1)	74 (67.3)	48 (69.6)	5 (71.4)	6 (66.7)	50 (69.4)
Unemployed	32 (46.4)	3 (23.1)	12 (46.2)	26 (28.9)	36 (32.7)	21 (30.4)	2 (28.6)	3 (33.3)	22 (30.6)
p- value	<0.001	0.583	0.047	0.790	0.247	0.873	0.944	0.810	0.846
Family type									
Original	34 (49.3)	4 (30.8)	8 (30.8)	49 (54.5)	55 (50.0)	32 (46.4)	3 (42.8)	4 (44.5)	35 (48.6)
Other	35 (50.7)	9 (69.2)	18 (69.2)	41 (45.5)	55 (50.0)	37 (53.6)	4 (57.1)	5 (55.5)	37 (51.4)
p- value	0.678	0.125	0.023	0.365	0.671	0.297	0.652	0.677	0.562
Family functioning									
Very good/Good	49 (71.0)	9 (69.2)	20 (76.9)	65 (72.2)	79 (71.8)	43 (62.3)	7 (100.0)	7 (77.8)	46 (63.9)
Fair/Poor	20 (28.9)	4 (30.8)	6 (23.1)	25 (27.8)	31 (28.2)	26 (37.7)	0 (0.0)	2 (22.2)	26 (36.1)
p- value	0.697	0.775	0.592	0.901	0.749	0.012	0.097	0.721	0.028
IRSAD quintile									
Lowest (Most disadvantaged)	18 (26.1)	4 (30.8)	9 (34.6)	18 (20.0)	24 (21.8)	12 (17.4)	2 (28.5)	1 (11.1)	12 (16.7)
Second	7 (10.2)	1 (7.7)	2 (7.7)	10 (11.1)	12 (10.9)	12 (17.4)	1 (14.3)	1 (11.1)	12 (16.7)
Third	17 (24.6)	2 (15.4)	6 (23.1)	22 (24.4)	29 (26.4)	16 (23.2)	1 (14.3)	4 (44.5)	18 (25.0)
Fourth	11 (15.9)	2 (15.4)	4 (15.4)	16 (17.8)	19 (17.3)	10 (14.5)	1 (14.3)	1 (11.1)	10 (13.9)
Highest (Most advantaged)	16 (23.2)	4 (30.7)	5 (19.2)	24 (26.7)	26 (23.6)	19 (27.5)	2 (28.5)	2 (22.2)	20 (27.8)
p- value	0.402	0.734	0.471	0.131	0.056	0.428	0.967	0.572	0.263
Substance Use by the child									
No	10 (14.5)	2 (15.4)	5 (19.2)	14 (15.6)	17 (15.5)	7 (10.1)	0 (0.0)	2 (22.2)	9 (12.5)
Yes	59 (85.5)	11 (84.6)	21 (80.8)	76 (84.4)	93 (84.5)	62 (89.9)	7 (100.0)	7 (77.8)	63 (87.5)

(*Continued*)

Table 4. (Continued)

Characteristics	Child data					Parent data			
	Health Service	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
p- value	0.091	0.615	0.827	0.070	0.018	0.004	0.166	0.916	0.021
Any Mental disorder									
No	16 (23.2)	3 (23.1)	11 (42.3)	32 (35.6)	39 (35.5)	9 (13.0)	1 (14.3)	2 (22.2)	11 (15.3)
Yes	53 (76.8)	10 (76.9)	15 (57.7)	58 (64.4)	71 (64.5)	60 (87.0)	6 (85.7)	7 (77.8)	61 (84.7)
p- value	<0.001	0.170	0.889	0.119	0.042	<0.001	0.141	0.237	<0.001
Suicidality group									
Ideation without plan or attempt	16 (23.2)	1 (7.7)	7 (26.9)	27 (30.0)	32 (29.1)	14 (20.3)	1 (14.3)	2 (22.2)	14 (19.4)
Ideation with planned and/or attempted	33 (76.8)	12 (92.3)	19 (73.1)	63 (70.0)	78 (70.9)	55 (79.7)	6 (85.7)	7 (77.8)	58 (80.6)
p- value	0.379	0.106	0.986	0.312	0.353	0.112	0.446	0.751	0.063

Data are shown as n (%)

P-value of association with different mental health services

https://doi.org/10.1371/journal.pone.0231180.t004

situations (e.g. access to the Internet and telephone) where they can use mental health services easily compared to younger group [4]. Consistent with previous research [28, 38, 39], the present study has also shown that girls than boys either with mental disorder or suicidality were more likely to use mental health services. This is may be due to the fact that girls are experiencing more mental health problems than boys in the adolescence [4]. Amongst other factors, the fact that fewer boys were using mental health services could be attributed to their lower perceived need for mental health support due to mental health problems, their preference for self-management and their lack of knowledge about where to get services, and more negative attitudes towards health service providers [39–41]. The results also show that adolescents with mental disorders and suicidality living in families with unemployed parents, low-medium income, or with other families (i.e. combination of sole, step and blended parent) accessed more mental health services than those in families that were least disadvantaged. Previous studies claimed that the service use is higher among disadvantaged families because mental health problems are more prevalent among adolescents in these families [15, 26]. Interestingly, the findings also suggest that substance use by the adolescents is significantly associated with service use in both subgroups, which is not similar with the previous research [42] and shows the increasing importance of service use among adolescents with the habit of substance use. Also, confirming the previous research [43], the present study shows that adolescents with multiple mental disorders more likely to access health services, school services or any services compared to those with single mental disorder. This is may be because individuals with multiple mental disorders undergo more adverse social consequences such as stigma, stress, social withdrawal, family conflict, and financial problems, and as a result seeking professional help for mental health problems [43, 44]. Furthermore, among suicidal adolescents, suicidal ideation with planned and/or attempted group accessed more mental health services compared to ideators group only. However, these differences were not statistically significant, which most likely results due to small sample size. Overall, results indicated that the increased service use by adolescents with mental disorders and/or suicidality was noticeable for health services and online services, which is corroborated and expanded on those from previous studies in Australia [26, 45]. Further, data revealed that adolescents in both subpopulations did not use school services and telephone services as they were expected, which may results from an uptake of

Table 5. Factors associated with mental health service uses in sub-sample II (binary regression).

Sociodemographic factors		Child data					Parent data			
		Health Service	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (Ref. 13 to ≤15)	>15 to 17	0.73 (0.30, 1.79)	0.34 (0.09, 1.32)	1.21 (0.41, 3.55)	1.78 (0.79, 4.00)	1.72 (0.77, 3.87)	0.96 (0.41, 2.24)	0.03 (0.00, 1.02)	11.47***(1.29, 101.57)	0.89 (0.38, 2.08)
Gender (Ref. Boys)	Girls	2.75** (1.04, 7.29)	2.24 (0.47, 10.62)	2.02 (0.46, 8.86)	2.39** (1.11, 5.13)	2.21 (0.98, 4.94)	2.18 (0.88, 5.36)	3.18 (0.08, 113.43)	3.13 (0.20, 47.75)	2.41*** (1.01, 5.74)
Remoteness (Ref. Cities)	Regional/Remote	0.71 (0.32, 1.59)	0.58 (0.12, 2.73)	1.76 (0.61, 5.10)	0.88 (0.41, 1.85)	1.17 (0.51, 2.65)	0.74 (0.31, 1.72)	2.89 (0.50, 16.71)	0.61 (0.13, 2.78)	0.81 (0.36, 1.86)
Household income (Ref. Low)	Medium	0.46 (0.15, 1.41)	2.07 (0.31, 13.55)	0.34 (0.09, 1.30)	1.60 (0.64, 3.98)	0.82 (0.29, 2.36)	1.01 (0.35, 2.86)	0.44 (0.00, 85.36)	1.75 (0.19, 15.47)	1.00 (0.35, 2.82)
	High	0.40 (0.10, 1.61)	2.66 (0.25, 28.25)	0.29 (0.04, 1.74)	2.62 (0.71, 9.60)	1.29 (0.29, 5.60)	0.51 (0.12, 2.13)	0.57 (0.00, 43.74)	0.24 (0.01, 5.02)	0.78 (0.19, 3.18)
Parents' education (Ref. Bachelor)	Diploma	0.81 (0.27, 2.39)	0.93 (0.15, 5.73)	0.91 (0.17, 4.74)	1.21 (0.42, 3.45)	1.32 (0.44, 3.98)	0.36 (0.10, 1.23)	0.16 (0.01, 1.89)	0.72 (0.10, 5.03)	0.35 (0.10, 1.16)
	Year 10/11	0.63 (0.10, 1.61)	0.90 (0.14, 5.57)	0.91 (0.19, 4.40)	2.26 (0.71, 7.11)	2.86 (0.83, 9.84)	0.45 (0.10, 1.98)	0.81 (0.04, 15.36)	1.89 (0.39, 9.01)	0.40 (0.09, 1.69)
Parents' employment (Ref. Employed)	Unemployed	5.88**(2.07, 16.68)	0.75 (0.09, 6.11)	1.58 (0.48, 5.18)	1.16 (0.47, 2.84)	1.90 (0.71, 5.10)	1.14 (0.43, 3.06)	1.56 (0.24, 9.87)	1.08 (0.18, 6.31)	1.17 (0.44, 3.10)
Family type (Ref. Original)	Other	1.12 (0.46, 2.69)	4.11 (0.95, 17.74)	3.59 (1.29, 10.02)	0.85 (0.40, 1.79)	1.47 (0.64, 3.38)	2.04 (0.81, 5.12)	0.69 (0.06, 7.29)	1.30 (0.37, 4.58)	1.73 (0.73, 4.09)
Family functioning (Ref. Very good/Good)	Fair/Poor	0.80 (0.33, 1.88)	1.07 (0.26, 4.36)	0.60 (0.17, 2.15)	0.94 (0.42, 2.09)	0.80 (0.35, 1.82)	1.36 (0.62, 2.97)	-	0.41 (0.07, 2.41)	1.18 (0.54, 2.56)
IRSAD quintiles (Ref. Lowest)	Second	0.27* (0.07, 1.02)	0.21 (0.01, 3.02)	0.32 (0.05, 2.02)	0.73 (0.22, 2.38)	0.55 (0.13, 2.33)	1.27 (0.28, 5.77)	2.43 (0.01, 442.14)	0.91 (0.03, 23.49)	1.30 (0.31, 5.47)
	Third	1.41 (0.40, 4.96)	0.49 (0.06, 3.99)	1.71 (0.28, 10.29)	1.13 (0.38, 3.34)	2.36 (0.70, 7.99)	1.06 (0.28, 4.07)	4.38 (0.03, 620.39)	4.37 (0.36, 51.67)	1.48 (0.39, 5.52)
	Fourth	2.41 (0.62, 9.37)	0.62 (0.07, 5.14)	1.68 (0.41, 6.91)	1.44 (0.52, 3.94)	2.47 (0.71, 8.52)	1.68 (0.40, 7.04)	0.69 (0.02, 19.64)	2.04 (0.09, 43.91)	1.38 (0.33, 5.69)
	Highest	2.03 (0.51, 8.03)	0.83 (0.09, 7.46)	2.47 (0.55, 10.92)	2.05 (0.61, 6.87)	3.15 (0.86, 11.51)	2.54 (0.60, 10.77)	4.17 (0.14, 121.74)	1.75 (0.15, 20.01)	2.03 (0.51, 8.03)
Substance Use (Ref. No)	Yes	4.55**(1.34, 15.44)	2.79 (0.28, 27.88)	1.03 (0.28, 3.77)	1.76 (0.67, 4.66)	2.18 (0.80, 5.92)	3.11 (0.74, 12.94)	-	0.67 (0.13, 3.45)	2.61 (0.71, 9.50)
Mental disorder (Ref. No.)	Yes	4.88*(2.17, 10.98)	4.32 (0.74, 24.93)	0.83 (0.28, 2.43)	1.60 (0.78, 3.28)	1.81 (0.80, 4.08)	12.01** (3.69, 39.05)	10.79** (1.81, 64.29)	3.58 (0.33, 38.05)	9.67*(3.31, 28.24)
Ideators (Ref. Ideation without plan or attempt)	Ideation with planned and/or attempted	1.39 (0.49, 3.90)	5.29 (0.35, 79.67)	1.05 (0.34, 3.17)	0.72 (0.32, 1.62)	0.57 (0.22, 1.48)	1.98 (0.90, 4.32)	1.91 (0.06, 60.56)	1.81 (0.52, 6.33)	2.38*** (1.09, 5.17)

OR = odds ratio; CI = confidence interval

Level of Significance Considered: P<0.05***, P<0.01**, P<0.001*

Survey weight adjusted

https://doi.org/10.1371/journal.pone.0231180.t005

online service among adolescents [26]. Further research is needed supporting the efficacy of school and telephone services in adolescents aged 13–17 with mental disorders and/or suicidality.

This study has a few limitations that deserve to be mentioned. First, information on suicidality was from self-reported child data and not based on validated screening/assessment tools; hence stigma may have resulted in underreporting. Second, some determinants such as duration, waiting times, past experiences with accessed services were not included in the analysis, which can be serious barriers to mental health service uses [38]. The study is also limited by the fact that it did not examine whether the service use improved the mental health problems in adolescents, their performance in schools and social functioning [3]. Lastly, the reliability of recall as the analysis was based on a cross-sectional data which limits causal inferences. However, this is the most plausible method, and has been validated in earlier studies and accepted

by experts in the field [46]. However, findings of the study provided a better understanding of the several factors that have an impact on mental health service use in adolescents with mental disorder and suicidality using nationally representative data.

Conclusion

For many adolescents experiencing mental disorders and/or suicidality, mental health service uses remain low; which may be fueled by the lack of understanding of the factors that affecting mental health services in adolescents aged 13–17 years. The results indicated that some factors must be more clearly understood to facilitate increased service use by adolescents with mental disorder and/or suicidality. For instance, in adolescents with mental disorder and suicidality, there is inequitable access to services among subgroups such boys and adolescents from disadvantaged families. Innovative initiatives are necessary to reach this community. Additional research should address the specific barriers that may limit the use of mental health services, school and telephone counseling services in particular.

Acknowledgments

The paper is a part of the PhD study of the first author. The PhD program was funded by the University of Southern Queensland, Australia. The authors would like to thank the Telethon Kids Institute, The University of Western Australia, Roy Morgan Research, the Australian Government Department of Health for conducting the survey, and the Australian Data Archive for providing the YMM data set. The authors also would like to thank Dr Barbara Harmes for proofreading the manuscript before submission.

Author Contributions

Conceptualization: Md. Irteja Islam.

Data curation: Md. Irteja Islam.

Formal analysis: Md. Irteja Islam.

Methodology: Md. Irteja Islam, Enamul Kabir.

Project administration: Rasheda Khanam.

Resources: Rasheda Khanam.

Software: Md. Irteja Islam.

Supervision: Rasheda Khanam, Enamul Kabir.

Validation: Rasheda Khanam, Enamul Kabir.

Writing – original draft: Md. Irteja Islam.

Writing – review & editing: Rasheda Khanam, Enamul Kabir.

References

1. Rhodes AE, Bethell J, Bondy SJ. Suicidality, depression, and mental health service use in Canada. The Canadian Journal of Psychiatry. 2006; 51(1):35–41. https://doi.org/10.1177/070674370605100107 PMID: 16491982
2. Slade T, Johnston A, Oakley Browne M, Andrews G, Whiteford H. National Survey of Mental Health and Wellbeing: methods and key findings. Aust. N. ZJ Psychiatry 43 (7), 594–605. 2007.
3. Vu X-BB, Biswas RK, Khanam R, Rahman M. Mental health service use in Australia: The role of family structure and socio-economic status. Children and Youth Services Review. 2018; 93:378–89.

4. Cheung A, Dewa C, Cairney J, Veldhuizen S, Schaffer A. Factors associated with use of mental health services for depressed and/or suicidal youth aged 15–24. Community Mental Health Journal. 2009; 45 (4):300–6. https://doi.org/10.1007/s10597-009-9205-8 PMID: 19562486

5. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. Archives of general psychiatry. 2005; 62(6):593–602. https://doi.org/10.1001/archpsyc.62.6.593 PMID: 15939837

6. Kinchin I, Doran C. The cost of youth suicide in Australia. International journal of environmental research and public health. 2018; 15(4):672.

7. WHO. Preventing suicide: a global imperative. Geneva, Switzerland: World Health Organization; 2014. Report No.: 9241564776.

8. Curtin SC, Heron MP. Death rates due to suicide and homicide among persons aged 10–24: United States, 2000–2017. 2019.

9. Christensen H, O'Neil D, editors. Suicide prevention in Australia using online interventions2018: Australian Primary Health Care Research Institute (APHCRI), The Australian National University.

10. ABS. Causes of Death, Australia, 2018 2018 [https://mindframe.org.au/suicide/data-statistics/abs-data-summary-2018.

11. Zubrick SR, Hafekost J, Johnson SE, Lawrence D, Saw S, Sawyer M, et al. Suicidal behaviours: prevalence estimates from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. Australian & New Zealand Journal of Psychiatry. 2016; 50(9):899–910.

12. AIHW. Mental health services In brief 2019. Canberra, Australia; 2019.

13. Cheung AH, Dewa CS. Mental health service use among adolescents and young adults with major depressive disorder and suicidality. The Canadian Journal of Psychiatry. 2007; 52(4):228–32. https://doi.org/10.1177/070674370705200404 PMID: 17500303

14. Lin E, Goering P, Offord DR, Campbell D, Boyle MH. The use of mental health services in Ontario: epidemiologic findings. The Canadian Journal of Psychiatry. 1996; 41(9):572–7. https://doi.org/10.1177/070674379604100905 PMID: 8946080

15. Lawrence D, Johnson S, Hafekost J, Boterhoven de Haan K, Sawyer M, Ainley J, et al. The mental health of children and adolescents: Report on the second Australian child and adolescent survey of mental health and wellbeing. 2015.

16. Sheppard R, Deane FP, Ciarrochi J. Unmet need for professional mental health care among adolescents with high psychological distress. Australian & New Zealand Journal of Psychiatry. 2018; 52 (1):59–67.

17. Lawrence D, Hafekost J, Johnson SE, Saw S, Buckingham WJ, Sawyer MG, et al. Key findings from the second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry. 2016; 50(9):876–86.

18. Cuffe SP, Waller JL, Addy CL, McKeown RE, Jackson KL, Moloo J, et al. A longitudinal study of adolescent mental health service use. The Journal of Behavioral Health Services & Research. 2001; 28(1):1–11.

19. Bergeron E, Poirier L-R, Fournier L, Roberge P, Barrette G. Determinants of service use among young Canadians with mental disorders. The Canadian Journal of Psychiatry. 2005; 50(10):629–36. https://doi.org/10.1177/070674370505001009 PMID: 16276854

20. Zwaanswijk M, Verhaak PF, Bensing JM, Van der Ende J, Verhulst FC. Help seeking for emotional and behavioural problems in children and adolescents. European child & adolescent psychiatry. 2003; 12 (4):153–61.

21. Merikangas KR, Nakamura EF, Kessler RC. Epidemiology of mental disorders in children and adolescents. Dialogues in clinical neuroscience. 2009; 11(1):7. PMID: 19432384

22. Steele L, Dewa C, Lee K. Socioeconomic status and self-reported barriers to mental health service use. The Canadian Journal of Psychiatry. 2007; 52(3):201–6. https://doi.org/10.1177/070674370705200312 PMID: 17479529

23. Roy-Byrne PP, Joesch JM, Wang PS, Kessler RC. Low socioeconomic status and mental health care use among respondents with anxiety and depression in the NCS-R. Psychiatric Services. 2009; 60 (9):1190–7. https://doi.org/10.1176/ps.2009.60.9.1190 PMID: 19723733

24. Wang PS, Lane M, Olfson M, Pincus HA, Wells KB, Kessler RC. Twelve-month use of mental health services in the United States: results from the National Comorbidity Survey Replication. Archives of general psychiatry. 2005; 62(6):629–40. https://doi.org/10.1001/archpsyc.62.6.629 PMID: 15939840

25. Zimmerman FJ. Social and economic determinants of disparities in professional help-seeking for child mental health problems: Evidence from a national sample. Health services research. 2005; 40(5p1):1514–33.

26. Johnson SE, Lawrence D, Hafekost J, Saw S, Buckingham WJ, Sawyer M, et al. Service use by Australian children for emotional and behavioural problems: Findings from the second Australian Child and

Adolescent Survey of Mental Health and Wellbeing. Australian & New Zealand Journal of Psychiatry. 2016; 50(9):887–98.

27. Brent DA. Depression and suicide in children and adolescents. Pediatrics in review. 1993; 14(10):380–8. https://doi.org/10.1542/pir.14-10-380 PMID: 8255818

28. Wu P, Hoven CW, Cohen P, Liu X, Moore RE, Tiet Q, et al. Factors associated with use of mental health services for depression by children and adolescents. Psychiatric services. 2001; 52(2):189–95. https://doi.org/10.1176/appi.ps.52.2.189 PMID: 11157117

29. Hafekost J, Lawrence D, Boterhoven de Haan K, Johnson SE, Saw S, Buckingham WJ, et al. Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing. Australian & New Zealand Journal of Psychiatry. 2016; 50(9):866–75.

30. Thomas HJ, Connor JP, Lawrence DM, Hafekost JM, Zubrick SR, Scott JG. Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. Australian & New Zealand Journal of Psychiatry. 2017; 51(9):909–20.

31. Association AP. Diagnostic and Statistical Manual of Mental Disorders (4th edn, text revision)(DSM–IV–TR) 4th, Text revision ed. Washington, DC: American Psychiatric Association; 2000.

32. CDC. Youth Risk Behavior Surveillance—United States. Centers for Disease Control and Prevention; 2013.

33. Deville J-C, Särndal C-E. Calibration estimators in survey sampling. Journal of the American statistical Association. 1992; 87(418):376–82.

34. Andrews G, Henderson S, Hall W. Prevalence, comorbidity, disability and service utilisation: overview of the Australian National Mental Health Survey. The British Journal of Psychiatry. 2001; 178(2):145–53.

35. Andrews G, Issakidis C, Carter G. Shortfall in mental health service utilisation. The British Journal of Psychiatry. 2001; 179(5):417–25.

36. Lesage A. Prevalence of Mental Illness and Related Service Untilization in Canada: An Analysis of the Canadian Community Health Survey: Canadian Collaborative Mental Health Initiative; 2006.

37. Freedenthal S. Racial disparities in mental health service use by adolescents who thought about or attempted suicide. Suicide and Life-Threatening Behavior. 2007; 37(1):22–34. https://doi.org/10.1521/suli.2007.37.1.22 PMID: 17397277

38. Fleury M-J, Ngui A, Bamvita J-M, Grenier G, Caron J. Predictors of healthcare service utilization for mental health reasons. International journal of environmental research and public health. 2014; 11 (10):10559–86. https://doi.org/10.3390/ijerph111010559 PMID: 25321874

39. Dey M, Jorm AF. Social determinants of mental health service utilization in Switzerland. International journal of public health. 2017; 62(1):85–93. https://doi.org/10.1007/s00038-016-0898-5 PMID: 27628490

40. Slaunwhite AK. The role of gender and income in predicting barriers to mental health care in Canada. Community mental health journal. 2015; 51(5):621–7. https://doi.org/10.1007/s10597-014-9814-8 PMID: 25563485

41. Johnson JL, Oliffe JL, Kelly MT, Galdas P, Ogrodniczuk JS. Men's discourses of help-seeking in the context of depression. Sociology of health & illness. 2012; 34(3):345–61.

42. Reavley NJ, Cvetkovski S, Jorm AF, Lubman DI. Help-seeking for substance use, anxiety and affective disorders among young people: results from the 2007 Australian National Survey of Mental Health and Wellbeing. Australian and New Zealand Journal of Psychiatry. 2010; 44(8):729–35. https://doi.org/10.3109/00048671003705458 PMID: 20636194

43. Fleury M-J, Grenier G, Bamvita J-M, Perreault M, Caron J. Determinants associated with the utilization of primary and specialized mental health services. Psychiatric Quarterly. 2012; 83(1):41–51. https://doi.org/10.1007/s11126-011-9181-3 PMID: 21607642

44. Guzzetta F, Miglio R, Santone G, Picardi A, Norcio B, Bracco R, et al. First-ever admitted psychiatric inpatients in Italy: clinical characteristics and reasons contributing to admission: findings from a national survey. Psychiatry research. 2010; 176(1):62–8. https://doi.org/10.1016/j.psychres.2008.11.005 PMID: 20089315

45. Pirkis JE, Burgess PM, Meadows GN, Dunt DR. Suicidal ideation and suicide attempts as predictors of mental health service use. Medical journal of Australia. 2001; 175(10):542–5. PMID: 11795546

46. Kessler RC, Walters EE. Epidemiology of DSM-III-R major depression and minor depression among adolescents and young adults in the national comorbidity survey. Depression and anxiety. 1998; 7 (1):3–14. https://doi.org/10.1002/(sici)1520-6394(1998)7:1<3::aid-da2>3.0.co;2-f PMID: 9592628

3.3 Study 6 - Suicidality, mental disorder, and the utilization of mental health services among Australian adolescents (Published in Children and Youth Services Review, Q1, IF: 1.870, SNIP: 1.104, Publisher - Elsevier)

Children and Youth Services Review 111 (2020) 104821

Contents lists available at ScienceDirect

Children and Youth Services Review

journal homepage: www.elsevier.com/locate/childyouth

Suicidality, mental disorder and the utilization of mental health services among Australian adolescents

Md. Irteja Islam[a,b,*], Enamul Kabir[a], Rasheda Khanam[a]

[a] Centre for Health, Informatics, and Economic Research and School of Commerce, University of Southern Queensland, West Street, Darling Heights, Toowoomba, Queensland 4350, Australia

[b] Maternal and Child Health Division, International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), 68, Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh

ABSTRACT

Introduction: Suicidality among adolescents continues to be a serious public health concern worldwide, and suicide is the leading cause of death for young Australians. However, to develop effective preventive interventions, it is essential to understand the types and rates of mental health service utilization among adolescents. This study investigated the association between suicidality and mental health service utilization among Australian adolescents, and to test whether service use is affected by the simultaneous presence of suicidality and mental disorders.

Method: Adolescents aged 13–17 years (n = 2134) were used in this study from The Second Australian Child and Adolescent Mental Health and Wellbeing Survey – Young Minds Matter (YMM), which is a nationwide cross-sectional survey. Data were collected through face-to-face interviews with parents using a structured-questionnaire, while, adolescents completed a computer-based self-reported questionnaire privately. The YMM reported four types of mental health service: (1) health services – any services provided by a qualified health professional, regardless of where that service was provided; (2) school services – any services such as counseling or support programs provided by school or any educational institution; (3) telephone counseling services; and (4) online services. Both bivariate and multivariate analyses were used to assess the relationships between independent variables (suicidality, mental disorder) and their distributions over outcome variables (mental health services), adjusting for relevant sociodemographic and potential risk factors such as age, gender, remoteness, household income, family type, family functioning, parents' education, parents' employment, substance use by the child. An interaction between mental disorders and suicidality were included in the regression to examine whether and to what extent service use is affected if an adolescent has both suicidality and a mental disorder.

Results: Overall, 168 (8%) adolescents reported suicidality and prevalence of suicidality (ideation, plan and attempt) was higher in adolescents with mental disorders ($P < 0.01$ for all). Suicidality was high among girls irrespective of mental health condition. Both bivariate and multivariate analyses using child data and parent data showed a strong and significant association between suicidality and mental health service utilization among adolescents. Online service and health services were more likely to be accessed by adolescents with suicidality as reported in child data and parent data, respectively; while, school and telephone counselling service were less utilized within the same population. However, still, a large number of adolescents with suicidality did not access any services, even the incidence of seeking any mental health service was higher among adolescents with suicidality compared to those with a mental disorder.

Conclusion: The limited number of suicidal adolescents is using mental health services, which is alarming for prevention of suicide. Further research is warranted to understand the quality of service received by adolescents and the factors influencing service utilization due to mental health-related problems. Also, interventions to improve care, prevention and monitoring are solely required for this group of people.

1. Introduction

Suicide among young people is recognized as a significant public health problem worldwide (McKinnon, Gariépy, Sentenac, & Elgar, 2016; Robinson, Calear, & Bailey, 2018; WHO, 2012). An estimated 6% of all young people die from suicide (McKinnon et al., 2016; WHO, 2012). Globally, it is the second leading cause of death among females and the third leading cause among males aged 10–24 years (Christensen & O'Neil, 2018; McKinnon et al., 2016; WHO, 2014). In Australia, suicide is the leading cause of death in individuals aged 15–24 years (Christensen & O'Neil, 2018; Kinchin & Doran, 2018). According to the Australian Bureau of Statistics, 404 individuals aged between 15 and 24 years died of suicide (ABS, 2017).

Suicidal behaviours include a spectrum of suicidality – suicidal ideations, plans, attempts and suicide itself (Page, Saumweber, Hall, Crookston, & West, 2013; WHO, 2014). Suicidality are prevalent in

* Corresponding author at: Centre for Health, Informatics, and Economic Research and School of Commerce, University of Southern Queensland, Workstation 15, Room T450, Block T, West Street, Darling Heights, Toowoomba, Queensland 4350, Australia. Maternal and Child Health Division (Level-7), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), 68, Shaheed Tajuddin Ahmed Sarani Mohakhali, Dhaka 1212, Bangladesh.

E-mail addresses: irteja.islam@icddrb.org, mdirteja.islam@usq.edu.au (Md. Irteja Islam), enamul.kabir@usq.edu.au (E. Kabir), rasheda.khanam@usq.edu.au (R. Khanam).

https://doi.org/10.1016/j.childyouth.2020.104821

Received 24 November 2019; Received in revised form 30 January 2020; Accepted 30 January 2020

Available online 08 February 2020

0190-7409/ © 2020 Elsevier Ltd. All rights reserved.

adolescence, and among girls in particular (McKinnon et al., 2016; Page et al., 2013). Though cross-national investigation of the prevalence of suicidality among adolescents is problematic due to variations in age aggregation, definitions and measures of suicidal behaviours, a mix of lifetime and 12-month prevalence has been reported by several studies (Kokkevi, Rotsika, Arapaki, & Richardson, 2012; McKinnon et al., 2016; Zubrick et al., 2016b). A study across 17-European countries indicated that the lifetime prevalence of ideation and suicide attempts in 15–16 years-old age-group was between 15% and 31.5% and 4.1%–23.5%, respectively (Kokkevi et al., 2012; McKinnon et al., 2016). A study conducted in 49 lower-middle-income countries (LMICs) reported that 15.3% of adolescents aged between 13 and 15 years considered suicide seriously in the past 12-months (McKinnon et al., 2016; Page et al., 2013). In New Zealand, the 12-month prevalence among 13–17 years-old ranged from 13.0 to 17.9% for ideation, 6.0%-11.6% for making a plan and 3.8%-5.7% for suicide attempts. These are among the highest estimates of suicidal behaviours involving adolescents among developed nations (Clark et al., 2013; Robinson et al., 2018; Zubrick et al., 2016b). In Australia, the rate of suicidal behaviours is not as high as in New Zealand. However, the recent estimates from a nationwide survey in Australia shows that about 7.5%, 5.2% and 2.4% among adolescents aged 12–17 years reported suicidal ideation, plans and attempts in the past 12-months, which is still alarming (Zubrick et al., 2016a, 2016b).

Suicide and suicidality, particularly in adolescence, is considered to be the end product of complex interactions between multiple risk factors which include mental and physical conditions, cultural and socio-economic status and lifestyle behaviour (i.e. alcohol and drug abuse) (De Leo, Burgis, Bertolote, Kerkhof, & Bille-Brahe, 2006; WHO, 2012). For instance, there is substantial evidence to suggest that mental disorders play a vital role in suicidal morbidity (ideation, plan or attempt) and mortality (Paschall & Bersamin, 2018; Sampasa-Kanyinga, Roumeliotis, & Xu, 2014). In addition, it has been found that suicide rates are commonly used as mental health indicators (Kung, Pearson, & Wei, 2005; Paschall & Bersamin, 2018; Sampasa-Kanyinga et al., 2014). A survey in 2013–14 reported that the rates of mental-health-service use for mental disorders among Australian adolescents aged 12–17 years (61.5%) has been increasing (Johnson et al., 2016) since the Australian government has instigated several programmes to increase access to these services for adolescents (Johnson et al., 2016; Vu, Biswas, Khanam, & Rahman, 2018). However, there have been a few empirical researches to examine the possible interactions between suicidality and mental disorders in explaining the utilization of mental health services.

Despite the claim that suicide is largely preventable is believed to be unsafe (Pridmore & Maajid, 2016; WHO, 2012), it has been shown in research that prevention of suicide begins with identifying the warning signs and considering them seriously, having discussions with adolescents about what problems they may be experiencing, and guiding them to seek proper mental health services. It is possible that a sense of suicidality may lead people to seek services, and timely intervention from service providers might play a significant role to reduce suicidality among adolescents (Pirkis, Burgess, Meadows, & Dunt, 2001). However, only a few studies have evaluated the association between suicidality and mental-health-service use involving adolescents, which makes the topic less clear (Rhodes, Bethell, & Bondy, 2006; Sareen et al., 2016). The majority of the studies to date have considered mental-health-services to be predictors and suicidality as the outcome variable, suggesting the service use is predictive of suicidal behaviours (Pirkis et al., 2001; Schweitzer, Klayich, & McLean, 1995). However, limited studies conceptualize the correlation the other way round – considering suicidality as a predictor of the use of mental-health-services (Pirkis et al., 2001). Moreover, few studies have estimated the degree of mental-health-service utilization in the simultaneous presence of suicidality and mental disorder. To the best of our knowledge, only one previous study (Pirkis et al., 2001); examined the extent to which suicidal ideation and suicidal attempts were predictive of mental-health-service utilization in Australia using data from the National Survey from Mental Health and Wellbeing in 1997, where the participants were aged at least 18 years. However, the authors only investigated the association by the type of health service providers involving only adult populations and did not consider two types of services: telephone and online services, which are currently becoming popular among young people. Furthermore, Pirkis et al. (2001) did not estimate the 12-month prevalence of suicidality in the presence or absence of mental disorders or examine the moderating effects of interaction terms among suicidality and mental disorders on the association. Studies by (Johnson et al., 2016), (Vu et al., 2018) and (Zubrick et al., 2016a,b), examined the determinants of service use and suicidal behaviors or self-harm among adolescents by using the same dataset; however, none of these explored the association of suicidality and mental-health-service utilization nor estimated the effect of interaction between suicidality and mental disorders on the association.

Thus, the purpose of the current study was to: (i) estimate 12-month prevalence of suicidality (ideation, plan and attempt) in adolescents aged 13–17 years; (ii) examine the association between suicidality with the use of mental-health-services; and (iii) investigate the extent to which mental-health-service use is affected by the simultaneous presence of suicidality and a mental disorder in an adolescent. There is an urgent need of understanding the interplay among suicidality, mental disorder and mental-health-service use for this age-group from policy perspective. This is because nowadays suicidality and mental disorders are common in adolescents, but the provision of mental-health-services are the worst for this population (Bowers, Manion, Papadopoulos, & Gauvreau, 2013; James, 2007; Kieling et al., 2011; Patel, Flisher, Hetrick, & McGorry, 2007). In addition, in developed countries like Australia, although promoting the development of mental-health-service in an educational setting and via the internet have emerged only fairly recently especially for young people, engaging adolescents with a particular style and therapeutic skill is often challenging. For these factors, a considerable gap exists between efficacy and effectiveness in the utilization of mental-health-service among adolescents (James, 2007; Patel et al., 2007).

2. Methods

2.1. Data source

Young Minds Matter (YMM): the second Australian Child and Adolescent Survey of Mental Health and Wellbeing, is a national cross-sectional survey that has been conducted during 2013–2014 by the University of Western Australia (UWA) thorough the Telethon Kids Institute, in partnership with Roy Morgan Research and funded by the Australian Government Department of Health (Hafekost et al., 2016; Lawrence, Johnson, Hafekost, Boterhoven de Haan, Sawyer, Ainley, & Zubrick, 2015). Briefly, YMM employed a multi-stage, area-based random sampling technique, designed to be representative of households with adolescents aged 4–17 year-olds in Australia. If there was more than one eligible child in the household, a single child was randomly included for the survey (Thomas et al., 2017). In total, 6310 parents/carers (55% of eligible households) of adolescents aged 4–17 years participated voluntarily in the survey. In addition, 2967 adolescents (89% of eligible households) of 11–17 year-olds completed a self-reported questionnaire using a tablet or computer in a private setting at home to provide information on service use and risk behaviours. However, the most remote areas, homeless adolescents, adolescents living in any institutional care and in households where the interviews could not be conducted in English were excluded for the survey (Lawrence et al., 2015; Thomas et al., 2017). The design, sampling and survey methods are extensively described elsewhere (Hafekost et al., 2016).

2.2. Measures

2.2.1. Outcome variables:

Different types of mental health services used by the adolescents were considered as outcome variable in this study. Both self-reported child data and parent data provided information on the use of the following mental-health-services in the past 12-months by adolescents: (a) health services – any mental-health-services provided by a qualified health professional, regardless of where that service was provided - includes private chamber, hospital, CAMHS, public mental health centre, headspace centre and community clinics ; (b) school services – any services such as counseling, support programs provided by a school or any educational institution; (c) telephone counseling services; and (d) online services (only obtained from child data) (Lawrence et al., 2015). An extensive set of questions were asked to all consenting parents/carers about the use of mental health services by their adolescents; while self-reported information of service use was restricted to adolescents aged 13–17 years. Each service was a binary variable and responses were coded as '1' for Yes and '0' for No. Lastly, for both self-reported child data and parent data, all types of services were combined to create a binary variable – any service used by stating 'Yes' (Coded as 1) if at least one of the services used, and 'No' (Coded as 0) if none of these used.

2.2.2. Independent variables:

Suicidality (suicidal thoughts/ideation, plans and attempts) was measured through a series of questions where the respondents were adolescents aged 12–17 years, and items measuring suicidality were taken from CDC, 2014 YRBSS (CDC, 2014). Suicidal ideations were assessed with a question: 'During the past 12 months, did you ever seriously consider attempting suicide?' [Yes/No]. Among ideators, suicide plans and attempts were assessed with two questions, respectively; 'During the past 12 months, did you make a plan about how you would attempt suicide?' [Yes/No] and 'Did you attempt suicide during the past 12 months?' [Yes/No]. In this study, responses to these questions [Yes or No] were used to classify the suicidality into three groups: (i) only ideation (without plan and attempt); (ii) planned suicide; (iii) attempted suicide. Note that data on suicidality gathered from self-reported-questionnaires completed by adolescents aged 12–17 years at home, where confidentiality was maintained regarding all responses and not shared with consenting parents (Zubrick et al., 2016b).

Mental disorders: Seven modules of the diagnostic Interview schedule for Children-Version IV (DISC-IV) were included in the survey to identify the presence or absence of a mental disorder in the previous 12 months (APA, 2000). The broad categories of mental disorders included attention-deficit hyperactivity disorder (ADHD), major depressive disorders (MDD), conduct disorder (CD) and four types of anxiety disorders: generalized anxiety disorder (GAD), separation anxiety disorder (SAD), social phobia (SP) and obsessive–compulsive disorder (OCD) (Lawrence et al., 2015). In this paper, dichotomous variables were created to signify the presence of any mental disorders using parent data as it only provides information on the diagnosis of each type of mental disorder. Initially, GAD, SAD, SP and OCD were combined into one category as anxiety disorders (AD), and then, four types of mental disorders - ADHD, MDD, CD and AD, were combined to create a binary variable – presence of any mental disorder by stating 'Yes' (Coded as 1) - if at least of the mental illness present, and 'No' (Coded as 0) - if none of these present.

Sociodemographic factors: The following variables were taken from parent data and assessed as covariates - age, gender [boys/girls], household income/year [> $130000 (high)/$52000-$129999 (medium)/ < $52000 (low)], The index of relative socio-economic advantage and disadvantage (IRSAD) quintile (lowest/second/third/fourth/highest), family type [original/others included step, blended, sole parent and other], family functioning [very good/good and fair/poor], parents' education [bachelor/diploma/year-10/11], parents employment [employed/unemployed), substance use by the child [Yes/No].

2.3. Statistical analysis

This study uses the following conditions to conduct analyses on the samples (n = 2134) obtained after combining self-reported child data and parent data to achieve study objectives.

- The analysis was restricted to respondents 13–17 years to maintain age comparability across the survey. This is because data on service use was strictly restricted to age-group 13–17 years adolescents in the self-reported child data, and suicidal behaviour related information was only available in self-reported child data and was completely limited to age group 12–17 years.
- In addition, 'Don't know' and 'Prefer not to say' options in the response categories were omitted during analyses.

Initially, descriptive statistics of the used sample were calculated and bivariate analyses were conducted to examine the variables and their distributions over the outcome variable (mental-health-services). The chi-square test signified the strength of the bivariate associations (Table 1) (Agresti & Kateri, 2011) between these characteristics and the use of different mental-health-services. A bivariate analysis between an outcome and an independent variable shows a simplified view of an association in isolation from other independent variables. However, a multivariate analysis between an outcome variable and several independent variables can show associations that reflect the real situation, where many independent variables are operating together. To determine which factors are most strongly associated with the choice of a treatment provider, binary logistic regression was employed.

Odds ratios (ORs) and 95% confidence intervals (CIs) were computed from binary logistic regressions that examined associations between suicidality and various mental-health-services used by adolescents. Binary logistic models were used with a thought that they could measure the strength and statistical significance of each independent variable such as sociodemographic factors and mental disorders, and for determining whether each response is dependent on other independent variables and/or to describe the association between responses (Glonek & McCullagh, 1995; Harrell Jr, Lee, Califf, Pryor, & Rosati, 1984; Liang, Zeger, & Qaqish, 1992). In regression Model-1, all sociodemographic variables – age, gender, household income, family type, family functioning, parents' education, parents' employment, remoteness and substances used by the child were adjusted to examine the association between the predictor and outcome variables. In Model-2, mental disorders were adjusted together with Model-1 to see the changes in the odds of utilizing mental health services among those who reported suicidality. Finally, an interaction term (Ahlbom & Alfredsson, 2005; Karaca-Mandic, Norton, & Dowd, 2012) between suicidality and mental disorders was added to the regression Model-2 to investigate the different relations between the involved variables in the model. This was named Model-3. Stata/IC Version 14.1 was used for all data analyses.

3. Results

Table 1 reports the distribution and descriptive statistics of variables used in this study by mental-health-services used by adolescents aged 13–17. Respondents included in the analyses (n = 2134) had a mean age of 15.4, almost 60% were aged more than 15 years and more than half of the respondents were boys, 42.6% had a history of using substances, and more than one-third of adolescents (34.7%) were reported to have a mental disorder. As reported by self-reported child data, about 24.1% of adolescents aged 13–17 years accessed at least one service and a greater proportion used online service (19%). In contrast, parents reported data revealed that about 13.6% of the same aged adolescents

Table 1
Sample characteristics and bivariate associations between socio-demographic characteristics and mental health services used by children aged 13–17 years.

Characteristics	Total	Child data					Parent data			
		Health Service[T]	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
Total	2134 (1 0 0)	211 (9.9)	28 (1.3)	59 (2.8)	405 (19.0)	515 (24.1)	276 (12.9)	22 (1.0)	23 (1.1)	290 (13.6)
Age (Mean = 15.4, SD = 1.39)										
13 - < 15	891 (41.7)	69 (32.7)	13 (46.4)	21 (35.6)	137 (33.8)	184 (35.7)	98 (35.5)	15 (68.2)	4 (17.4)	104 (35.9)
≥15 − 17	1243 (58.3)	142 (67.3)	15 (53.6)	38 (64.4)	268 (66.2)	331 (64.3)	178 (64.5)	7 (31.8)	19 (82.6)	186 (64.1)
P value		0.005	0.614	0.331	< 0.001	0.001	0.024	0.012	0.017	0.029
Gender										
Boys	1112 (52.1)	72 (34.1)	8 (28.6)	20 (33.9)	142 (35.0)	193 (37.5)	118 (42.8)	10 (45.4)	6 (26.1)	124 (42.8)
Girls	1022 (47.9)	139 (65.9)	20 (71.4)	39 (66.1)	263 (65.0)	322 (62.5)	158 (57.2)	12 (54.6)	17 (73.9)	166 (57.2)
P value		< 0.001	0.012	0.005	< 0.001	< 0.001	0.001	0.530	0.012	0.001
Remoteness										
Cities	1372 (64.3)	147 (69.7)	20 (71.4)	39 (66.1)	281 (69.4)	357 (69.3)	175 (63.4)	13 (59.1)	18 (78.3)	185 (63.8)
Regional/Remote	762 (36.7)	64 (30.3)	8 (28.6)	20 (33.9)	124 (30.6)	158 (30.7)	101 (36.6)	9 (40.9)	5 (21.7)	105 (36.2)
P value		0.086	0.428	0.769	0.018	0.006	0.742	0.609	0.160	0.849
Family type										
Original	1275 (59.7)	106 (50.2)	14 (50.0)	21 (35.6)	241 (59.5)	293 (56.9)	121 (43.8)	11 (50.0)	8 (34.8)	129 (44.5)
Other	859 (40.3)	105 (49.8)	14 (50.0)	38 (64.4)	164 (40.5)	222 (43.1)	155 (56.2)	11 (50.0)	15 (65.2)	161 (55.5)
P-value		0.003	0.290	< 0.001	0.913	0.129	< 0.001	0.349	0.014	< 0.001
Family functioning										
Very good/Good	1758 (82.4)	166 (78.7)	20 (71.4)	48 (81.4)	330 (81.5)	420 (81.5)	212 (76.8)	19 (86.4)	17 (73.9)	223 (76.9)
Fair/Poor	376 (17.6)	45 (21.3)	8 (28.6)	11 (18.6)	75 (18.5)	95 (18.5)	64 (23.2)	3 (13.6)	6 (26.1)	67 (23.1)
P value		0.136	0.126	0.834	0.598	0.572	0.009	0.622	0.284	0.008
Parents' educational level										
Bachelor	684 (32.1)	72 (34.1)	10 (35.7)	15 (25.4)	145 (35.8)	179 (34.8)	80 (29.0)	9 (40.9)	5 (21.7)	85 (29.3)
Diploma	771 (36.1)	83 (38.3)	10 (35.7)	23 (39.0)	152 (37.5)	192 (37.3)	98 (35.5)	9 (40.9)	12 (52.2)	105 (36.2)
Year 10/11	679 (31.8)	56 (26.6)	8 (28.6)	21 (35.6)	108 (26.7)	144 (27.9)	98 (35.5)	4 (18.2)	6 (26.1)	100 (34.5)
P value		0.220	0.899	0.538	0.036	0.083	0.313	0.371	0.263	0.464
Parents' employment status										
Employed	1631 (76.4)	144 (68.2)	21 (75.0)	38 (64.4)	312 (77.0)	382 (74.2)	186 (67.4)	17 (77.3)	15 (65.2)	195 (67.2)
Unemployed	503 (23.6)	67 (31.8)	7 (25.0)	21 (35.6)	93 (23.0)	133 (25.8)	90 (32.6)	5 (22.7)	8 (34.8)	95 (32.8)
P value		0.003	0.858	0.027	0.749	0.166	< 0.001	0.925	0.203	< 0.001
Household income^										
Low	493 (23.1)	64 (30.3)	5 (17.9)	24 (40.7)	85 (21.0)	125 (24.3)	93 (33.7)	7 (31.8)	7 (30.4)	99 (34.1)
Medium	983 (46.1)	90 (42.7)	12 (42.9)	21 (35.6)	196 (48.4)	239 (46.4)	117 (42.4)	10 (45.5)	11 (47.8)	123 (42.4)
High	658 (30.8)	57 (27.0)	11 (39.3)	14 (23.7)	124 (30.6)	151 (29.3)	66 (23.9)	5 (22.7)	5 (21.8)	68 (23.5)
P value		0.030	0.589	0.005	0.457	0.630	< 0.001	0.547	0.554	< 0.001
IRSAD quintile[#]										
Lowest (Most disadvantaged)	323 (15.1)	37 (17.5)	5 (17.9)	13 (22.0)	57 (14.1)	79 (15.3)	50 (18.1)	2 (9.1)	5 (21.7)	53 (18.3)
Second	370 (17.3)	24 (11.4)	3 (10.7)	8 (13.6)	55 (13.6)	69 (13.4)	56 (20.3)	3 (13.6)	2 (8.7)	58 (20.0)
Third	454 (21.3)	48 (22.7)	7 (25.0)	15 (25.4)	85 (21.0)	111 (21.6)	61 (22.1)	6 (27.3)	7 (30.4)	66 (22.7)
Fourth	474 (22.2)	54 (25.6)	5 (17.9)	14 (23.7)	98 (24.2)	127 (24.7)	49 (17.8)	5 (22.7)	4 (17.4)	51 (17.6)

(*continued on next page*)

Table 1 (*continued*)

Characteristics	Total	Child data			Parent data				
		Health Service[τ]	School Service	Telephone Service	Online Service	Any Service	Health Service	School Service	Telephone Service	Any Service
Highest (Most advantaged)	513 (24.0)	48 (22.8)	8 (28.5)	9 (15.3)	110 (27.1)	129 (25.0)	60 (21.7)	6 (27.3)	5 (21.7)	62 (21.4)
P value		0.121	0.822	0.297	0.117	0.083	0.131	0.880	0.578	0.087
Substance Use by the child										
No	1225 (57.4)	83 (39.3)	11 (39.3)	17 (28.8)	181 (44.7)	235 (45.6)	121 (43.8)	11 (50.0)	8 (34.8)	131 (45.2)
Yes	909 (42.6)	128 (60.7)	17 (60.7)	42 (71.2)	224 (55.3)	280 (54.4)	155 (56.2)	11 (50.0)	15 (65.2)	159 (53.8)
P value		< 0.001	0.051	< 0.001	< 0.001	< 0.001	< 0.001	0.480	0.027	< 0.001
Mental disorders[§]										
No	1394 (65.3)	91 (43.1)	15 (53.6)	30 (50.9)	257 (63.5)	312 (60.6)	65 (23.5)	3 (13.6)	4 (17.4)	69 (23.8)
Yes	740 (34.7)	120 (56.9)	13 (46.4)	29 (49.1)	148 (36.5)	203 (39.4)	211 (76.5)	19 (86.4)	19 (82.6)	221 (76.2)
P value		< 0.001	0.188	0.018	0.381	0.009	< 0.001	< 0.001	< 0.001	< 0.001

Data are shown as n (%).
P-value (using the Pearson's chi-square test) of association with different mental health services.
[Ŧ]Household income: Low (< $52000), Medium ($52000-$129999) and High (> $130000).
[#] The Index of Relative Socio-economic Advantage and Disadvantage (IRSAD): Summarises information about the economic and social conditions of people and households within an area, including both relative advantage and disadvantage measures. Low incicates relatively greater disadvantage and a lack of advantage in general and high score indicates a relative lack of disadvantage and greater advantage in general.
[§] Presence of any mental disordres such as ADHD or Major depressive disorder or Anxiety disorder (General anxiety/Separation anxiety/Obsessive Compulsive Disorder/Social phobia) or conduct disorder.
[τ] Health services include private, hospital, CAMHS, public mental health, headspace centre, community and any health professional that the children have accessed in last 12 months.

accessed any services and approximately 12.9% of adolescents only used health services. Both data showed school services were the least used by the adolescents.

3.1. Relationship between mental-health-services and sociodemographic and potential risk factors

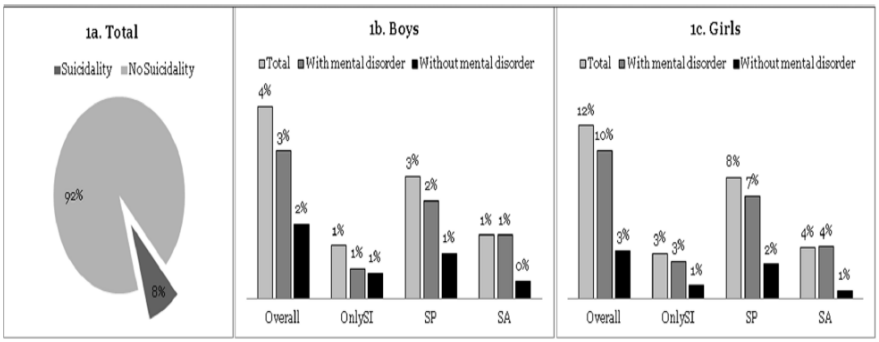
Table 1 also demonstrates the sociodemographic factors such as age, gender, remoteness, household income, primary carer's employment status, family type, family functioning type, substances used by adolescents and presence of any mental disorders that may have had significant associations with several services accessed by the adolescents, as shown by child data and parent data. Adolescents aged 15–17 years used most of the services compared to 13 to < 15 age-group, which was probably because 15–17 year-olds adolescents may have different understanding about mental health problems as they are approaching to adulthood and might exposed to advance educations in schools. Girls used all types of services than boys and adolescents from low-medium income households accessed more mental services compared to adolescents from high income families. This was probably due to the fact that adolescents from low-medium income households were likely to experience more mental health problems compared to adolescents from high income families, so they required seeking mental-health-services. Educational background of parents' did not show such impact on the use of mental services except on online services reported by the adolescents in the child data. However, child self-reported data showed that adolescents of working parents were almost three times (74.2% v 25.8%) more likely to use any services than those of unemployed parents. On the other hand, parent reported data showed that adolescents of working parents were more than twice as likely (67.2% v 32.8%, $P < 0.001$) to access any services. Both data reported that adolescents who used any substances like tobacco, alcohol or marijuana accessed more health services (60.7% in child data and 56.2% in parent data) compared to adolescents who did not. Unexpectedly, IRSAD quintile did not show any significant impact on the utilization of mental-health-services. The use of online services, which was only exclusive in self-reported child data, was significantly associated with gender ($P < 0.001$), and substance use of the adolescents ($P < 0.001$). Self-reported child data and parent data also demonstrated significant use of services by adolescents ($P < 0.05$) with mental disorders compared to those who had no mental illnesses, except health services and online services (child reported).

3.2. Prevalence of suicidality

Fig. 1 shows that overall, 168 (8%) participants reported suicidality (ideation/plan/attempt), 47 boys and 121 girls. Of the total respondents, 2.1% were only ideators, 5.4% were planned suicide and 2.5% were attempted suicide in the last 12 months preceding the survey. Among those with suicidality, more girls reported only suicidal ideation (19%), planned suicide (51%) and attempted suicide (21%) compared to boys. In addition, both boys and girls with a mental disorder more commonly reported suicidality compare to those without a mental disorder. Fig. 1 also depicts that overall suicidality is highest among the girls irrespective of mental health condition.

3.3. Bivariate association between the use of mental-health-services and suicidality

The bivariate analysis (Child data, Fig. 2) between mental health services and suicidality shows that about 71%, 66% and 77% of the adolescents who reported only ideation, suicidal plan and suicidal attempt, respectively, used any mental-health-services in the previous 12-months. That means, though the rate was slightly lower but a significant proportion had not used any services for those who reported ideation only (29%), plan (24%) and attempt (19%). Although online



Note: 1a. Overall, 1b. Among boys, 1c. Among Girls
Overall Suicidality, OnlySI - Only Suicidal Ideation, SP- Suicidal Plan, SA- Suicidal Attempt

Fig. 1. Prevalence of Suicidality by gender.

service was more preferred compared to other services as reported by adolescents, approximately 40% of adolescents who reported suicidality had not used this service. Child data (Fig. 2) also shows that school and telephone services were among the least used service among the adolescents with suicidality regardless of mental health condition.

Parent data (Fig. 2) illustrates that only 31%, 47% and 67% of those who reported suicidality (only ideation, suicidal plan and attempt) used any service, respectively. It also indicates that the rates of any service use are lower compared to the rates reported by adolescents, which is alarming. According to the parents, health services were more frequently used among adolescents who reported suicidality with or without mental disorder compared to other services. Similar to child data, parent data also indicates that school service is less commonly used by their children. The associations between the use of mental-health-services and suicidality were statistically significant ($P < 0.05$) for the overall sample who reported suicidality (ideation, plan and attempt), except for school services among those who reported ideation only in both child data and parent data. .

3.4. Multivariate association between the use of mental-health-services and suicidality

In this section we controlled for a range of potential socio-demographic covariates (age, gender, remoteness, household income, family type, family functioning, educational level and employment status of parents, IRSAD quintile and substance use by the child) with suicidality (ideation, plan and attempt) to investigate the association between suicidality and mental-health-services use. We termed this as Model-1. Then we added mental disorder (=1, if the child had any type of mental disorder) variable with Model-1 and named this Model-2. Finally, we added an interaction term, mental disorder*suicidality (ideation, plan and attempt) with Model-2 and called it Model-3. The justification of using this interaction was to investigate the extent of service use if a child has suicidality and mental disorder simultaneously. We applied logistic regression to estimate these three models for child data and parent data separately and reported the results in Table 2 and Table 3, respectively.

Although we adjusted for a range of variables in Model 1, 2, and 3, however, we only report the results of our main variables of interests: suicidality (ideation, plan and attempt), mental disorder and the interaction term (suicidality*mental disorder). Table 2 from child data shows that after controlling for a range of potential sociodemographic covariates in Model-1 adolescents who reported only ideation, plan and attempt were statistically significant and 4.19 (95% CI, 2.01–8.73), 5.28 (95% CI, 3.28–8.50) and 8.11 (95% CI, 3.98–16.49) times more likely to utilize at least one service compared to those who had not reported suicidality, respectively. In addition, online service (which was only inclusive in child data) was also found to be most commonly used by those who reported ideation, plan and attempt compared to those who had not reported suicidality. Model-2 (i.e. mental disorders

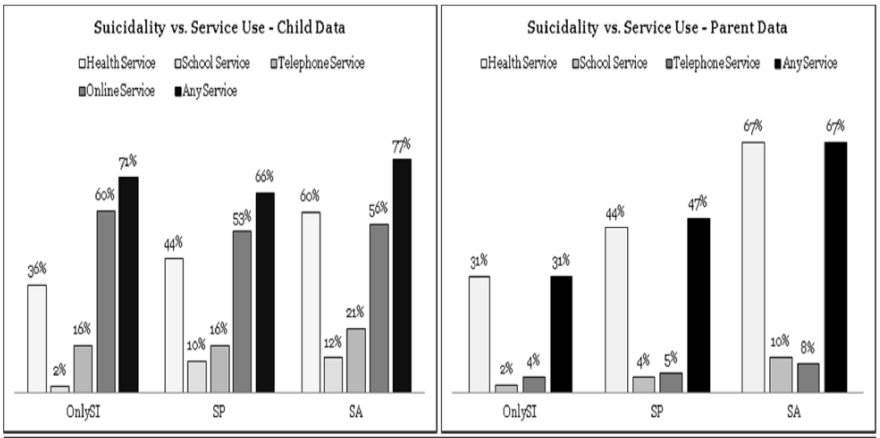


Figure 2. The use of mental health services among children who reported suicidality (i.e. OnlySI-Suicidal ideation only, SP-Suicidal Plan, SA-Suicidal Attempt)
Notes: P-values of association (Pearson's chi-square test used) between suicidality and different types of services were significant, except for school services among those who reported

Fig. 2. Mental health service use among children who reported suicidality.

Table 2
Binary logistic regression models for the odds of mental health service use by suicidality - Child data.

Suicidality	Health Service OR (95% CI)	School Service OR (95% CI)	Telephone Service OR (95% CI)	Online Service OR (95% CI)	Any Service OR (95% CI)
Model 1					
Suicidal ideation only	3.10** (1.55, 6.17)	0.88 (0.10, 7.54)	5.10** (1.78, 14.62)	3.66* (1.91, 7.01)	4.19* (2.01, 8.73)
Model 2					
Suicidal ideation only	2.74** (1.27, 5.89)	0.80 (0.09, 6.84)	4.79** (1.58, 14.47)	3.59* (1.85, 6.98)	4.05* (1.89, 8.67)
Mental disorder	2.48* (1.73, 3.55)	1.68 (0.69, 4.08)	1.49 (0.78, 2.83)	1.13 (0.87, 1.47)	1.28** (1.01, 1.63)
Model 3					
Suicidal ideation only	3.39*** (1.02, 11.25)	0.16 (0.01, 1.84)	9.11** (2.18, 38.07)	7.24* (2.68, 19.53)	8.29* (2.83, 24.25)
Mental disorder	2.52* (1.75, 3.63)	0.44 (0.10, 1.90)	1.66 (0.87, 3.16)	1.19 (0.91, 1.55)	1.33** (1.04, 1.70)
Ideation*Mental disorder	0.69 (0.16, 2.88)	28.38* (6.84, 117.80)	0.29 (0.87, 3.16)	0.26 (0.07, 0.95)	0.26 (0.06, 1.08)
Model 1					
Suicidal plan	7.40* (4.79, 11.41)	12.49* (5.27, 29.61)	6.18* (3.06, 12.47)	4.04* (2.56, 6.38)	5.28* (3.28, 8.50)
Model 2					
Suicidal plan	6.46* (4.24, 9.85)	12.20* (5.23, 27.59)	5.87* (2.87, 11.97)	3.99* (2.52, 6.32)	5.08* (3.16, 8.18)
Mental disorder	2.26* (1.58, 3.22)	1.22 (0.49, 4.30)	1.34 (0.71, 2.51)	1.06 (0.81, 1.38)	1.20 (0.94, 1.52)
Model 3					
Suicidal plan	3.48** (1.64, 7.38)	4.47** (1.02, 19.49)	7.90* (2.98, 20.91)	1.81 (0.89, 3.68)	2.53** (1.28, 5.01)
Mental disorder	1.95** (1.32, 2.90)	0.60 (0.15, 2.33)	1.54 (0.73, 3.26)	0.92 (0.69, 1.23)	1.08 (0.84, 1.39)
Plan*Mental disorder	2.82** (1.07, 7.43)	6.29 (0.77, 51.16)	0.57 (0.15, 2.12)	4.08** (1.66, 10.06)	3.80** (1.51, 9.56)
Model 1					
Suicidal attempt	13.41* (6.96, 25.84)	9.41* (2.96, 29.85)	6.40* (2.61, 15.68)	3.98* (2.13, 7.45)	8.11* (3.98, 16.49)
Model 2					
Suicidal attempt	11.17* (6.03, 20.68)	8.64* (2.62, 28.45)	5.94* (2.39, 14.78)	3.87* (2.05, 7.32)	7.63* (3.75, 15.54)
Mental disorder	2.30* (1.60, 3.32)	1.35 (0.55, 3.33)	1.40 (0.73, 2.68)	1.10 (0.84, 1.43)	1.22 (0.98, 1.65)
Model 3					
Suicidal attempt	6.58** (2.14, 20.23)	6.98 (0.85, 57.22)	8.66** (2.32, 32.27)	1.99 (0.65, 6.05)	3.86** (1.18, 12.61)
Mental disorder	2.20* (1.50, 3.21)	1.29 (0.46, 3.63)	1.51 (0.75, 3.04)	1.06 (0.80, 1.39)	1.19 (0.92, 1.53)
Attempt*Mental disorder	2.25 (0.55, 9.16)	1.34 (0.09, 19.34)	0.55 (0.10, 3.01)	2.66 (0.66, 10.62)	2.95 (0.68, 12.71)

Notes: Model 1: Sociodemographic factors are adjusted (age, gender, remoteness, household income, family type, family functioning, parents' education, parents' employment, IRSAD quintile, substance use by the child).
Model 2: Mental Disorders plus all variables from Model 1.
Model 3: Interaction between Suicidality and Mental disorder plus all variables from Model 2.
Survey weight adjusted.
* $p < 0.001$,
** $p < 0.01$,
*** $p < 0.05$ considered significant

were adjusted with all the variables in Model-1 also depicted significant associations between suicidality (ideation only, suicidal plan and attempt) and the use of mental-health-services compared to no suicidality. However, in Model-2, those who reported only suicidal ideation and mental disorder were 1.28 (95% CI, 1.01–1.63) times more likely to use any services compared to no suicidality. Surprisingly, mental disorder did not show any significant association in case of suicidal plan and attempt. In addition, results from Model-3 shows that utilization of any services were respectively 8.29 (95% CI, 2.83–24.25), 2.53 (95% CI, 1.28–5.01) and 3.86 (95% CI, 1.18–12.61) times more likely by the adolescents who reported suicidality (only ideation, plan and attempt) but no mental disorder compared to no suicidality. Adolescents who reported having mental disorders but no ideation was 1.33 (95% CI, 1.04–1.70) times more likely to use any services compared to adolescents who reported no mental disorder. The combined effect of suicidality and mental disorder on the service use was assessed by multiplying odds of suicidality, mental disorders and interaction term. Adolescents who reported simultaneous presence of suicidal plan and mental disorders were 19.13, 6.79 and 10.38, times more likely to use health service, online service and any services, respectively, compared to those who did not report suicidality and mental disorder. Results also revealed that the odds of using mental health services are statistically insignificant among adolescents with simultaneous presence of suicidal ideation and attempt, and mental disorders compared to those who had not reported any one of these. This result was not expected and this may be due to small numbers who reported both suitability and mental disorder. Almost similar findings were revealed from parent data with the exception of Model-3, which is presented in Table 3. For example, the findings reveal that adolescents who reported suicidality (only ideation, plan and attempt) were respectively 2.22, 6.28 and 9.45 times more likely to use any service compared to those who did not report suicidality. Other findings from Tables 2 and Table 3 were not discussed in detail to avoid excessive texts in the paper, however, can be provided upon request.

4. Discussion

The Australian Government has invested in large-scale interventions to provide mental-health-services to reduce mental health related problems and their consequences among adolescents. This initiative was motivated by the fact that most adolescents with suicidality usually do not receive timely care either due to lack of provision of mental-health-services during adolescence or due to access barriers to services (McGrath et al., 2011; Patel et al., 2007; Stephan, Weist, Kataoka, Adelsheim, & Mills, 2007). Although a few studies (Johnson et al., 2016; Vu et al., 2018) investigated the prevalence and determinants of mental-health-service uses among adolescents with mental disorders, however, research on the use of mental-health-services among adolescents with suicidality is very limited. This study fills this gap in the literature by examining the prevalence of suicidality among Australian adolescent (aged 13–17 years), and the association between suicidality and the utilization of mental-health-services using data from latest nationwide survey. In addition, this study investigated whether and to what extent mental-health-services utilization is affected by the simultaneous presence of suicidality and mental disorder at adolescence.

Findings from both child data and parent data suggested that the individuals with suicidal ideation and/or plans were more likely to make use of any services compared with non-suicidal individuals, and

Table 3
Binary logistic regression models for the odds of mental health service use by suicidality - Parent data.

Suicidality	Health Service OR (95% CI)	School Service OR (95% CI)	Telephone Service OR (95% CI)	Any Service OR (95% CI)
Model 1				
Suicidal ideation only	2.38*** (1.16, 4.88)	1.27 (0.14, 10.94)	2.80 (0.61, 12.73)	2.22*** (1.09, 4.54)
Model 2				
Suicidal ideation only	1.85 (0.94, 3.64)	1.02 (0.11, 9.24)	1.57 (0.30, 8.28)	1.70 (0.86, 3.36)
Mental disorder	6.79* (4.68, 9.83)	13.41* (2.94, 61.13)	8.50** (2.41, 29.92)	6.84* (4.78, 9.78)
Model 3				
Suicidal ideation only	0.57 (0.06, 4.78)	0.26 (0.02, 3.11)	0.93 (0.14, 6.16)	0.54 (0.06, 4.51)
Mental disorder	6.57* (4.51, 9.55)	9.23** (1.91, 44.52)	6.95** (1.79, 27.02)	6.63* (4.61, 9.53)
Ideation*Mental disorder	4.12 (0.40, 42.43)	7.69* (2.54, 24.61)	2.13 (0.49, 9.22)	3.94 (0.39, 39.91)
Model 1				
Suicidal plan	5.82* (3.65, 9.29)	9.94* (4.15, 23.80)	2.76 (0.83, 9.18)	6.28* (3.93, 10.03)
Model 2				
Suicidal plan	4.93* (2.98, 8.15)	8.99* (3.04, 26.56)	2.07 (0.58, 7.30)	5.40* (3.24, 9.01)
Mental disorder	6.51* (4.45, 9.51)	12.44** (2.61, 59.32)	8.27** (2.34, 29.15)	6.58* (4.55, 9.51)
Model 3				
Suicidal plan	3.72** (1.44, 9.57)	27.98** (2.36, 331.27)	8.97*** (1.09, 73.86)	4.97* (2.03, 12.18)
Mental disorder	6.17* (4.13, 9.22)	20.60** (2.38, 177.88)	13.31** (2.62, 67.68)	6.47* (4.37, 9.57)
Plan*Mental disorder	1.52 (0.52, 4.41)	0.24 (0.01, 4.01)	0.16 (0.01, 2.27)	1.13 (0.40, 3.18)
Model 1				
Suicidal attempt	10.02* (4.97, 20.20)	31.45* (9.14, 108.24)	5.04*** (1.28, 19.87)	9.45* (4.71, 18.94)
Model 2				
Suicidal attempt	8.15* (4.34, 15.33)	21.51* (5.19, 89.14)	3.04 (0.68, 13.47)	7.61* (4.05, 14.31)
Mental disorder	6.60* (4.51, 9.65)	10.75** (2.27, 5.70)	7.86** (2.32, 26.63)	6.63* (4.60, 9.58)
Model 3				
Suicidal attempt	3.71** (1.00, 13.74)	17.93** (3.29, 97.45)	2.34 (0.44, 12.37)	3.56 (0.98, 12.91)
Mental disorder	6.20* (4.20, 9.15)	10.32** (2.06, 51.64)	7.11** (1.82, 27.68)	6.27* (4.30, 9.12)
Attempt*Mental disorder	3.29 (0.66, 16.17)	1.27 (0.33, 4.77)	1.47 (0.32, 6.58)	3.14 (0.65, 15.20)

Notes: Model 1: Sociodemographic factors are adjusted (age, gender, remoteness, household income, family type, family functioning, parents' education, parents' employment, IRSAD quintile, substance use by the child).
Model 2: Mental Disorders plus all variables from Model 1.
Model 3: Interaction between Suicidality and Mental disorder plus all variables from Model 2.
Survey weight adjusted.
* $p < 0.001$,
** $p < 0.01$,
*** $p < 0.05$ considered significant.

people with suicidal attempts were even more likely to do so. Results indicated that the increased use of services by individuals reporting suicidality was most marked for health services and online services reported by parent data and self-reported child data, respectively. These findings corroborated and expanded on those from previous studies in Australia (Pirkis et al., 2001). Further, data revealed that adolescents who reported suicidality did not use school services and telephone services as they were expected. However, evidence suggested that school services offered student greater support by not only eliminating hurdles in the conventional system to seek health care but also reduced the stigma in seeking support for mental health and ultimately enhanced clinical outcome (Nabors, Weist, & Reynolds, 2000; Stephan et al., 2007). In addition to these inherent advantages, school mental-health-services found to be effective in suicide prevention and in screening and treating comorbid mental disorders (Kataoka, Stein, Nadeem, & Wong, 2007; Stephan et al., 2007). Regarding telephone services, few empirical studies reported telephone counseling services as the choice among adolescents with suicidality due to their accessibility, anonymity and lack of parental involvement (King, Nurcombe, Bickman, Hides, & Reid, 2003; Shaw & Chiang, 2019). Further, previous research reported that telephone service has been used to improve compliance and outcome in individuals with suicidal-risk. However, still there is a lack of research supporting the efficacy of telephone services in suicide prevention (King et al., 2003; Krysinska & De Leo, 2007).

For adolescents reported suicidality, the effect of increased use of mental-health-service continued to be significant after controlling a range of potential covariates which includes several sociodemographic risk factors and the presence of mental disorders, which shows consistent results with previous studies (Rhodes & Fung, 2004; Rhodes, Lin, & Mustard, 2002). In this study, according to child data, adolescents with mental disorder and suicidal plan attempt were 19 times more likely to use health service compared to adolescents with no mental disorder and no suicidal plan, whereas adolescents with simultaneous presence of mental disorder, suicidal ideation or attempt did not show any statistically significant result in using health services. This is not expected result from a high risk group of adolescents with mental disorder and suicidality. This study found that although adolescents with suicidality and mental disorder were likely to use health service, however, still a significant portion of adolescents with suicidality and mental disorder did not seek any help/service, which is alarming for suicide prevention. This is because young people-specific services are limited even in fairly well resourced countries with mental-health programmes for adolescents (Patel et al., 2007; Rickwood, Deane, Wilson, & Ciarrochi, 2005). It is also suggested that since simultaneous presence of suicidality and mental disorders among adolescents are complex and often diagnostically confusing, intersectoral and multidisciplinary approach will be required for effective suicide prevention (Patel et al., 2007).

Although this study uses a large nationally representative sample and advances prior research on the potential use of mental health services among adolescents who reported suicidality, findings of this study also have several limitations that need to be addressed. Firstly, adolescents who reported suicidality relied on self-reported child data, without any external validation. Individuals who participated in the study were provided with an option of not answering by selecting 'prefer not to say' in the suicide-related questions. It was found that more than 5% of the participants selected the 'prefer not to say' option

and sequenced out of the remaining questions. Thus, it was not feasible to calculate the proportion of these individuals who might actually have experienced suicidality. In addition, only those who considered suicide in the past 12-months were asked about suicide attempts with the thought that attempts without ideation are unlikely, which is justified; however, it may lead to misclassification of suicidality. Lastly, the cross-sectional nature of the data prohibits evaluation of temporality and causality of the observed association between suicidality and mental health service use.

5. Conclusions

This study shows a strong and significant association between suicidality and access to service use; however, many adolescents did not use any services despite of having suicidality and/or a mental disorder. In-depth research is needed to understand the quality of service received by adolescents due to mental health problems and the factors that are attributable to service utilization. Further research are required to develop, test and implement interventions to deal with the burden of suicide so that the timely treatment of adolescents after developing suicidality can be increased, and suicidality can be prevented and monitored among these high-risk adolescents. .

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical Approval

Ethical approval is not required for this study as it used secondary data from the YMM survey, which was approved by the Human Research Ethics Committees of the Australian Government Department of Health and by the University of Western Australia, respectively.

CRediT authorship contribution statement

Md. Irteja Islam: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Visualization, Writing - original draft. **Enamul Kabir:** Investigation, Resources, Visualization, Writing - review & editing. **Rasheda Khanam:** Visualization, Writing - review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The paper is a part of the PhD study of the first author. The PhD program was funded by the University of Southern Queensland, Australia. The authors would like to thank the Telethon Kids Institute, The University of Western Australia, Roy Morgan Research, the Australian Government Department of Health for conducting the survey, and the Australian Data Archive for providing the YMM data set. The authors also would like to thank Dr Barbara Harmes for proofreading the manuscript before submission.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.childyouth.2020.104821.

References

ABS. (2017). Australian Bureau of Statistics (ABS) Catalogue 3303.0 Cause of Death Australia, 2017. Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/3303.0~2017~Main%20Features~Intentional%20self-harm,%20key%20characteristics~3.

Agresti, A., & Kateri, M. (2011). *Categorical data analysis*. Berlin Heidelberg: Springer.

Ahlbom, A., & Alfredsson, L. (2005). Interaction: A word with two meanings creates confusion. *European journal of epidemiology, 20*(7), 563–564.

APA. (2000). Diagnostic and Statistical Manual of Mental Disorders (4th ed.). Washington DC: American Psychiatric Association.

Bowers, H., Manion, I., Papadopoulos, D., & Gauvreau, E. (2013). Stigma in school-based mental health: Perceptions of young people and service providers. *Child and Adolescent Mental Health, 18*(3), 165–170.

CDC. (2014). YRBSS Quentionnaire. Retrieved from https://www.cdc.gov/healthyyouth/data/yrbs/questionnaires.htm.

Christensen, H., & O'Neil, D. (2018). Suicide prevention in Australia using online interventions.

Clark, T., Fleming, T., Bullen, P., Denny, S., Crengle, S., Dyson, B., ... Robinson, E. M. (2013). *Youth'12 Overview: The health and wellbeing of New Zealand secondary school students in 2012*. University of Auckland, Faculty of Medical and Health Sciences.

De Leo, D., Burgis, S., Bertolote, J. M., Kerkhof, A. J., & Bille-Brahe, U. (2006). Definitions of suicidal behavior: Lessons learned from the WHO/EURO Multicentre Study. *Crisis, 27*(1), 4–15.

Glonek, G. F., & McCullagh, P. (1995). Multivariate logistic models. *Journal of the Royal Statistical Society: Series B (Methodological), 57*(3), 533–546.

Hafekost, J., Lawrence, D., Boterhoven de Haan, K., Johnson, S. E., Saw, S., Buckingham, W. J., ... Zubrick, S. R. (2016). Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 866–875.

Harrell, F. E., Jr, Lee, K. L., Califf, R. M., Pryor, D. B., & Rosati, R. A. (1984). Regression modelling strategies for improved prognostic prediction. *Statistics in medicine, 3*(2), 143–152.

James, A. (2007). Mental health in childhood and adolescence. *the. Lancet, 369*(9569), 1251–1252. https://doi.org/10.1016/S0140-6736(07)60579-0.

Johnson, S. E., Lawrence, D., Hafekost, J., Saw, S., Buckingham, W. J., Sawyer, M., & Zubrick, S. R. (2016). Service use by Australian adolescents for emotional and behavioural problems: Findings from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 887–898. https://doi.org/10.1177/0004867415622562.

Karaca-Mandic, P., Norton, E. C., & Dowd, B. (2012). Interaction terms in nonlinear models. *Health services research, 47*(1pt1), 255–274.

Kataoka, S., Stein, B. D., Nadeem, E., & Wong, M. (2007). Who gets care? Mental health service use following a school-based suicide prevention program. *Journal of the American Academy of Child & Adolescent Psychiatry, 46*(10), 1341–1348.

Kieling, C., Baker-Henningham, H., Belfer, M., Conti, G., Ertem, I., Omigbodun, O., & Rahman, A. (2011). Child and adolescent mental health worldwide: Evidence for action. *the. Lancet, 378*(9801), 1515–1525.

Kinchin, I., & Doran, C. (2018). The cost of youth suicide in Australia. *International journal of environmental research and public health, 15*(4), 672.

King, R., Nurcombe, B., Bickman, L., Hides, L., & Reid, W. (2003). Telephone counselling for adolescent suicide prevention: Changes in suicidality and mental state from beginning to end of a counselling session. *Suicide and Life-Threatening Behavior, 33*(4), 400–411.

Kokkevi, A., Rotsika, V., Arapaki, A., & Richardson, C. (2012). Adolescents' self-reported suicide attempts, self-harm thoughts and their correlates across 17 European countries. *Journal of Child Psychology and Psychiatry, 53*(4), 381–389.

Krysinska, K. E., & De Leo, D. (2007). Telecommunication and suicide prevention: Hopes and challenges for the new century. *OMEGA-Journal of death and dying, 55*(3), 237–253.

Kung, H.-C., Pearson, J. L., & Wei, R. (2005). Substance use, firearm availability, depressive symptoms, and mental health service utilization among white and African American suicide decedents aged 15 to 64 years. *Annals of Epidemiology, 15*(8), 614–621.

Lawrence, D., Johnson, S., Hafekost, J., Boterhoven de Haan, K., Sawyer, M., Ainley, J., & Zubrick, S. R. (2015). The mental health of adolescents and adolescents: report on the second Australian child and adolescent survey of mental health and wellbeing.

Liang, K. Y., Zeger, S. L., & Qaqish, B. (1992). Multivariate regression analyses for categorical data. *Journal of the Royal Statistical Society: Series B (Methodological), 54*(1), 3–24.

McGrath, P. J., Lingley-Pottie, P., Thurston, C., MacLean, C., Cunningham, C., Waschbusch, D. A., ... Santor, D. (2011). Telephone-based mental health interventions for child disruptive behavior or anxiety disorders: Randomized trials and overall analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*(11), 1162–1172.

McKinnon, B., Gariépy, G., Sentenac, M., & Elgar, F. J. (2016). Adolescent suicidal behaviours in 32 low-and middle-income countries. *Bulletin of the World Health Organization, 94*(5), 340.

Nabors, L. A., Weist, M. D., & Reynolds, M. W. (2000). Overcoming challenges in outcome evaluations of school mental health programs. *Journal of School Health, 70*(5), 206–209.

Page, R. M., Saumweber, J., Hall, P. C., Crookston, B. T., & West, J. H. (2013). Multicountry, cross-national comparison of youth suicide ideation: Findings from Global School-based Health Surveys. *School Psychology International, 34*(5), 540–555.

Paschall, M. J., & Bersamin, M. (2018). School-based mental health services, suicide risk and substance use among at-risk adolescents in Oregon. *Preventive medicine, 106*, 209–215.

Patel, V., Flisher, A. J., Hetrick, S., & McGorry, P. (2007). Mental health of young people: A global public-health challenge. *the. Lancet, 369*(9569), 1302–1313.

Pirkis, J. E., Burgess, P. M., Meadows, G. N., & Dunt, D. R. (2001). Suicidal ideation and suicide attempts as predictors of mental health service use. *Medical journal of Australia, 175*(10), 542–545.

Pridmore, S., & Maajid, A. (2016). Suicide Is Preventable: An Unsafe Clause. *ASEAN Journal of Psychiatry, 17*(1), 132–136.

Rhodes, A. E., Bethell, J., & Bondy, S. J. (2006). Suicidality, depression, and mental health service use in Canada. *The Canadian Journal of Psychiatry, 51*(1), 35–41.
Rhodes, A. E., & Fung, K. (2004). Self-reported use of mental health services versus administrative records: Care to recall? *International Journal of Methods in Psychiatric Research, 13*(3), 165–175.
Rhodes, A. E., Lin, E., & Mustard, C. A. (2002). Self-reported use of mental health services versus administrative records: Should we care? *International Journal of Methods in Psychiatric Research, 11*(3), 125–133.
Rickwood, D., Deane, F. P., Wilson, C. J., & Ciarrochi, J. (2005). Young people's help-seeking for mental health problems. *Australian e-journal for the Advancement of Mental health, 4*(3), 218–251.
Robinson, J., Calear, A. L., & Bailey, E. (2018). Suicide prevention in educational settings: A review. *Australasian psychiatry, 26*(2), 132–140.
Sampasa-Kanyinga, H., Roumeliotis, P., & Xu, H. (2014). Associations between cyberbullying and school bullying victimization and suicidal ideation, plans and attempts among Canadian schooladolescents. *PloS one, 9*(7), e102145.
Sareen, J., Afifi, T. O., Taillieu, T., Cheung, K., Turner, S., Bolton, S.-L., ... Zamorski, M. A. (2016). Trends in suicidal behaviour and use of mental health services in Canadian military and civilian populations. *CMAJ, 188*(11), E261–E267.
Schweitzer, R., Klayich, M., & McLean, J. (1995). Suicidal ideation and behaviours among university students in Australia. *Australian and New Zealand Journal of Psychiatry, 29*(3), 473–479.
Shaw, F. F.-T., & Chiang, W.-H. (2019). An evaluation of suicide prevention hotline results in Taiwan: Caller profiles and the effect on emotional distress and suicide risk. *Journal of affective disorders, 244*, 16–20.
Stephan, S. H., Weist, M., Kataoka, S., Adelsheim, S., & Mills, C. (2007). Transformation of adolescents's mental health services: The role of school mental health. *Psychiatric Services, 58*(10), 1330–1338.
Thomas, H. J., Connor, J. P., Lawrence, D. M., Hafekost, J. M., Zubrick, S. R., & Scott, J. G. (2017). Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. *Australian & New Zealand Journal of Psychiatry, 51*(9), 909–920.
Vu, X.-B. B., Biswas, R. K., Khanam, R., & Rahman, M. (2018). Mental health service use in Australia: The role of family structure and socio-economic status. *Adolescents and Youth Services Review, 93*, 378–389.
WHO. (2012). Public health action for the prevention of suicide: a framework (9241503572). Retrieved from Geneva, Switzerland: https://apps.who.int/iris/bitstream/handle/10665/75166/9789241503570_eng.pdf.
WHO. (2014). Preventing suicide: a global imperative (9241564776). Retrieved from Geneva, Switzerland: https://apps.who.int/iris/bitstream/handle/10665/131056/9789241564779_eng.pdf?sequence=1.
Zubrick, S. R., Hafekost, J., Johnson, S. E., Lawrence, D., Saw, S., Sawyer, M., & Buckingham, W. J. (2016a). Self-harm: Prevalence estimates from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 911–921.
Zubrick, S. R., Hafekost, J., Johnson, S. E., Lawrence, D., Saw, S., Sawyer, M., ... Buckingham, W. J. (2016b). Suicidal behaviours: Prevalence estimates from the second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 899–910.

CHAPTER 4 – RESEARCH THEME III

4.0 Overview

Research Theme III - Measuring socioeconomic inequality in behavioural and mental health problems and the utilization of mental health services in adolescents, is illustrated in Chapter 4 of this thesis. Two studies *(Study 7 and Study 8)* are included in *Research Theme III*, which investigate the socioeconomic inequality in behavioural and mental health problems and mental health services utilization among adolescents in Australia. It further estimates the contribution of social determinants in the inequality of mental health services utilization. Summary of each included studies in this theme are given below,

- *Study 7* examined whether socioeconomic inequalities exist in bullying victimization, mental disorder, and health risk behaviours (self-harm and suicidality) among children and adolescents in Australia. This study found that adolescents from economically worse-off families reported more bullying victimization, mental disorder, and suicidal ideation in contrast to children from economically sound families. From the policy perspective, this study also highlighted the need for focusing the low socioeconomic group to reduce social disparities in behavioural and mental health issues in children and adolescents.
- *Study 8* investigated socioeconomic inequalities in the use of mental health services in Australian adolescents aged between 13-17 years. Also, estimated the contribution to the assessed socioeconomic disparity from possible determinants of mental health services. This study found pro-poor inequality in health services use and pro-rich inequality in online service utilization. *Study 8* also showed that social determinants such as age, gender, education, the family type had some contribution to the estimated inequality. Results of this study indicated the need for addressing inequalities in the utilization of mental health services among children and adolescents to ensure universal health coverage.

Details of the above-conducted studies under *Research Theme III* are described in the next pages of this Chapter 4.

4.1 Study 7 - An estimation of socioeconomic inequality in behavioural and mental health-related problems among Australian adolescents: Using concentration index approach (Under-review in PLOS One, Q1, IF: 2.740, SNIP: 1.205, Publisher - Public Library of Science)

Abstract

Purpose:

To measure income-based and geographical area-based inequality in behavioural (bullying) and mental health-related problems (mental disorders, self-harm and suicidality) among Australian adolescents.

Design:

A cross-sectional observational study.

Setting:

Young Minds Matter: a nationwide mental health survey in Australia

Subjects:

Adolescents aged 12-17-years (n = 2521).

Measures:

Outcome variables included bullying, mental disorders, self-harm, and suicidal ideation. Socioeconomic rank variables were equivalized household income quintiles and area-based Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) quintiles.

Analysis:

The Erreygers's corrected concentration index (CI) approach.

Results:

The overall prevalence among these study participants was bullying victimization (31.1%), mental disorder (22.9%), self-harm (9.1%) and suicidal ideation (8.5%). The CIs were statistically significant for bullying victimization (CI=-0.049, p=0.020), mental disorders (CI=-0.123, p=<0.001) and suicidal ideation (CI=-0.049, p=0.047), implying pro-poor socio-economic inequalities.

Conclusion:

Adolescents from economically worse-off families experienced more behavioural and mental health-related problems compared to those from economically better-off families. This has implications for prevention strategies and government policy to promote health and provide equitable healthcare facility.

Keywords

Bullying; Mental disorder; Self-harm; Suicidal ideation; Inequality; Children

Introduction

Globally, socioeconomic inequality has become one of the most widely debated topics in social sciences, public health research and has broad implications for policy formation (Bloom, 2011; Reiss, 2013; WHO, 2013). Low socioeconomic factors have widespread repercussions not only of adults but on children's education outcomes, health, and wellbeing (Reiss et al., 2019).

An analysis of socioeconomic inequalities of children and adolescent health across 34 high-income countries between 2002-2010, showed that mental and physical health issues increased during this period (Elgar, Craig, Boyce, Morgan, & Vella-Zarb, 2009; Elgar et al., 2013). Additionally, it was noted that larger differences in socioeconomic status (SES) were associated with impaired physical activity and psychological disorders (Elgar et al., 2013). Reiss's review of 52 papers, demonstrated the linkage of SES and children and adolescent's mental health problems but also highlighted the need for further in-depth analysis of the socio-determinants of mental health (Reiss, 2013). As inequality worsens, children psychological and physical symptoms got worse. Evidence suggested that mental health issues are reported as an end state, that is affected by socioeconomic factors and inequality (Morasae et al., 2012; Viner et al., 2012). In contrast, it is also reported mental health problems not only lead families toward poverty but also mediates relationship between health and socioeconomic inequality (Morasae et al., 2012; WHO, 2013). Moreover, it is found that because of social stigma and prejudice individuals with mental health issues often confront with violated human rights and with many being denied socioeconomic and cultural rights, which are thought to be attributable for the social inequality (WHO, 2013). However, a limited understanding of the potential determinants of mental health research particularly among children and adolescents makes it difficult to plan appropriate public health interventions to deal with social disparities (WHO, 2013).

Limited studies explored the severity of socioeconomic inequalities on children and adolescents' health and wellbeing. However, inequalities in health outcomes have been observed in both developed and developing countries (Marmot et al., 2008; Van Doorslaer & O'Donnell, 2011). Ongoing research has shown

associations between income and depression or suicidal behaviour, and delinquency as well as internally and externally directed violence during childhood including traditional bullying and cyberbullying (Hong, Knapp, & McGuire, 2011; Jarjoura, Triplett, & Brinker, 2002; Mok et al., 2018; Najman et al., 2010). Worldwide, suicide is the second most common cause of death among young people resulting in a large human cost and lost productivity (WHO, 2012, 2013). Increasingly, research supports the notion that socioeconomic issues during childhood impact not only childhood development but also predicts future adversities including mental health disorders (Galobardes, Lynch, & Smith, 2008; Poulton et al., 2002), self-directed harm (Galloway & Skardhamar, 2010; Page, Saumweber, Hall, Crookston, & West, 2013) including suicidality (Mok et al., 2018), delinquency (Najman et al., 2010) and externalized violence in the form of bullying (Mok et al., 2018). A Netherlands study (Weinberg, Stevens, Duinhof, & Finkenauer, 2019) found that parental socioeconomic status, adolescent subjective SES, and adolescent educational level where important indicators of inequalities in adolescent mental health. A Canadian study examined the association between cyberbullying, school bullying with suicidal ideation among middle and high school students and found significant links among these (Sampasa-Kanyinga, Roumeliotis, & Xu, 2014). Other studies found similar links between school bullying and suicide (H. H.-s. Kim & Chun, 2020; Y. S. Kim, Koh, & Leventhal, 2005).

Worldwide, mental health disorders account for a considerable percentage of the global burden of disease (mental, neurological and substance use disorders accounting for 13%, depression accounting for 4.3% of the global burden in 2004) (WHO, 2013). In 2010, the global direct and indirect economic cost of mental disorders were estimated to be US$2.5 trillion and are expected to double by 2030 (Bloom, 2011), illustrating the need for better prevention measures. In 2013, the World Health Organization launched the Mental Health Action Plan 2013-2020 to address the socio-determinants of mental health that impact the individual's overall health and wellbeing as the treatment gap for neurologic, mental and substance used disorders were found to be higher compared to other health issues (Trautmann, Rehm, & Wittchen, 2016; WHO, 2013). The need for evidence-based research was highlighted, to inform universal health delivery

strategies and appropriate community-based interventions (WHO, 2013). Evidenced-based policy measures are needed to tackle the underlying causes of inequality among households/population groups to improve socioeconomic mobility of adolescents into adult life (Mok et al., 2018).

In Australia, the 1997 National Survey of Mental Health and Wellbeing was conducted among individuals aged 18 years of over and brought great awareness of mental health disorders (Hall, Teesson, Lynskey, & Degenhardt, 1999). Moreover, the 2013-2014 Australian Child and Adolescent Survey of Mental Health and Wellbeing surveyed a sample of 5500 children and adolescents aged 4-17 years highlighted child and adolescent mental health issues (bullying, mental disorder, self-harm and suicidality) as a significant public health problem (Lawrence et al., 2016). Moreover, a recent paper estimated the prevalence of major depressive disorder (11.5%), ADHD (6.5%), anxiety disorder (7.1%), conduct disorder (1.9%), suicidality (8%), and non-suicidal self-harm (7.8%) in adolescents aged 12-17 years [7], and was similar to the research by Zubrick et al. that demonstrating the need for better public health interventions (Islam, Khanam, & Kabir, 2020). However, regarding behavioural and mental health inequalities in Australia, there are limited empirical records are available. To be more precise, most descriptive studies involving adults have shown that certain classes, such as the aged, the unemployed, the divorced, people with reduced education and living remotely have higher rates of mental and personality disorders in Australia (Astell-Burt & Feng, 2019; Bartram & Stewart, 2019; Bechtel, Lordan, & Rao, 2012; Fraser et al., 2005; Parslow & Jorm, 2000). While to date only a few have thoroughly investigated the extent of such mental health differences among adolescents. Most importantly no previous studies in Australia measured both household income-based and geographic area-based socioeconomic inequalities in regards to mental health among adolescents age group (Perales, Johnson, Baxter, Lawrence, & Zubrick, 2017; Shepherd, Li, Mitrou, & Zubrick, 2012). Therefore, this study aimed to measure socioeconomic inequality in behavioural, mental health disorders and health risk behaviours among Australian adolescents aged 12-17 years using a nationally representative sample.

Methods

Data source and study participants

The Young Minds Matter (YMM) is the nationally representative household-based cross-sectional children and adolescents survey of mental health and well-being in Australia. The YMM conducted in 2013-14 in collaboration with Telethon Kids Institute, University of Western Australia (UWA), Roy Morgan Research, and the Australian Government Department of Health (AGDH). Ethical approval for the YMM survey was obtained from the Human Research Ethics Committees of the UWA and AGDH (RA/4/1/9197) (Hafekost et al., 2016; Lawrence et al., 2016).

In summary, the YMM implemented the multi-stage, random sampling technique for Australian households with young people aged between 4-17-year-olds. In the household, the sample included a single child randomly selected when there was more than one qualified child (Hafekost et al., 2016; Lawrence et al., 2016). A standardized questionnaire was completed by a face-to-face interview with 6310 parents (55% of eligible households) of 4-17-year-olds. In addition, a computer-based self-reported questionnaire has been privately completed by 2967 children (89% of eligible households) aged between 11-17-years. The survey excluded homeless children, children from distant places and residents of all households or organizations who cannot be interviewed in English. More details about survey methods can be found elsewhere (Hafekost et al., 2016).

In this research, both parent-reported data and child-reported data were merged, and the analyses were restricted to children aged 12-17-years (n=2521) to preserve age-comparability across the survey and achieve the study objectives. Also, it is done because data on health-risk behaviours (self-harm and suicidal ideation) were only available in self-reported child-data and were strictly limited to 12-17-year-olds age-group.

Outcome variables

- *Bullying victimization*. In the YMM study, children were directly questioned whether they experienced traditional bullying and/or cyberbullying in the past twelve months. The Revised Olweus Bully/Victim Questionnaire

(OBVQ) and the questionnaire from the Cyber Friendly School Project, Edith Cowan University were used to incorporate the items measuring bullying victimization (Cross et al., 2016; Olweus, 1996; Thomas et al., 2017). Included questions were as follows: *'In the past 12 months, have you ever been bullied or cyberbullied?' with the listed bullying types – 'Hit, kicked, or pushed around', 'Made fun of or teased in a mean and hurtful way', 'Lies, rumours or nasty stories were spread', 'Threatened or made afraid', 'Deliberately ignored, left out on purpose or not allowed to join in', 'Other young people stole things or from me, or broke or damaged my things deliberately', 'Teased about my race, the colour of my skin or my religion',' Sent nasty messages by email, mobile phone, or on the internet', 'Nasty messages or pictures were sent about me to other young people via mobile phone, internet or email', and 'Nasty comments or pictures were sent or posted about me on websites (e.g. Facebook or Twitter)'*. All responses were dichotomous (Yes/No). In the analysis, from all the responses of the questions, a new binary variable was created as 'bullying victimization' and coded as 1 (Yes) and 0 (No).

- *Mental disorders.* Seven modules of the DISC-IV (Diagnostic Interview Schedule for Children, Version IV) (APA, 2013; Fisher et al., 1993) were used to assess the presence of mental disorder in the past 12 months among the study participants. The included mental disorders were major depressive disorder, attention-deficit-hyperactivity-disorder (ADHD), anxiety disorder, and conduct disorder (S. E. Johnson et al., 2016; Vu, Biswas, Khanam, & Rahman, 2018). For the analysis, from the responses of each mental disorder (Yes/No), a new dichotomous variable was created as 'mental disorder' with children who diagnosed with any of the four disorders in the past 12 months and coded as 1 (Yes) and 0 (No).
- *Health-risk behaviours (Self-harm and Suicidal ideation).* The Standard High School Questionnaire of the Youth Risk Behaviour Surveillance System (YRBSS) (CDC, 2014) were used in the YMM survey to collect information on self-harm and suicidal ideation. In YMM, children aged 12-17-years answered the following question regarding self-harm (S. R. Zubrick et al., 2016a), *"Have you ever deliberately done something to yourself to cause harm or injury, without intending to end your own life?"*. Like self-harm, suicidal ideation (S. R. Zubrick et al., 2016b) was identified in terms of following questions: *"Have you ever seriously*

consider attempting in the 12 months before the interview?". Response options for both self-harm and suicidal ideation were coded as 1 (Yes) and 0 (No). Note that regarding self-harm and suicidal ideation, all the information gathered from the children (self-reported) were kept confidential and not shared with the consenting parents or caregivers.

- *Socioeconomic rank variables.* In this paper, the equivalized household income (in quintiles) was used to quantify socioeconomic status (SES) and construct the income element of the concentration index (CI). Equivalised household income was measured using an equivalence factor based on the '*modified OECD equivalence scale*' and then the total household income was divided by that factor. The factor was determined by means of a weighted household size as follows, one point was contributed by the first adult; an additional 0.5 points was provided by additional adult or youth aged 14 years of age or older; and 0.3 points was contributed by any children aged under 14.(S. L. Zubrick, David; Sawyer, Michael; Ainley, John, 2013-13). In addition, in this study, the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD, in quintiles, Q1-Q5) from the Socioeconomic Indices for Areas (SEIFA) was used to rank SES of individuals and/or households within a geographical area. Note that the SEIFA is a composite index produced by the Australian Bureau of Statistics (ABS) that ranks areas in Australia based on relative socioeconomic advantage and disadvantage (ABS, 2018). While IRSAD is one of the indexes of SEIFA that summarizes the socioeconomic situation of individuals and households within an area, including relative advantages as well as disadvantage (ABS, 2018).

Statistical analysis

The analysis of this study is based on CIs, which is commonly used in health inequalities research. The sign of the CI implies the direction of any correlation between the health variable of interest and socioeconomic status. Its magnitude reflects not only the extent of the association but also the degree of variability of the health component (Pulok, van Gool, & Hall, 2020; Siriwardhana, Pathmeswaran, & Wickremasinghe, 2019). The value of CI ranges between +1 and -1, with a zero value of CI suggesting no socioeconomic inequality. A negative CI depicts an unequal concentration of the health variable of interest among the

poor (pro-poor inequality) and vice-versa (pro-rich inequality). The larger the absolute value of the CIs, the greater the inequalities (Van Doorslaer & O'Donnell, 2011; Wagstaff, Van Doorslaer, & Paci, 1991). However, in the case of a binary outcome (e.g., whether a child had a mental disorder or not), the value of the CI depends on the upper and lower limits (Wagstaff, 2005), which can contribute to unreliable comparisons of inequalities as the mean of the health-related variable varies over time and populations (Erreygers, 2009a, 2009b). There are two possible ways to tackle this dispute – a) Wagstaff's approach to standardize the CIs by dividing with one minus the means of the mental health-related variables (Wagstaff, 2005), and b) Erreygers's correction approach which adjusts the CIs by multiplying it by four times the mean health-related variable (Erreygers, 2009b). In the analysis, the second approach was used that fulfils all the four properties of rank dependent measures of inequalities (Kjellsson & Gerdtham, 2013).

In the analysis, two ranking variables - equivalized household income quintiles and area-based socioeconomic status (IRSAD quintiles) were used to test the robustness of the estimates due to different measures. Sample weights provided in the YMM dataset were applied in descriptive and inequality analyses to account for survey design of the YMM. Stata 14.1 was used for all statistical analyses.

Results

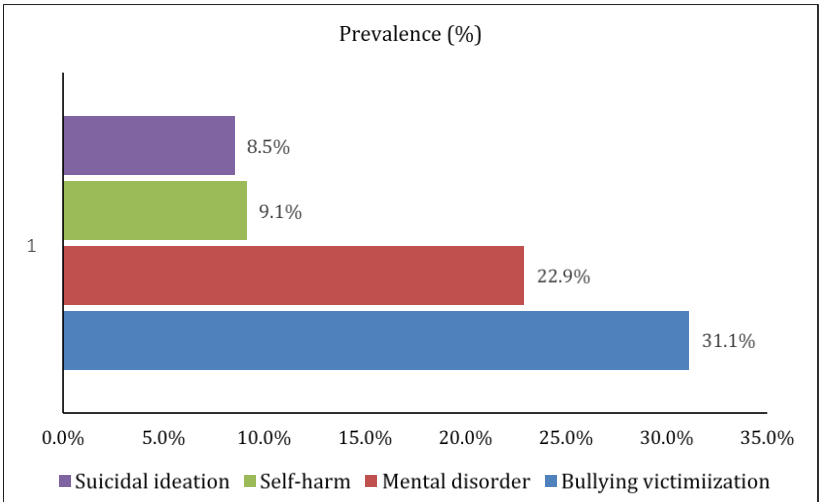
The sample characteristics of participants included in the analysis are presented in Table 1. In total, cross-sectional data of n=2521 children were analysed. Nearly 52% of the study population were boys, and more than 60% aged between 15-17-years (Mean=14.98, SD=1.72). Most children were Australian (86%) and lived-in cities (64.5%). More than 90% of children were school going and 37.4% of parents completed the diploma. Almost 60% of children lived with both biological parents, and a higher proportion of parents were being employed. Concerning socioeconomic status, the majority of the children were from middle-higher income families according to both equivalized household income and area-based IRSAD quintiles.

Table 1 Characteristics of the sample population

Characteristics	Children and adolescents (N=2521)	
	n	%
Gender		
Boys	1301	51.6
Girls	1220	48.4
Age		
12 to <15	952	37.8
≥15 to 17	1569	62.2
Country of Birth		
Overseas	354	14.0
Australia	2167	86.0
Place of residence		
Cities	1626	64.5
Regional	860	34.1
Remote	35	1.4
Schooling		
No	210	8.3
Yes	2311	91.7
Parents' Education		
Year 10/11	790	31.3
Diploma	943	37.4
Bachelor	788	31.3
Parents' Employment		
Unemployed	584	23.2
Employed	1937	76.8
Household income quintile†		
Q1 (0-20%, <$41,599 per year)	450	17.8
Q2 (20-40%, $41,600-$77,999 per year)	539	21.4
Q3 (40-60%, $78,000-$103,999 per year)	454	18.0
Q4 (60-80%, $104,000-$155,999 per year)	592	23.5
Q5 (80-100%, $156,000 or more per year)	486	19.3
Family type^		
Original	1492	59.2
Others	1029	40.8
Family functioning		
Poor	103	4.1
Fair	342	13.6
Good	652	25.8
Very good	1424	56.5
IRSAD quintile#		
Lowest	388	15.4
Second	445	17.7
Third	536	21.3
Fourth	555	22.0
Highest	597	23.6

Notes: †Household income quintile: The equivalised household income was calculated by using an equivalence factor based on 'Modified OECD' equivalence scale.
^Family type: original families mean children are natural, adopted, or foster child of both parents, and no stepchild; other families include step, blended and children from families who are not natural, adopted, foster or step of either parent.
#The Index of Relative Socio-economic Advantage and Disadvantage (IRSAD): Summarises information about the economic and social conditions of people and households within an area, including both relative advantage and disadvantage measures. Low indicates relatively greater disadvantage and a lack of advantage in general and high score indicates a relative lack of disadvantage and greater advantage in general.
** The 'Don't know' responses were omitted.

Figure 1 shows the prevalence of bullying victimization, mental disorder, self-harm, and suicidal ideation among the study participants (n=2521) was 31.1%, 22.9%, 9.1% and 8.5%, respectively. The prevalence of behavioural and mental health issues across equivalized household income quintiles are presented in Table 2. In the sample, all mental health issues (bullying victimization, mental disorder, self-harm, and suicidal ideation) were found to be more prevalent among the poorest (Table 2).



Notes:
- Bullying victimization: Number (%) of adolescents being bullied (traditional, cyber or both)
- Mental disorder: Number (%) of adolescents diagnosed with any of the following mental disorder - major depressive disorder, attention-deficit-hyperactivity disorder (ADHD), conduct disorder and anxiety disorder
- Self-harm: Number (%) of children deliberately done something to themselves to cause harm or injury, without intending to end their own life in the past 12 months.
- Suicidal ideation: Number (%) of children seriously considered attempting suicide in the past 12 months.

Figure 3 Prevalence of behavioural and mental health problems in the total sample (n=2521)

Table 3 reports inequality indices for the four outcome variables measured using Erreygers's correction. The concentration indices were negative and statistically significant for bullying victimization (CI = -0.049, p = 0.020), mental disorders (CI = -0.123, p = <0.001) and suicidal ideation (CI = -0.049, p=0.047) except for self-harm. This indicates that children from economically worse-off families experienced more mental health issues than those who were from economically better-off, implying a pro-poor inequality in Australia.

Table 5 Prevalence (%) of bullying victimization, Mental disorders, Self-harm and Suicidal ideation by socioeconomic quintile

	Equivalised Household Income Quintile				
	Q1	Q2	Q3	Q4	Q5
Bullying victimization	157 (20.0)	181 (23.1)	132 (16.8)	178 (22.7)	136 (17.4)
Mental disorder	141 (24.4)	140 (24.2)	92 (15.9)	117 (20.2)	88 (15.2)
Self-harm	54 (23.6)	42 (18.3)	42 (18.3)	51 (22.3)	40 (17.5)
Suicidal ideation	49 (23.0)	50 (23.5)	35 (16.4)	48 (22.5)	31 (14.6)
Notes: Data are shown as n (%) Equivalised Household income quintile: The equivalised household income was calculated by using an equivalence factor based on 'Modified OECD' equivalence scale. Q1 represents the lowest socioeconomic quintile and Q5 is the highest socioeconomic quintile					

Table 3 reports inequality indices for the four outcome variables measured using Erreygers's correction. The concentration indices were negative and statistically significant for bullying victimization (CI = -0.049, p = 0.020), mental disorders (CI = -0.123, p = <0.001) and suicidal ideation (CI = -0.049, p=0.047) except for self-harm. This indicates that children from economically worse-off families experienced more mental health issues than those who were from economically better-off, implying a pro-poor inequality in Australia.

Table 3 Erreyger's concentration indices for mental health issues among Australian children and adolescents

	Equivalised household income quintile	IRSAD quintile
Bullying victimization	-0.049 (0.021) *	-0.050 (0.021) **
Mental disorder	-0.123 (0.018) ***	-0.110 (0.018) ***
Self-harm	-0.017 (0.012)	-0.010 (0.012)
Suicidal ideation	-0.023 (0.011) *	-0.024 (0.012) *
Notes: Standard errors in parentheses and significance levels: *** p<0.001, ** p <0.01 and *p<0.05.		

However, there was no notable change in the findings when IRSAD quintiles were used instead of household income quintiles in estimating inequality indices. This signifies that the extent of CIs was similar regardless of whether using an equivalized household income or area-based socioeconomic status.

Discussion & Conclusion

This research investigates the socioeconomic inequality in behaviour and mental health issues such as bullying victimization, mental disorder, self-harm, and suicidal ideation among Australian adolescents by using a concentration index (CI) approach. The current study revealed that, although the magnitude of the

socioeconomic inequality was not large, behavioural, and mental health issues were unduly concentrated among children from poor socioeconomic families in Australia. The findings were consistent with the similar studies that indicated a higher prevalence of behavioural/mental disorders in children from low-income households, as well as clear consequences for the mental health of children and adolescents (Morasae et al., 2012; Reiss, 2013). For example, a meta-analysis claimed that socioeconomically disadvantaged children/adolescents were 2-3 times more likely to experience mental health issues (Reiss, 2013). Pickett and Wilkinson (2010) also found a strong relationship between income inequality and mental illnesses across 12 rich countries in the world including Australia. Also, a cross-national survey involving 31 European countries (Layte & Whelan, 2014) and a meta-analysis (Ribeiro et al., 2017) found that mental health problems are common in countries with greater socioeconomic inequalities.

This study substantiated the findings of other studies (Due, Damsgaard, Rasmussen, & Holstein, 2019; Due et al., 2009; Elgar et al., 2013; Y. S. Kim et al., 2005; Nordhagen, Nielsen, Stigum, & Köhler, 2005; Von Rueden, Gosch, Rajmil, Bisegger, & Ravens-Sieberer, 2006) that the prevalence of bullying victims is disproportionately high among children from low-income families, implying pro-poor socio-economic inequalities. Moreover, a multilevel study of children and adolescents in 37 countries confirmed that bullying victimization is significantly associated with income inequality (Elgar et al., 2009). One mechanism behind this may be the embrace of hierarchies and of having a more divided society that manifested in children's behaviour (Due et al., 2019; Due et al., 2009), as Wilkinson and Pickett (2011) explain socioeconomic inequality as a type of structural violence that stimulates disgrace, embarrassment, and violent reprisal.

Similarly, to be consistent with previous research findings (Gilman et al., 2013; Hashmi, Alam, Gow, & March, 2020; Reiss, 2013; Ribeiro et al., 2017; Taylor, Page, Morrell, Harrison, & Carter, 2005; Weich, Lewis, & Jenkins, 2001; Wilkinson & Pickett, 2011) the current study found that the burden of personality and mental disorders was higher among children from lower socioeconomic households compared to others. This is because the human brain's dominance behavioural system is more likely to be involved in a wide array of behavioural and mental

health problems as they process questions of social superiority and subordination (S. L. Johnson, Leedom, & Muhtadie, 2012). In particular, the researchers advised that externalizing disorders such as ADHD and conduct disorder are linked to increased desire for superiority, whereas depressive and anxiety disorders are correlated with subordination and obedience (Pickett & Wilkinson, 2010; Wilkinson & Pickett, 2017).

Moreover, the findings of the study show suicidal ideation were unequally concentrated among children from economically worse-off families in Australia. This was consistent across different countries, age, gender, and different indexes such as household-income and/or area-level SES (Cairns, Graham, & Bambra, 2017; Cohen et al., 2010; Gilman et al., 2013; M.-H. Kim, Jung-Choi, Jun, & Kawachi, 2010; Taylor et al., 2005). While the study found that self-harming behaviour was particularly concentrated among children from poor-income families, but not statistically significant. Though previous research reported that low parental socioeconomic conditions are significantly associated with self-harm among children and adolescents (Jablonska, Lindberg, Lindblad, & Hjern, 2009; Lodebo, Möller, Larsson, & Engström, 2017; Mok et al., 2018). The increased risk of suicidal and self-harming behaviour attributed to low SES can be supported by a few mechanisms. First, children in adverse conditions in socially disadvantaged households are may be vulnerable to many stressors and are more prone to behavioural and mental health problems (McLeod & Shanahan, 1996). Second, the low socioeconomic condition may be linked with a wide range of undesirable parental consequences such as substance misuse, unemployment, mental and/or physical disorders (Eamon & Zuehl, 2001; Hong et al., 2011), which could affect parenting (Lang & Zagorsky, 2001). A third underlying cause may be social isolation, which can result in decreased self-esteem, feelings of solitude, and depressive symptoms including suicidal ideation and self-harm behaviours during adolescence (Beautrais, 2003; Lodebo et al., 2017; Von Rueden et al., 2006).

Given the strengths of this study, few limitations need to be considered. First, information on bullying, self-harm and suicidal ideation were from self-reported child-data, which was not validated by any screening tool; maybe resulting in

under/overestimation. Second, recall bias may be a concern as mental disorders in children and adolescents were mostly gathered from parent-data. Third, indicators of socioeconomic rank were measured only by parent-reports, which may include social desirability bias. Lastly, since the data comes from a cross-sectional analysis, causality is difficult to identify.

Yet, the implications of these empirical findings are relatively straight forward. If children and adolescents are suffering from behavioural and mental health problems such as bullying, depression, anxiety, self-harming and suicidal behaviours because of low social status, shame, and stigma, they must be handled with dignity and respect for their human worth (Pickett & Wilkinson, 2010). In addition, as researchers suggested policy interventions should target to redistribute wealth through taxation and benefits, find ways to reduce sector income gaps before taxes (Pickett & Wilkinson, 2010; Pulok et al., 2020), or both to make developed countries like Australia a prosperous and healthier country. Moreover, the findings of the study suggest that more research on the changes in mental health inequality and sociodemographic factors affecting inequalities over time are required to better understand the underlying causes and current distribution of behavioural and mental health problems among adolescents in Australia.

In conclusion, children from families with lower income in Australia are at higher risk of suffering from different behavioural and mental health problems including bullying victimization, mental disorder, and suicidal ideation. This clear evidence of inequalities justifies the need to establish targeted interventions for addressing the growing issue of behavioural and mental health problems particularly among children who experienced chronic poverty in developed countries like Australia.

References

ABS. (2018). Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2011. Retrieved from https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2033.0.55.001main+features100042011

APA. (2013). Diagnostic and statistical manual of mental disorders. *BMC Med, 17*, 133-137.

Astell-Burt, T., & Feng, X. (2019). Association of urban green space with mental health and general health among adults in Australia. *JAMA network open, 2*(7), e198209-e198209.

Bartram, M., & Stewart, J. M. (2019). Income-based inequities in access to psychotherapy and other mental health services in Canada and Australia. *Health policy, 123*(1), 45-50.

Beautrais, A. L. (2003). Suicide and serious suicide attempts in youth: a multiple-group comparison study. *American Journal of Psychiatry, 160*(6), 1093-1099.

Bechtel, L., Lordan, G., & Rao, D. P. (2012). Income inequality and mental health—empirical evidence from Australia. *Health economics, 21*, 4-17.

Bloom, D. E., Cafiero, E.T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L.R., Fathima, S., Feigl, A.B., Gaziano, T., Mowafi, M., Pandya, A., Prettner, K., Rosenberg, L., Seligman, B., Stein, A.Z., & Weinstein, C. (2011). *The Global Economic Burden of Non-communicable Diseases*. Retrieved from Geneva: http://www3.weforum.org/docs/WEF_Harvard_HE_GlobalEconomicBurdenNonCommunicableDiseases_2011.pdf

Cairns, J.-M., Graham, E., & Bambra, C. (2017). Area-level socioeconomic disadvantage and suicidal behaviour in Europe: a systematic review. *Social science & medicine, 192*, 102-111.

CDC. (2014). Adolescent and School Health: YRBSS Questionnaires. Retrieved from https://www.cdc.gov/healthyyouth/data/yrbs/questionnaires.htm

Cohen, A., Chapman, B. P., Gilman, S. E., Delmerico, A. M., Wieczorek, W., Duberstein, P. R., & Lyness, J. M. (2010). Social inequalities in the occurrence of suicidal ideation among older primary care patients. *The American journal of geriatric psychiatry, 18*(12), 1146-1154.

Cross, D., Shaw, T., Hadwen, K., Cardoso, P., Slee, P., Roberts, C., . . . Barnes, A. (2016). Longitudinal impact of the Cyber Friendly Schools program on adolescents' cyberbullying behavior. *Aggressive behavior, 42*(2), 166-180.

Due, P., Damsgaard, M. T., Rasmussen, M., & Holstein, B. E. (2019). Trends in Social Inequality in Exposure to Bullying at School 1994-2018. *Journal of Education, Society and Behavioural Science*, 1-7.

Due, P., Merlo, J., Harel-Fisch, Y., Damsgaard, M. T., soc, M. s., Holstein, B. E., . . . Gabhainn, S. N. (2009). Socioeconomic inequality in exposure to bullying during adolescence: a comparative, cross-sectional, multilevel study in 35 countries. *American journal of public health, 99*(5), 907-914.

Eamon, M. K., & Zuehl, R. M. (2001). Maternal depression and physical punishment as mediators of the effect of poverty on socioemotional problems of children in single-mother families. *American Journal of Orthopsychiatry, 71*(2), 218-226.

Elgar, F. J., Craig, W., Boyce, W., Morgan, A., & Vella-Zarb, R. (2009). Income inequality and school bullying: multilevel study of adolescents in 37 countries. *Journal of Adolescent Health, 45*(4), 351-359.

Elgar, F. J., Pickett, K. E., Pickett, W., Craig, W., Molcho, M., Hurrelmann, K., & Lenzi, M. (2013). School bullying, homicide and income inequality: a cross-national pooled time series analysis. *International journal of public health, 58*(2), 237-245.

Erreygers, G. (2009a). Can a single indicator measure both attainment and shortfall inequality? *Journal of health economics, 28*(4), 885-893.

Erreygers, G. (2009b). Correcting the concentration index. *Journal of health economics, 28*(2), 504-515.

Fisher, P. W., Shaffer, D., Piacentini, J. C., Lapkin, J., Kafantaris, V., Leonard, H., & Herzog, D. B. (1993). Sensitivity of the Diagnostic Interview Schedule for Children, (DISC-2.1) for specific diagnoses of children and adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry, 32*(3), 666-673.

Fraser, C., Jackson, H., Judd, F., Komiti, A., Robins, G., Murray, G., . . . Hodgins, G. (2005). Changing places: the impact of rural restructuring on mental health in Australia. *Health & Place, 11*(2), 157-171.

Galloway, T. A., & Skardhamar, T. (2010). Does parental income matter for onset of offending? *European Journal of Criminology, 7*(6), 424-441.

Galobardes, B., Lynch, J. W., & Smith, G. D. (2008). Is the association between childhood socioeconomic circumstances and cause-specific mortality established? Update of a systematic review. *Journal of Epidemiology & Community Health, 62*(5), 387-390.

Gilman, S. E., Bruce, M. L., Ten Have, T., Alexopoulos, G. S., Mulsant, B. H., Reynolds, C. F., & Cohen, A. (2013). Social inequalities in depression and suicidal ideation among older primary care patients. *Social psychiatry and psychiatric epidemiology, 48*(1), 59-69.

Hafekost, J., Lawrence, D., Boterhoven de Haan, K., Johnson, S. E., Saw, S., Buckingham, W. J., . . . Zubrick, S. R. (2016). Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 866-875.

Hall, W., Teesson, M., Lynskey, M., & Degenhardt, L. (1999). The 12-month prevalence of substance use and ICD-10 substance use disorders in Australian adults: findings from the National Survey of Mental Health and Well-Being. *Addiction, 94*(10), 1541-1550.

Hashmi, R., Alam, K., Gow, J., & March, S. (2020). Prevalence of Mental Disorders by Socioeconomic Status in Australia: A Cross-Sectional Epidemiological Study. *American Journal of Health Promotion*, 0890117120968656.

Hong, J., Knapp, M., & McGuire, A. (2011). Income-related inequalities in the prevalence of depression and suicidal behaviour: a 10-year trend following economic crisis. *World Psychiatry, 10*(1), 40.

Islam, M. I., Khanam, R., & Kabir, E. (2020). Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data. *Psychiatry Research*, 113364. doi:https://doi.org/10.1016/j.psychres.2020.113364

Jablonska, B., Lindberg, L., Lindblad, F., & Hjern, A. (2009). Ethnicity, socio-economic status and self-harm in Swedish youth: a national cohort study. *Psychological medicine, 39*(1), 87.

Jarjoura, G. R., Triplett, R. A., & Brinker, G. P. (2002). Growing up poor: Examining the link between persistent childhood poverty and delinquency. *Journal of Quantitative Criminology, 18*(2), 159-187.

Johnson, S. E., Lawrence, D., Hafekost, J., Saw, S., Buckingham, W. J., Sawyer, M., . . . Zubrick, S. R. (2016). Service use by Australian children for emotional and behavioural problems: Findings from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 887-898. doi:10.1177/0004867415622562

Johnson, S. L., Leedom, L. J., & Muhtadie, L. (2012). The dominance behavioral system and psychopathology: Evidence from self-report, observational, and biological studies. *Psychological bulletin, 138*(4), 692.

Kim, H. H.-s., & Chun, J. (2020). Bullying victimization, school environment, and suicide ideation and plan: focusing on youth in low-and middle-income countries. *Journal of Adolescent Health, 66*(1), 115-122.

Kim, M.-H., Jung-Choi, K., Jun, H.-J., & Kawachi, I. (2010). Socioeconomic inequalities in suicidal ideation, parasuicides, and completed suicides in South Korea. *Social science & medicine, 70*(8), 1254-1261.

Kim, Y. S., Koh, Y.-J., & Leventhal, B. (2005). School bullying and suicidal risk in Korean middle school students. *Pediatrics, 115*(2), 357-363.

Kjellsson, G., & Gerdtham, U.-G. (2013). On correcting the concentration index for binary variables. *Journal of health economics, 32*(3), 659-670.

Lang, K., & Zagorsky, J. L. (2001). Does growing up with a parent absent really hurt? *Journal of human Resources*, 253-273.

Lawrence, D., Hafekost, J., Johnson, S. E., Saw, S., Buckingham, W. J., Sawyer, M. G., . . . Zubrick, S. R. (2016). Key findings from the second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 876-886.

Layte, R., & Whelan, C. T. (2014). Who feels inferior? A test of the status anxiety hypothesis of social inequalities in health. *European Sociological Review, 30*(4), 525-535.

Lodebo, B. T., Möller, J., Larsson, J.-O., & Engström, K. (2017). Socioeconomic position and self-harm among adolescents: a population-based cohort

study in Stockholm, Sweden. *Child and adolescent psychiatry and mental health, 11*(1), 46.

Marmot, M., Friel, S., Bell, R., Houweling, T. A., Taylor, S., & Health, C. o. S. D. o. (2008). Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet, 372*(9650), 1661-1669.

McLeod, J. D., & Shanahan, M. J. (1996). Trajectories of poverty and children's mental health. *Journal of health and social behavior*, 207-220.

Mok, P. L., Antonsen, S., Pedersen, C. B., Carr, M. J., Kapur, N., Nazroo, J., & Webb, R. T. (2018). Family income inequalities and trajectories through childhood and self-harm and violence in young adults: a population-based, nested case-control study. *The Lancet Public Health, 3*(10), e498-e507.

Morasae, E. K., Forouzan, A. S., Majdzadeh, R., Asadi-Lari, M., Noorbala, A. A., & Hosseinpoor, A. R. (2012). Understanding determinants of socioeconomic inequality in mental health in Iran's capital, Tehran: a concentration index decomposition approach. *International journal for equity in health, 11*(1), 18.

Najman, J. M., Clavarino, A., McGee, T. R., Bor, W., Williams, G. M., & Hayatbakhsh, M. R. (2010). Timing and chronicity of family poverty and development of unhealthy behaviors in children: a longitudinal study. *Journal of Adolescent Health, 46*(6), 538-544.

Nordhagen, R., Nielsen, A., Stigum, H., & Köhler, L. (2005). Parental reported bullying among nordic children: a population-based study. *Child: care, health and development, 31*(6), 693-701.

Olweus, D. (1996). Revised Olweus bully/victim questionnaire. *British Journal of Educational Psychology*.

Page, R. M., Saumweber, J., Hall, P. C., Crookston, B. T., & West, J. H. (2013). Multi-country, cross-national comparison of youth suicide ideation: Findings from Global School-based Health Surveys. *School Psychology International, 34*(5), 540-555.

Parslow, R. A., & Jorm, A. F. (2000). Who uses mental health services in Australia? An analysis of data from the National Survey of Mental Health and

Wellbeing. *Australian & New Zealand Journal of Psychiatry, 34*(6), 997-1008.

Perales, F., Johnson, S. E., Baxter, J., Lawrence, D., & Zubrick, S. R. (2017). Family structure and childhood mental disorders: new findings from Australia. *Social psychiatry and psychiatric epidemiology, 52*(4), 423-433.

Pickett, K. E., & Wilkinson, R. G. (2010). Inequality: an underacknowledged source of mental illness and distress. *The British Journal of Psychiatry, 197*(6), 426-428.

Poulton, R., Caspi, A., Milne, B. J., Thomson, W. M., Taylor, A., Sears, M. R., & Moffitt, T. E. (2002). Association between children's experience of socioeconomic disadvantage and adult health: a life-course study. *The Lancet, 360*(9346), 1640-1645.

Pulok, M. H., van Gool, K., & Hall, J. (2020). Horizontal inequity in the utilisation of healthcare services in Australia. *Health policy, 124*(11), 1263-1271.

Reiss, F. (2013). Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. *Social science & medicine, 90*, 24-31.

Reiss, F., Meyrose, A.-K., Otto, C., Lampert, T., Klasen, F., & Ravens-Sieberer, U. (2019). Socioeconomic status, stressful life situations and mental health problems in children and adolescents: Results of the German BELLA cohort-study. *PloS one, 14*(3), e0213700.

Ribeiro, W. S., Bauer, A., Andrade, M. C. R., York-Smith, M., Pan, P. M., Pingani, L., . . . Evans-Lacko, S. (2017). Income inequality and mental illness-related morbidity and resilience: a systematic review and meta-analysis. *The Lancet Psychiatry, 4*(7), 554-562.

Sampasa-Kanyinga, H., Roumeliotis, P., & Xu, H. (2014). Associations between cyberbullying and school bullying victimization and suicidal ideation, plans and attempts among Canadian schoolchildren. *PloS one, 9*(7), e102145.

Shepherd, C. C., Li, J., Mitrou, F., & Zubrick, S. R. (2012). Socioeconomic disparities in the mental health of Indigenous children in Western Australia. *BMC public health, 12*(1), 756.

Siriwardhana, D. D., Pathmeswaran, A., & Wickremasinghe, A. R. (2019). Socioeconomic inequality and determinants of postnatal home visits made by public health midwives: An analysis of the Sri Lanka Demographic and Health Survey. *PloS one, 14*(4), e0215816.

Taylor, R., Page, A., Morrell, S., Harrison, J., & Carter, G. (2005). Mental health and socio-economic variations in Australian suicide. *Social science & medicine, 61*(7), 1551-1559.

Thomas, H. J., Connor, J. P., Lawrence, D. M., Hafekost, J. M., Zubrick, S. R., & Scott, J. G. (2017). Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. *Australian & New Zealand Journal of Psychiatry, 51*(9), 909-920.

Trautmann, S., Rehm, J., & Wittchen, H. U. (2016). The economic costs of mental disorders: Do our societies react appropriately to the burden of mental disorders? *EMBO reports, 17*(9), 1245-1249.

Van Doorslaer, E., & O'Donnell, O. (2011). Measurement and explanation of inequality in health and health care in low-income settings *Health Inequality and Development* (pp. 20-44): Springer.

Viner, R. M., Ozer, E. M., Denny, S., Marmot, M., Resnick, M., Fatusi, A., & Currie, C. (2012). Adolescence and the social determinants of health. *The Lancet, 379*(9826), 1641-1652.

Von Rueden, U., Gosch, A., Rajmil, L., Bisegger, C., & Ravens-Sieberer, U. (2006). Socioeconomic determinants of health related quality of life in childhood and adolescence: results from a European study. *Journal of Epidemiology & Community Health, 60*(2), 130-135.

Vu, X.-B. B., Biswas, R. K., Khanam, R., & Rahman, M. (2018). Mental health service use in Australia: The role of family structure and socio-economic status. *Children and Youth Services Review, 93*, 378-389.

Wagstaff, A. (2005). The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality. *Health economics, 14*(4), 429-432.

Wagstaff, A., Van Doorslaer, E., & Paci, P. (1991). On the measurement of horizontal inequity in the delivery of health care. *Journal of health economics, 10*(2), 169-205.

Weich, S., Lewis, G., & Jenkins, S. P. (2001). Income inequality and the prevalence of common mental disorders in Britain. *The British Journal of Psychiatry, 178*(3), 222-227.

Weinberg, D., Stevens, G. W., Duinhof, E. L., & Finkenauer, C. (2019). Adolescent Socioeconomic Status and Mental Health Inequalities in the Netherlands, 2001–2017. *International journal of environmental research and public health, 16*(19), 3605.

WHO. (2012). *Public health action for the prevention of suicide: a framework* (9241503572). Retrieved from Geneva, Switzerland: https://apps.who.int/iris/bitstream/handle/10665/75166/9789241503570_eng.pdf

WHO. (2013). *Mental Health Action Plan 2013-2020*. Retrieved from Geneva, Switzerland: https://apps.who.int/iris/bitstream/handle/10665/89966/9789241506021_eng.pdf;jsessionid=B7731D305686A3A35D3C49380A8D21E4?sequence=1

Wilkinson, R., & Pickett, K. (2011). *The spirit level: Why greater equality makes societies stronger*: Bloomsbury Publishing USA.

Wilkinson, R., & Pickett, K. (2017). Inequality and mental illness. *The Lancet Psychiatry, 4*(7), 512-513.

Zubrick, S. L., David; Sawyer, Michael; Ainley, John,. (2013-13). *Young Minds Matter: The second Australian Child and Adolescent Survey of Mental Health and Wellbeing, 2013-14*.

Zubrick, S. R., Hafekost, J., Johnson, S. E., Lawrence, D., Saw, S., Sawyer, M., . . . Buckingham, W. J. (2016a). Self-harm: prevalence estimates from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 911-921.

Zubrick, S. R., Hafekost, J., Johnson, S. E., Lawrence, D., Saw, S., Sawyer, M., . . . Buckingham, W. J. (2016b). Suicidal behaviours: prevalence estimates from the second Australian child and adolescent survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry, 50*(9), 899-910.

4.2 Study 8 - Inequality in the mental health services utilization among Australian adolescents: A decomposition analysis' (Under-review in Public Health Journal, Q2, IF: 1.774, SNIP: 1.045, Publisher - Elsevier)

Abstract

Objectives

This study aimed to measure socioeconomic inequality in mental health services utilization among Australian adolescents aged 13-17-years and estimated the contributions of potential determinants of mental health services to the measured socioeconomic inequality.

Study design

The study based on data from the nationwide survey, Young Minds Matter (YMM): the second Australian Child and Adolescent Survey of Mental Health and Wellbeing.

Methods

The Erreygers corrected concentration indices for binary variables were used to quantify the socioeconomic inequality in the utilization of mental health services. Further, decomposition analysis using probit regression conducted to estimate the contributions of different factors to the observed inequality.

Results

Overall, 34.3% of adolescents (n=2268) aged 13-17-year-olds visited at least one services. The highest percentage of adolescents used online services (24%), while school services (2%) is the least used service. The concentration indices for health services were -0.073 ($p<0.001$) and -0.032 ($p<0.001$) for telephone services, implies pro-poor socioeconomic inequality. The main contributors resulting in the observed inequalities in health services and telephone services were age, gender, education, parents' employment, and family type.

Conclusion

The findings suggested that health services and telephone services were more frequently accessed by the adolescents from poor socioeconomic families, therefore, steps should be taken to improve adolescent mental health. Moreover, the associated social determinants of mental health services should be addressed

through a multi-sectoral approach from policy perspective to reduce inequality and increase universal health coverage.

Keywords

Mental health services; Socioeconomic inequality, Concentration index; Decomposition, Adolescents

Introduction

Child and adolescent mental health are a global concern nowadays, however, evidence indicates an inverse relationship between socioeconomic inequalities and mental health problems: socioeconomically disadvantaged children and adolescents are two to three times more likely to develop mental health problems [1-3]. These inequalities are driven by complex and interrelated factors and several studies over the years indicate that the selection and causation effects are not mutually exclusive; rather these processes create a cycle of deprivation and mental health problems that persists across generations [2, 4]. Irrespective of socioeconomic status, all young children and adolescents should have access to and receive mental health services according to their needs. Research, however, also indicates significant variations in the utilization of mental health services among individuals including adolescents by their socioeconomic status, environments they live in, and their capability to access available services [4-8].

Estimates from national surveys in Australia shows that about 14% of children and adolescents suffer from mild to severe mental health disorders, the most common ones being attention-deficit/hyperactivity and anxiety disorders [9]. Despite the availability of effective services delivered by the mixed public-private health system, a concerning proportion of the adolescents in the country have unmet mental health needs and remain untreated [10]. Findings reveal that, around 65% of adolescents aged 12-17 years old with a mental disorder in the past year sought care or spoke to a health professional about their symptoms [11]. Among the different kinds of available services, health professionals and online services were accessed more frequently followed by school and telephone services [11, 12].

Despite the high number of adolescents with unmet needs in Australia, we found the research body on socioeconomic inequality in mental health services utilization especially using advanced analytical approaches such as concentration indices and decomposition analysis to be scarce. A recent study by Bartram and Stewart [13] using nationally representative data among adults in Australia found that the utilization of psychologist services to be more concentrated at higher income levels (i.e. pro-rich) and the distribution of unmet need for psychotherapy (as a negative indicator of access) to be more

concentrated at lower income levels (i.e. pro-poor) despite expanded public insurance coverage. Several studies in Australia or across developed nations have, however, utilized regression analysis to determine various socio-demographic factors that influence mental health service utilization among adolescents. Their findings reveal associations with several socioeconomic factors including gender [14-16], age [14, 17], household/parental income or affluence [16], parental education and parental employment [12], location and ethnicity/immigration status [18, 19]. Moreover, Vu, Biswas [12] also revealed differences in access to services based on family functioning with children from step, blended and sole-parent households compared to original parent households to be more likely to use any type of mental health services.

In recent times, although adolescents and young children are found to be more susceptible to mental illnesses, they significantly underutilize mental health services [11]. Despite this recognition in developed countries including Australia, the evidence regarding inequality in terms of access to mental health services has not been widely researched [13]. This study, therefore, aims to use concentration index and decomposition analysis to measure socioeconomic inequality in mental health services utilization and quantify the contributions of potential determinants of mental health services to the measured socioeconomic inequality. We believe that exploration of service utilization in a more sophisticated way will provide a greater understanding of the relationship between SES and mental health service use in adolescents. Findings will help in guiding mental health planners and policymakers in developing effective mental health services that can be accessed and used by all those who need them.

Methods

Data source and sample size

This study is based on data from the Young Minds Matter (YMM) nationwide survey, that provides the most reliable and comprehensive source of data on mental health and wellbeing among children and adolescents in Australia. The YMM is cross-sectional in design and follows a multi-stage, area-based random sampling technique to represent sample of households across the country [9, 20]. If there was a household with more than one qualified child, the sample included

one child. In total, 6310 parents of children aged 4-17 years (55% of eligible households) willingly completed a structured computer-based survey questionnaire via face-to-face interview. In addition, a tab-based, self-reported questionnaire was completed privately at home for 2967 children aged 11-17 years (89% of eligible households) to gather information on the health risk behaviours and mental health services use. However, the sample excludes the most remote areas, homeless children, children living in residential care and families that could not provide interview in English language. Out of the sampled, children aged between 13-17 years were only considered for this study (n=2945), this is because the self-reported child-data on service use were strictly limited to 13-17-year-olds [9, 20].

The YMM was conducted by the Telethon Kids Institute, University of Western Australia in partnership with Roy Morgan Research and the Australian Government Department of Health. Ethics was obtained through the Human Research Ethics Committees of University of Western Australia and Australian Government Department of Health (RA/4/1/9197). More detail about the survey method can be found elsewhere [20].

Outcome variables

Mental health service accessed by the children and adolescents aged 13-17 years were considered as outcome variables in this study. Both parent data and self-reported child data provided information in the utilization of following services: (in) Health services – any mental health-related services provided by the general medical practitioners, family physicians, paediatricians, psychiatrists, psychologists, psychotherapists, mental health counsellors, nurses and social workers, mental health supporting centres such as headspace centres and community clinics; (ii) School services – counselling service provided to a child at any school or in an educational institute; (iii) Telephone service – when a child receiving psychological counselling support over the phone; (iv) Online services [11]. In the analysis, both parent data and self-reported child data were combined to create a dichotomous variable for each service and responses were included 'Yes' (coded as 1) and 'No' (coded as 0). Lastly, a new binary variable was created

as ‘any service’ with children who accessed any of the four available services, coded 1 for ‘Yes’ and 0 for ‘No’.

Explanatory variables

Sociodemographic covariates included - age of the child (13 to ≤15 and >15 to 17), gender (boys and girls), country of birth (overseas and Australia), place of residence (Remote, regional and cities), the region of residence (non-metropolitan and metropolitan), schooling (no and yes), education of parents (year 10/11, diploma and bachelor), employment of parents (unemployed and employed), housing tenure (rented and owned), family type (original parents and others included step, blended, sole or foster parents), family functioning (poor, fair, good and very good) and equivalized household income quintiles (Q1-Poorest, Q2-2nd poorest, Q3-middle, Q4-2nd richest and Q5-Richest). The equivalized household income quintiles were calculated by using an equivalence factor on the basis of ‘Modified OECD’ equivalence scale [21].

Statistical approach

Sociodemographic characteristics of the sample (n=2268) were described using frequencies and percentages. Percentage of the children (aged 13-17 years) who accessed mental health services was reported across each level of sociodemographic characteristic. The Pearson chi-square tests were used to examine the association between each sociodemographic characteristic and services. Then, to measure the socio-economic inequality in the utilization of mental health services, concentration indices (CIs) were computed for each outcome variable. The value of CI is a summary measure of socio-economic inequality that ranges between +1 and -1 (i.e., $-1 \leq CI \leq 1$), where a value of 0 (Zero) indicated no inequality [22, 23]. A positive value of the CI suggests inequality concentrated among the richest while the negative value indicates the disproportionate concentration amongst the poorest. The larger the absolute value of the CI, the greater the extent of inequality [22-24].

In case of binary outcomes (e.g., whether a child accessed mental health services or not), however, CI values differ with the upper and lowest limits [24], as their mean vary over time and populations, which can lead to unreliable comparisons of inequalities [25, 26]. Typically, two potential approaches are used to deal with this

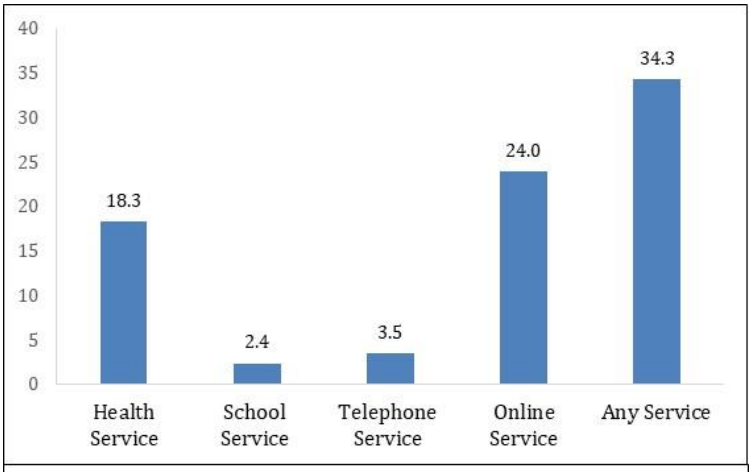
kind of issue: i) the Wagstaff approach - standardising CIs by dividing with one minus the means of mental health services variables [24], and ii) the corrected Erreyger's approach – adjusting CIs by multiplying it by four times with the means mental health services variables [25]. In the present study, the later approach was used that satisfy all four properties of the rank-dependent variable of inequalities [27].

Then, the CIs were decomposed using probit models to determine the contribution of various socio-economic factors to the observed inequality. The following steps were taken for decomposition analysis,

- Step 1: Marginal effects were calculated to demonstrate associations between the determinants and the health variable of interest (i.e., mental health services),
- Step 2: Mean values for all explanatory variables were calculated,
- Step 3: Elasticities were calculated for all independent variables using the mean values and beta-coefficients from the probit models,
- Step 4: Using the CONINDEX and SVY command [28], CIs of all independent variables were calculated,
- Step 5: Then, to get the relevant contribution of each independent variable, elasticities and CIs of each independent variables were multiplied.
- Step 6: Finally, all the earlier steps were repeated to get a pooled estimate. Pooled estimate reflects the average contribution of factors for each mental health services.

The decomposition analysis revealed how each explanatory variable contributed to inequality in mental health services utilization among adolescents. The contribution of each indicator depends on how income is spread in a society and how the distribution of wealth influences the use of mental health services. The absolute contribution implied the degree of inequality from each explanatory variable. A negative value of the absolute contribution means that the indicator contributed to the pro-poor inequalities and vice versa. Pro-rich inequality thus means that adolescents from wealthy household used more mental health services than the poor [29].

All analyses were performed in Stata software version 14.1.



Notes:
- Health service: When children recieved any services from private, hospital, CAMHS, public mental health, headspace centre, community and/or any health professional in last 12 months;
- School service: When children accessed any mental health related counselling services in the school or in any educational institute in the past 12 months;
- Telephone service: When children recieved any service through phone or mobile in the previous 12 months;
- Online service: When children used online services to recieve mental health support or counselling or to participae in a personalised assessment program in the past 12 months;

Figure 4 Mental health services utilization in the sample (in percentages, n=2268)

Results

Figure 1 illustrates the percentage distribution of utilization of mental health services by Australian adolescents aged 13-17 years. Out of the four services, online services (24%) were preferable, and school services (2%) were the least popular service among adolescents. While approximately 18% of adolescents used health services and 4% utilized telephone counselling services.

Table 1 shows with the increase in age, the utilization of all four services goes on increasing, and girls utilized more services than boys. A higher percentage of adolescents who live in cities and metropolitan areas, had schooling, from educated parents (diploma and above), and belongs to a higher income family utilized the mental health services than their counterparts.

Table 6 Percentage distribution of the utilisation of mental health services by selected socio-demographic characteristics (n=2268)

Characteristics	Frequency (%)	Health Service (%)	School Service (%)	Telephone Service (%)	Online Service[d] (%)	Any Service (%)
Age						
13 to ≤15	955 (42.1)	15.9	3.3	3.0	20.1	30.3
>15 to 17	1313 (57.9)	20.1	1.8	3.6	26.9	37.2
p-value		0.011	0.030	0.280	<0.001	0.001
Gender						
Boys	1177 (51.9)	14.7	1.9	2.2	17.6	27.7
Girls	1091 (48.1)	22.3	2.9	4.9	30.9	41.3
p-value		<0.001	0.130	<0.001	<0.001	<0.001
Country of Birth						
Overseas	339 (14.9)	12.4	2.7	2.7	25.7	31.9
Australia	1929 (85.1)	19.4	2.4	3.7	23.7	34.7
p-value		0.002	0.765	0.345	0.445	0.313
Place of residence						
Cities	1467 (64.7)	18.8	2.7	3.7	26.4	36.3
Regional	768 (33.9)	17.4	1.9	2.9	19.7	30.5
Remote	33 (1.4)	18.2	3.0	6.1	21.2	30.3
p-value		0.730	0.574	0.478	0.002	0.019
Schooling						
No	431 (19.0)	20.2	1.4	3.5	16.9	30.6
Yes	1837 (81.0)	17.9	2.7	3.5	25.7	35.1
p-value		0.272	0.121	0.953	<0.001	0.077
Education level of Parents						
Year 10/11	722 (31.8)	18.6	2.2	3.9	20.1	31.9
Diploma	819 (36.1)	18.9	2.3	3.7	26.0	36.3
Bachelor	727 (32.1)	17.5	2.8	3.0	25.7	34.4
p-value		0.749	0.780	0.656	0.011	0.190
Employment status of Parents						
Unemployed	538 (23.7)	24.4	2.6	5.4	23.1	37.9
Employed	1730 (76.3)	16.5	2.4	2.9	24.3	33.1
p-value		<0.001	0.760	0.007	0.542	0.041
Household income quintile†						
Q1 (0-20%)	402 (17.2)	25.1	2.2	5.5	19.2	37.1
Q2 (20-40%)	473 (20.9)	20.9	2.1	4.7	24.9	35.2
Q3 (40-60%)	400 (17.6)	15.0	2.8	3.0	27.3	35.0
Q4 (60-80%)	543 (23.9)	15.1	2.4	2.9	22.3	30.4
Q5 (80-100%)	450 (19.8)	16.4	2.7	1.8	26.7	33.8
p-value		<0.001	0.969	0.025	0.035	0.205
Family type^						

Characteristics	Frequency (%)	Health Service (%)	School Service (%)	Telephone Service (%)	Online Service[d] (%)	Any Service (%)
Original	1339 (59.0)	14.1	2.0	2.2	23.2	30.9
Others	929 (41.0)	24.4	3.0	5.4	25.2	39.1
p-value		<0.001	0.129	<0.001	0.282	<0.001
Notes: p-value for each mental health services category results from Pearson chi-square test for independence. †Household income quintile: The equivalised household income was calculated by using an equivalence factor based on 'Modified OECD' equivalence scale. ^Family type: original families mean children are natural, adopted, or foster child of both parents, and no stepchild; other families include step, blended and children from families who are not natural, adopted, foster or step of either parent						

Socioeconomic inequality

Overall, the utilization of any mental health services is disproportionately concentrated among adolescents from lower income families (Table 2) implying a pro-poor inequality. The concentration indices (CIs) for the mental health services in Table 2 also suggested that adolescents from economically worse-off household utilized more health services (CI = -0.073, p<0.001) and telephone services (CI= -0.032, p<0.001) than those who were economically better-off. In contrast, the concentration indices for the school services (CI = 0.005) and online services (CI = 0.033) indicates a pro-rich inequality but not statistically significant.

Table 7 Inequalities in the utilization of mental health services among Australian adolescents

Services	Concentration Index (CI)	Standard Error (CI)	p-value
Health services	-0.073	0.018	<0.001
School services	0.005	0.008	0.474
Telephone services	-0.032	0.009	<0.001
Online services	0.033	0.020	0.102
Any services	-0.040	0.022	0.071
Notes: The Corrected Erreygers Concentration Index (CI) was used			

Decomposition of the inequality

In the first step, to calculate the adjusted coefficients between mental health services and its determinants a logit model was applied. Table 3 demonstrates that some of the determinants – including being aged between >15-17-years, female, Australian, schooling, employment of parents, high household income (only significant in online services), not living with original biological parents and

being a member poor functioning family increased the odds of using any mental health services. To understand the factors that contribute to inequality, we decomposed the estimates reported in Table 3. In this table, for each service, marginal effects of each determinants (β), the means (μ), the elasticities (η), the CIs of the explanatory variables (C_k) and absolute contribution (C_a) of determinants are reported. Overall, the result shows that each of following variables – age, gender, country of birth, schooling, parental employment, and family type negatively contributed to the inequality mainly due to increased probability of the any services utilization (positive marginal effects), meaning that poor people were disproportionately concentrated (negative concentration indices) (Table 3). While significant negative marginal effects were observed for the regional area of residence and for the employment of parents (Table 3). These estimates were statistically significant at the 5% level.

After adjusting for all other variables, being aged between >15-17 years increased the probability of using any service by almost 21.2% (C_k= -0.0235, p<0.001) compared with children aged 13-15 years. Similarly, being girls, being Australian and being a school going children respectively increased the probability of using any mental health services by nearly 31.5% (C_k= -0.0380, p<0.001), 14.4% (C_k= -0.0389, p<0.10) and 24.2% (C_k= -0.0249, p<0.01) compared with their counterparts (Table 3). While being a resident in the regional area decreased the probability of service use by 19.6% (C_k= -0.0244, p<0.010) compared with children from cities and remote areas. A similar pattern was observed with parental employment.

Table 8 Decomposition of observed socioeconomic inequality of mental health services.

Variables		Health Service	School Service	Telephone Service	Online Service	Any Service
Age (Ref. 13 to ≤15)						
>15 to 17	β^1	0.1668**	-0.2794**	0.1257	0.2759****	0.2120****
	μ^2	0.2033	0.0170	0.0403	0.2678	0.3712
	η^3	0.1928	-0.1786	0.1454	0.3258	0.2394
	C_k^4	-0.0713	-0.0040	-0.0379	0.0550	-0.0235
	C_a^5	-0.0137	0.0007	-0.0055	0.0179	-0.0056
Gender (Ref. Boys)						
Girls	β	0.2224***	0.2205*	0.3632***	0.4027****	0.3157****
	μ	0.2050	0.0326	0.0483	0.2904	0.3886
	η	0.2590	0.2705	0.5039	0.5154	0.3732
	C_k	-0.0973	-0.0018	-0.0492	0.0254	-0.0380
	C_a	-0.0252	-0.0005	-0.0248	0.0131	-0.0142
Country of birth (Ref. Overseas)						
Australia	β	0.3754****	0.0293	0.0523	0.0140	0.1443*
	μ	0.1878	0.0266	0.0356	0.2238	0.3326
	η	0.4008	0.0293	0.0535	0.0138	0.1460
	C_k	-0.0823	-0.0009	-0.0332	0.0459	-0.0389
	C_a	-0.0330	0.0000	-0.0018	0.0006	-0.0057
Place of residence (Ref. Cities)						
Regional	β	-0.1098	-0.0706	-0.0921	-0.1774	-0.1966*
	μ	0.1627	0.0229	0.0304	0.1860	0.2827
	η	-0.1015	-0.0609	-0.0804	-0.1454	-0.1691
	C_k	-0.0733	0.0311	-0.0032	0.0437	-0.0244
	C_a	0.0074	-0.0019	0.0003	-0.0064	0.0041
Remote	β	0.1041	0.4686	0.4245	-0.0829	-0.0940
	μ	0.1944	0.0597	0.0716	0.1844	0.2875
	η	0.1150	1.0531	0.8725	-0.0674	-0.0822
	C_k	0.0711	0.2160	-0.0912	0.1337	0.2559
	C_a	0.0082	0.2275	-0.0796	-0.0090	-0.0210
Schooling (Ref. No)						
Yes	β	0.0190	0.2022	0.2367**	0.4621****	0.2423***
	μ	0.1726	0.0288	0.0363	0.2438	0.3380
	η	0.0186	0.2189	0.2466	0.4964	0.2491
	C_k	-0.0592	0.0100	-0.0328	0.0313	-0.0249
	C_a	-0.0011	0.0022	-0.0081	0.0156	-0.0062
Employment status of Parents (Ref. Year 10/11)						
Employed	β	-0.2249***	-0.2312	-0.2557*	-0.0615	-0.1520*
	μ	0.1565	0.0244	0.0278	0.2290	0.3150
	η	-0.2001	-0.2124	-0.2044	-0.0621	-0.1457
	C_k	-0.0316	0.0055	-0.0136	0.0278	-0.0138
	C_a	0.0063	-0.0012	0.0028	-0.0017	0.0020

Variables		Health Service	School Service	Telephone Service	Online Service	Any Service
Household income (Ref. Q1)						
Q2	β	-0.0266	0.2086	0.0479	0.3567***	0.1174
	μ	0.1925	0.0268	0.0439	0.2521	0.3563
	η	-0.0292	0.2102	0.0604	0.3964	0.1273
	C_k	-0.0306	-0.0260	0.0170	0.0072	-0.0180
	C_a	0.0009	-0.0055	0.0010	0.0029	-0.0023
Q3	β	-0.1431	0.3282	-0.0071	0.3411***	0.0517
	μ	0.1471	0.0287	0.0314	0.2547	0.3267
	η	-0.1196	0.3540	-0.0064	0.3828	0.0514
	C_k	0.8703	0.0153	-0.0136	0.0412	0.0172
	C_a	-0.1041	0.0054	0.0001	0.0158	0.0009
Q4	β	-0.1462	0.2820	-0.0657	0.1981**	-0.0445
	μ	0.1442	0.0264	0.0272	0.2089	0.2895
	η	-0.1198	0.2802	-0.0513	0.1824	-0.0392
	C_k	-0.0247	0.0027	-0.0100	0.0189	-0.0304
	C_a	0.0030	0.0008	0.0005	0.0034	0.0012
Q5	β	-0.1242	0.3042	-0.3442	0.3120***	0.0257
	μ	0.1523	0.0304	0.0139	0.2513	0.3247
	η	-0.1076	0.3475	-0.1375	0.3456	0.0254
	C_k	0.0409	-0.0203	-0.0130	0.0248	0.0050
	C_a	-0.0044	-0.0071	0.0018	0.0086	0.0001
Family type (Ref. Original)						
Others	β	0.3530****	0.2702**	0.4255***	0.1538*	0.2448***
	μ	0.2423	0.0321	0.0570	0.2407	0.3828
	η	0.4863	0.3268	0.6967	0.1632	0.2851
	C_k	-0.0510	0.0117	-0.0222	0.0645	-0.0224
	C_a	-0.0248	0.0038	-0.0155	0.0105	-0.0064

Notes:
Level of significance: ****p<0.001, ***p<0.01, **p<0.05, *p<0.10 (Multivariate probit regression-Z-Test)
Ref: Reference group used in the probit regression
[1]Marginal effects (β) demonstrate associations between the determinants and services.
[2]Weighted mean (μ) of the determinant.
[3]Elasticity (η) of the determinant = (β*μ)/overall weighted mean of each services
[4]Erreygers corrected concentration index (C_k) of the determinant
[5]Absolute contribution (C_a) of each determinant to overall CI for each service = (η*C_k)

Discussion

The results of the current study shed light on the socioeconomic inequality in the utilization of mental health services among adolescents aged 13-17 years in Australia. In this study, we measured the equivalized household income-based socioeconomic inequalities in the utilization of four mental health services (i.e., health services, school services, telephone counselling services and online services) using a CI decomposition approach. This assisted us to get to the underlying causes of socioeconomic inequalities in the mental health services utilization in our communities, which are essential from policy perspectives [30].

Evidence suggests that income-based health-related inequalities in Australia are both considerable and persistent [31]; as a result, the Government of Australia launched a country-wide program (i.e. Better Access to Mental Health Care) in 2006 [13, 32]. The present study revealed that the magnitude of inequality in services utilization due to mental health problems in Australia was enduring but small. This is maybe because of income protection by the government through unemployment benefits or other benefits, Australia's universal health insurance scheme – Medicare, and several concessions. In consistent with previous studies from other developed countries including the USA, the UK and Australia [30, 33-36], the results found a mix of pro-poor (in health and telephone services) and pro-rich (online services) inequalities in the utilization of mental health services in Australia; however, the extent of inequality was small. This may be because children and adolescents from poorer families are most often at risk for psychological distress and mental illnesses such as abuse, crime, social strife, civil unrest, homelessness, and unemployment. Moreover, research suggests poor neighbourhoods also seem to have much greater effects for mental illnesses than well-to-do families [31]. A recent study conducted in Spain also reported that under-15-aged children from lower socioeconomic status accessed more mental health services compared to children belongs to higher socioeconomic families [37]. Additionally, a study from Australia reported that respondents from low-income backgrounds were more likely to use health services (e.g. general practitioners) overall but were less likely to use other healthcare services for preventive purposes such as mental health counselling for self-harm/suicidality,

pap-smear, mammography for breast cancer [32]. However, population-based cohort study in Denmark reported that generally people from low-income background accessed less mental healthcare services compared to high-income ones [38]. Moreover, the study found that adolescents from high-income families used more online services than those from low-middle income families. This is mainly because the high-income parents can afford more modern hi-tech devices such as smartphones, tabs, laptops with internet connection for their child's personal use than low-middle income parents.

Furthermore, in the study, decomposition analysis of mental health services inequality revealed that some explanatory variables have negative contributions to socio-economic inequality in using health services, while the same determinants have positive contributions to socioeconomic inequality in accessing online services. A positive contribution suggests that the combined effect of the marginal effect of the desired determinant and its distribution based on equivalized household income increases pro-rich socioeconomic inequality in the utilization of online services, while the negative contributions in health services indicate the increased pro-poor inequality. The decomposition of CI approach helps to measure the contributions of determinants to socioeconomic inequality in health-related outcome such as mental health service utilization and found to be important as it merges monitoring of inequalities and identifying its determinants [39, 40]. Overall, regarding demographics, along with other studies [13, 37, 41, 42], this study revealed that older age-group, being girls and Australian, school going, living in regional areas, having employed parents and children from step/blended families have positively contributed to online services inequality; while the same factors negatively contributed in health services inequality. Although Parslow and Jorm [43] using adult cohort found that none of the determinants were significantly associated with different categories of mental health services in Australia.

There are several policy implications of this study, which can be contextualized nationally and globally. For example, public health researchers and policymakers should address inequality in mental health services utilization among adolescents as it is a matter of concern that although Better Access launched in 2006, inequality persists in Australia. Also, government policy should be structured in such a way that children and adolescents would obtain adequate psychological counselling support via online, particularly focusing on those from the lower socioeconomic background. Moreover, since this study identified some socioeconomic factors that are affecting mental health service utilization among adolescents, it would be worthwhile from a policy perspective to carrying out inequality analysis over time to track down the progress towards equality in services use.

Like many previous studies, this study also has some limitations. First, the main outcome of this study, access to mental health services, is likely to be subject to recall bias although YMM used both self-reported child and parent-reported information. Additionally, causal interpretations could not be possible due to the cross-sectional study design. Further, as this study only covers children and adolescents aged 13-17-years, we are lacking information on the distribution of mental health service utilization in other age-groups such as adults, who make up a significant proportion of the Australian population.

Conclusions

The study revealed though the magnitude of inequality was small, there is a mix of pro-poor and pro-rich inequalities in mental health services utilization among adolescents in Australia. Health services were preferable in the lower socioeconomic group, while online services were mostly used by adolescents from high-income families. The decomposition analysis showed that age, gender, education, occupation, family type negatively contributed to health services use, while those factors had a positive contribution to online services in adolescents. Further, the findings indicate that broadening knowledge about socioeconomic inequality of mental health and services utilization, especially among adolescents needs to become a part of health policy towards achieving universal health coverage.

Acknowledgements

This work was undertaken as a part of the PhD program of the first author. The authors wish to thank the Telethon Kids Institute, The University of Western Australia, Roy Morgan Research, the Australian Government Department of Health for conducting the survey, and the Australian Data Archive for providing the YMM data set without any cost.

References

1. Ravens-Sieberer, U., et al., *Socioeconomic inequalities in mental health among adolescents in Europe.* Social cohesion for mental well-being among adolescents, 2008: p. 26-42.
2. Reiss, F., *Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review.* Social science & medicine, 2013. **90**: p. 24-31.
3. Weinberg, D., et al., *Adolescent Socioeconomic Status and Mental Health Inequalities in the Netherlands, 2001–2017.* International journal of environmental research and public health, 2019. **16**(19): p. 3605.
4. Amaddeo, F. and J. Jones, *What is the impact of socio-economic inequalities on the use of mental health services?* Epidemiology and Psychiatric Sciences, 2007. **16**(1): p. 16-19.
5. Alegría, M., et al., *Disparities in child and adolescent mental health and mental health services in the US.* New York, NY: William T. Grant Foundation, 2015.
6. Tello, J.E., et al., *A census-based socio-economic status (SES) index as a tool to examine the relationship between mental health services use and deprivation.* Social science & medicine, 2005. **61**(10): p. 2096-2105.
7. Dey, M. and A.F. Jorm, *Social determinants of mental health service utilization in Switzerland.* International journal of public health, 2017. **62**(1): p. 85-93.
8. Lin, E., et al., *The use of mental health services in Ontario: epidemiologic findings.* The Canadian Journal of Psychiatry, 1996. **41**(9): p. 572-577.
9. Lawrence, D., et al., *Key findings from the second Australian child and adolescent survey of mental health and wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 876-886.
10. Sheppard, R., F.P. Deane, and J. Ciarrochi, *Unmet need for professional mental health care among adolescents with high psychological distress.* Australian & New Zealand Journal of Psychiatry, 2018. **52**(1): p. 59-67.
11. Johnson, S.E., et al., *Service use by Australian children for emotional and behavioural problems: Findings from the second Australian Child and*

Adolescent Survey of Mental Health and Wellbeing. Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 887-898.

12. Vu, X.-B.B., et al., *Mental health service use in Australia: The role of family structure and socio-economic status.* Children and Youth Services Review, 2018. **93**: p. 378-389.
13. Bartram, M. and J.M. Stewart, *Income-based inequities in access to psychotherapy and other mental health services in Canada and Australia.* Health policy, 2019. **123**(1): p. 45-50.
14. Sawyer, M., L. Miller-Lewis, and J. Clark, *The mental health of 13–17 year-olds in Australia: Findings from the national survey of mental health and well-being.* Journal of Youth and Adolescence, 2007. **36**(2): p. 185-194.
15. Bergeron, E., et al., *Determinants of service use among young Canadians with mental disorders.* The Canadian Journal of Psychiatry, 2005. **50**(10): p. 629-636.
16. Cheung, A., et al., *Factors associated with use of mental health services for depressed and/or suicidal youth aged 15–24.* Community Mental Health Journal, 2009. **45**(4): p. 300-306.
17. Cuffe, S.P., et al., *A longitudinal study of adolescent mental health service use.* The Journal of Behavioral Health Services & Research, 2001. **28**(1): p. 1-11.
18. John, F., *Ethnic and gender disparities in needed adolescent mental health care.* Journal of Health Care for the Poor and Underserved, 2011. **22**(1): p. 101.
19. Zahner, G.E. and C. Daskalakis, *Factors associated with mental health, general health, and school-based service use for child psychopathology.* American journal of public health, 1997. **87**(9): p. 1440-1448.
20. Hafekost, J., et al., *Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 866-875.
21. Zubrick, S.L., David; Sawyer, Michael; Ainley, John,, *"Young Minds Matter: The second Australian Child and Adolescent Survey of Mental Health and Wellbeing, 2013-14*. 2013-13, ADA Dataverse.

22. Kakwani, N., A. Wagstaff, and E. Van Doorslaer, *Socioeconomic inequalities in health: measurement, computation, and statistical inference.* Journal of econometrics, 1997. **77**(1): p. 87-103.
23. O'donnell, O., et al., *Analyzing health equity using household survey data: a guide to techniques and their implementation*. 2007: The World Bank.
24. Wagstaff, A., v.E. Doorslaer, and N. Watanabe, *On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam*. 2001: The World Bank.
25. Ali, B., P. Dhillon, and S.K. Mohanty, *Inequalities in the utilization of maternal health care in the pre-and post-National Health Mission periods in India.* Journal of Biosocial Science, 2020. **52**(2): p. 198-212.
26. O'Donnell, O., et al., *Conindex: estimation of concentration indices.* The Stata journal, 2016. **16**(1): p. 112-138.
27. Morasae, E.K., et al., *Understanding determinants of socioeconomic inequality in mental health in Iran's capital, Tehran: a concentration index decomposition approach.* International journal for equity in health, 2012. **11**(1): p. 18.
28. Isaacs, A.N., et al., *Lower income levels in Australia are strongly associated with elevated psychological distress: Implications for healthcare and other policy areas.* Frontiers in Psychiatry, 2018. **9**: p. 536.
29. Turrell, G., et al., *Health inequalities in Australia: morbidity, health behaviours, risk factors and health service use.* 2006.
30. Hong, J., M. Knapp, and A. McGuire, *Income-related inequalities in the prevalence of depression and suicidal behaviour: a 10-year trend following economic crisis.* World Psychiatry, 2011. **10**(1): p. 40.
31. Garratt, E.A., et al., *The interactive role of income (material position) and income rank (psychosocial position) in psychological distress: a 9-year longitudinal study of 30,000 UK parents.* Social psychiatry and psychiatric epidemiology, 2016. **51**(10): p. 1361-1372.
32. Gornick, J.C. and B. Milanovic, *Income inequality in the United States in cross-national perspective: Redistribution revisited.* LIS Center Research Brief, 2015. **1**(2015): p. 1-7.

33. Pulok, M.H., K. van Gool, and J. Hall, *Horizontal inequity in the utilisation of healthcare services in Australia.* Health Policy, 2020. **124**(11): p. 1263-1271.
34. García-Altés, A., et al., *Socioeconomic inequalities in health and the use of healthcare services in Catalonia: analysis of the individual data of 7.5 million residents.* J Epidemiol Community Health, 2018. **72**(10): p. 871-879.
35. Packness, A., et al., *Impact of socioeconomic position and distance on mental health care utilization: a nationwide Danish follow-up study.* Social psychiatry and psychiatric epidemiology, 2017. **52**(11): p. 1405-1413.
36. Harper, S. and J. Lynch, *Commentary: using innovative inequality measures in epidemiology.* International journal of epidemiology, 2007. **36**(4): p. 926-928.
37. Speybroeck, N., et al., *Decomposing socioeconomic health inequalities.* International journal of public health, 2010. **55**(4): p. 347-351.
38. Brydsten, A., A. Hammarström, and M. San Sebastian, *Health inequalities between employed and unemployed in northern Sweden: a decomposition analysis of social determinants for mental health.* International journal for equity in health, 2018. **17**(1): p. 59.
39. Reiss, F., et al., *Socioeconomic status, stressful life situations and mental health problems in children and adolescents: Results of the German BELLA cohort-study.* PLoS one, 2019. **14**(3): p. e0213700.
40. Parslow, R.A. and A.F. Jorm, *Who uses mental health services in Australia? An analysis of data from the National Survey of Mental Health and Wellbeing.* Australian & New Zealand Journal of Psychiatry, 2000. **34**(6): p. 997-1008.

CHAPTER 5 – CONCLUSION

5.0 Overview

This PhD thesis by publication has encompassed an empirical investigation of two issues: behavioural and mental health-related problems; and mental health services utilization among adolescents in a developed country like Australia. The thesis encapsulates a theoretical interpretation using three theories: psychosocial theory; the theory of care-seeking behaviour; and ecosocial theory. The research questions underpinning this thesis were: What are the roles of social determinants on behavioural and mental health problems, and mental health services utilization; and to what extent do they contribute to socioeconomic inequality? The main objective of the thesis was to investigate the effect of social determinants (demographic, socioeconomic, psychological, behavioural, biological) on bullying, mental disorders, self-harm, suicidality, and the utilization of mental health services among adolescents aged 12-17 years. The investigation followed the WHO recommended the CSDH framework in the Australian context. To address the research questions, and to achieve the research objectives, a quantitative research approach was utilized. In total, eight studies were conducted under three broad research themes using the nationally representative data from the second Child and Adolescent Survey of Mental Health and Wellbeing (YMM) in Australia. *Studies 1-3* were consolidated under *Research Theme I - Identifying the determinants of behavioural and mental health problems in adolescents* and described in Chapter 2 of the thesis. Chapter 3 explained the findings of *Studies 4-6* under *Research Theme II - Assessing the utilization of mental health services among adolescents with behavioural and mental health issues.* In Chapter 4, *Study 7* and *Study 8* were grouped under *Research Theme III - Measuring inequality in behavioural and mental health problems and the utilization of mental health services in adolescents*. Finally, Chapter 5 of this thesis included the summary of the thesis, together with the research contribution, limitations of the thesis, future research directions and conclusion with policy implications of the thesis.

5.1 Contribution of the thesis

This thesis has expanded previous research and made significant contributions in adolescent mental health research in several ways, following three basic theories and the WHO recommended conceptual framework. In general, this thesis (*Study 1-Study 8*) has provided national prevalence estimates on traditional bullying, cyberbullying, mental disorders (major depressive disorder, ADHD, conduct disorder and anxiety disorder), self-harm, suicidality, and the use of mental health services. In line with the national prevalence estimates, the research involves Australian adolescents, in contrast to most of the previous research conducted in Australia which has been state-wide [25, 51]. These estimates are expected to shed light on the need for more research regarding behavioural and mental health issues and service utilization among adolescents at the national level.

Further, this thesis *(Study 3, Study 4 and Study 7)* has focused on areas that have previously received little attention, considering, for example, cyberbullying victimization as well as traditional bullying victimization. Cyberbullying victimization has increased significantly in recent years among children and adolescents due to the growing popularity of hi-tech devices such as laptops, smartphones, and tablets [32, 54, 55, 77]. Moreover, the current thesis has considered both self-harm and suicidality, which differs from most of the past studies which included either self-harm or suicidality in their research. Furthermore, *Study 3* of this PhD thesis tested the mediating effect of each mental disorder on the association between traditional bullying victimization, cyberbullying victimization, self-harm, and suicidality in adolescents, using a quantitative model: The Baron and Kenny approach. This has not previously been addressed as most of the earlier studies focused their examination of the moderating effect of depression and/or anxiety on traditional bullying victims [21, 32]. Overall, the findings on traditional bullying, cyberbullying, mental disorders, self-harm, and suicidality will help the researchers and health professionals to generate new research hypotheses to reduce the prevalence of behavioural and mental health problems among adolescents.

Furthermore, to the best of our knowledge, for the first time in Australia, *Studies 4-6* assessed the utilization of mental health services, specifically among those adolescents who reported bullying victimization, self-harm and suicidality. Previous research typically focused only on mental disorders. These findings on the access to mental health services, especially among adolescents with behavioural and mental health problems, portray a gap where the researchers and policymakers could usefully place their attention to increasing service utilization.

In addition, *Study 7* and *Study 8* of the present thesis have measured socioeconomic inequalities in behavioural and mental health problems, and mental health services utilization in adolescents aged 12-17 years. These studies are unique because most of the previous research in Australia involved adults and youths rather than adolescents [78, 79]. *Study 7* found that adolescents from low-socioeconomic groups experienced more bullying, with consequent mental disorders and suicidality than those from high-socioeconomic groups. Most significantly, *Study 8* found that health service providers (e.g., general practitioners, psychiatrists, psychologists) were more commonly accessed among adolescents from low-income families, while online services were most likely used by adolescents from high-income families. In general, these findings on socioeconomic inequalities about the use of mental health and services, particularly among adolescents, will not only contribute to reducing health inequalities and promoting health equity but will also guide stakeholders and policymakers to formulate new policy designs and continue research into health interventions.

5.2 Limitations of the thesis

Despite using a nationally representative sample, this PhD thesis has some limitations. First of all, this thesis utilized a cross-sectional survey data, which limit the causal interpretation between the variables of interest [80]. In general, the thesis was limited to the 12–17-year-old age group, with no information on the distribution of behavioural and mental health, and service utilization for other age-groups such as adults, who make up a significant proportion of the Australian population. Therefore generalisability of findings to other age groups

was an issue [81]. Hence, surveys covering all demographic groups could more accurately reflect mental health-related socioeconomic inequality and better tackle the socioeconomic determinants of mental health inequality through approved policies. Also, the sample size, as well as age-group, varied in the included studies of the thesis due to limitation of the availability of variables of interest, which might have an impact on the overall findings of the thesis.

Further, information regarding bullying, self-harm and suicidality were gathered from self-reported child data, so reliability was a concern. This data may have resulted in a biased response [82], even though experts in this field confirmed the findings in previous research that self-reporting is the most logical approach to data collection [83]. Information about mental health services and mental disorders and other sociodemographic factors were obtained from parent-reported data, which may have involved recall or social desirability bias [84] and ultimately resulted in under/overestimation of the results [64]. Moreover, since the thesis was based on secondary dataset for selecting variables for analysis, it was not possible to design survey tool which could reflect this research interest more accurately. For example, regarding the mental health service utilization, YMM omitted some important variables such as the number of visits, duration, waiting times, or past experiences, all of which can be a serious barrier to the use of mental health services [85]. The thesis was also restricted to the fact that the YMM did not investigate whether service use enhances mental health issues, school achievement and social functioning in children and adolescents [13].

5.3 Future research directions

Since this PhD thesis has recognized behavioural and mental health in adolescents as an overlooked area of research in the setting of a developed country like Australia, it provides meaningful insights and directions for future academic research. For example, considering similar research questions and objectives, researchers may conduct a nationwide longitudinal study involving children, adolescents, youths, and adults, which will subsequently help to develop effective interventions to reduce behavioural and mental health-related problems and enhance the utilization of mental health services.

In addition, the findings of the current thesis will help the researchers to formulate new hypotheses for an in-depth qualitative study that explores topics such as the experience of behavioural and mental health, and service use among adolescents. Moreover, using the findings of the thesis, researchers and policymakers will be able to develop adolescent-focused promotion and prevention initiatives that widely improve mental health literacy (bullying, mental disorders, self-harm, suicidality) and knowledge about the availability of different services. Mental health literacy is essential for minimising stigma and misinformation among the general people and healthcare professionals.

5.4 Conclusion with policy implications

The overall burden of behavioural and mental health problems in adolescents is substantial, while mental health services are under-utilized in Australia. This PhD thesis has documented an understanding of social determinants concerning bullying victimization, mental disorders, self-harm, suicidality, and the utilization of mental health services among adolescents aged 12-17 years in Australia. Also, it has provided an estimation of socioeconomic inequality in behavioural and mental health, and utilization of mental health services, along with empirical policy implications.

Overall, the findings of this PhD thesis have contributed to an evidence-based recommendation for policymakers and healthcare professionals. For example, the thesis has found that bullying victimization (traditional, cyber and both) is one of the key determinants of mental disorders, self-harm, and suicidality. This suggests that it is essential to consider both traditional bullying as well as cyberbullying from policy perspectives for the successful implementation of self-harm and suicide prevention programs. Moreover, the findings have shown that mental disorders have a mediating effect on the association of bullying, self-harm and suicidality. The findings indicate that healthcare professionals, and general practitioners should recognise existing mental health problems and consider them in the treatment plan to reduce the prevalence of self-harm and ultimately suicide among adolescents.

The thesis has also found that access to mental health services due to behavioural and mental health problems was limited, as significant numbers of adolescents

did not use school services or telephone counselling services. The thesis recommends that researchers and policy formulators should take urgent action to reinforce school services programs and telephone counselling services to reduce the behavioural and mental health problems of adolescents of Australia.

Further, the findings of this thesis have reported that pro-poor socioeconomic inequalities exist in behavioural and mental health, and service utilization among Australian adolescents. The thesis indicates that targeted treatment models and appropriate mental health services should be provided to socioeconomically disadvantaged adolescents and easily accessed by them. Moreover, it recommends that researchers and policymakers should take every feasible measure to redistribute wealth via benefits (e.g., family benefit, unemployment, and retirement benefits) and income taxation and find suitable ways to minimize the income gap before tax to reduce socioeconomic inequalities. Lastly, this thesis suggests that empirical longitudinal research is required on this topic for policymaking and legislation at the national level.

REFERENCES

1. WHO, *Constitution of the World Health Organization,* , in *Google Scholar*. 1948, World Health Organization: Geneva.
2. WHO, *The WHO special initiative for mental health (2019-2023): Universal health coverage for mental health*. 2019, World Health Organization: Geneva.
3. Izutsu, T., et al., *Mental health and wellbeing in the Sustainable Development Goals.* The Lancet Psychiatry, 2015. **2**(12): p. 1052-1054.
4. WHO, *Mental Health Action Plan 2013-2020*. 2013, World Health Organization: Geneva, Switzerland.
5. WHO. *Mental health: strengthening our response*. 2018; Available from: https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response.
6. WHO. *Mental health*. 2021; Available from: https://www.who.int/health-topics/mental-health#tab=tab_1.
7. Alonso, J., S. Chatterji, and Y. He, *The burdens of mental disorders: Global perspectives from the WHO World Mental Health Surveys*. 2013: Cambridge University Press.
8. Vigo, D., G. Thornicroft, and R. Atun, *Estimating the true global burden of mental illness.* The Lancet Psychiatry, 2016. **3**(2): p. 171-178.
9. WHO, *Enhancing mental health pre-service training with the mhGAP intervention guide: experiences and lessons learned.* 2020, World Health Organization: Geneva.
10. Stanaway, J.D., et al., *Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017.* The Lancet, 2018. **392**(10159): p. 1923-1994.
11. Patel, V., et al., *The Lancet Commission on global mental health and sustainable development.* The Lancet, 2018. **392**(10157): p. 1553-1598.
12. Slade, T., et al., *National Survey of Mental Health and Wellbeing: methods and key findings. Aust. N. ZJ Psychiatry 43 (7), 594–605*. 2007.

13. Vu, X.-B.B., et al., *Mental health service use in Australia: The role of family structure and socio-economic status.* Children and Youth Services Review, 2018. **93**: p. 378-389.
14. Lawrence, D., et al., *Key findings from the second Australian child and adolescent survey of mental health and wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 876-886.
15. AIHW. *Deaths in Australia*. 2019 5 January 2020]; Available from: https://www.aihw.gov.au/reports/life-expectancy-death/deaths-in-australia.
16. Islam, M.I., E. Kabir, and R. Khanam, *Suicidality, Mental Disorder and the Utilization of Mental Health Services among Australian Adolescents.* Children and Youth Services Review, 2020: p. 104821.
17. Islam, M.I., R. Khanam, and E. Kabir, *Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data.* Psychiatry Research, 2020: p. 113364.
18. Islam, M.I., R. Khanam, and E. Kabir, *The use of mental health services by Australian adolescents with mental disorders and suicidality: Findings from a nationwide cross-sectional survey.* Plos one, 2020. **15**(4): p. e0231180.
19. Olweus, D., *Cyberbullying: An overrated phenomenon?* European journal of developmental psychology, 2012. **9**(5): p. 520-538.
20. Olweus, D., *School bullying: Development and some important challenges.* Annual review of clinical psychology, 2013. **9**: p. 751-780.
21. Jadambaa, A., et al., *The contribution of bullying victimisation to the burden of anxiety and depressive disorders in Australia.* Epidemiology and psychiatric sciences, 2020. **29**.
22. Bannink, R., et al., *Cyber and traditional bullying victimization as a risk factor for mental health problems and suicidal ideation in adolescents.* PloS one, 2014. **9**(4): p. e94026.
23. Kowalski, R.M. and G.W. Giumetti, *Bullying in the digital age*, in *Cybercrime and its victims*. 2017, Routledge. p. 167-186.
24. Quintana-Orts, C. and L. Rey, *Traditional bullying, cyberbullying and mental health in early adolescents: Forgiveness as a protective factor of peer*

victimisation. International journal of environmental research and public health, 2018. **15**(11): p. 2389.

25. Jadambaa, A., et al., *Prevalence of traditional bullying and cyberbullying among children and adolescents in Australia: A systematic review and meta-analysis.* Australian & New Zealand Journal of Psychiatry, 2019: p. 0004867419846393.
26. Thomas, H.J., et al., *Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth.* Australian & New Zealand Journal of Psychiatry, 2017. **51**(9): p. 909-920.
27. Thomas, H.J., et al., *Association of different forms of bullying victimisation with adolescents' psychological distress and reduced emotional wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(4): p. 371-379.
28. Demmrich, S. and S. Akgül, *Bullying experience among adolescents with a Turkish migration background in Germany: ethnic class composition, integration, and religiosity as protective factors?* International journal of environmental research and public health, 2020. **17**(13): p. 4776.
29. Merrill, R.M. and C.L. Hanson, *Risk and protective factors associated with being bullied on school property compared with cyberbullied.* BMC public health, 2016. **16**(1): p. 145.
30. Waasdorp, T.E. and C.P. Bradshaw, *The overlap between cyberbullying and traditional bullying.* Journal of Adolescent Health, 2015. **56**(5): p. 483-488.
31. Kyu, H.H., et al., *Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017.* The Lancet, 2018. **392**(10159): p. 1859-1922.
32. Ford, R., et al., *Bullying and mental health and suicidal behaviour among 14-to 15-year-olds in a representative sample of Australian children.* Australian & New Zealand Journal of Psychiatry, 2017. **51**(9): p. 897-908.
33. Kinchin, I. and C. Doran, *The cost of youth suicide in Australia.* International journal of environmental research and public health, 2018. **15**(4): p. 672.
34. Patton, G.C., et al., *Our future: a Lancet commission on adolescent health and wellbeing.* The Lancet, 2016. **387**(10036): p. 2423-2478.

35. Zubrick, S.R., et al., *Suicidal behaviours: prevalence estimates from the second Australian child and adolescent survey of mental health and wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 899-910.
36. Zubrick, S.R., et al., *Self-harm: prevalence estimates from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 911-921.
37. ABS. *Causes of Death, Australia, 2018*. 2019; Available from: https://mindframe.org.au/suicide/data-statistics/abs-data-summary-2018.
38. De Leo, D., et al., *Definitions of suicidal behavior: Lessons learned from the WHO/EURO Multicentre Study.* Crisis, 2006. **27**(1): p. 4-15.
39. WHO, *Public health action for the prevention of suicide: a framework*. 2012, WHO Press: Geneva, Switzerland.
40. Christensen, H. and D. O'Neil, *Suicide prevention in Australia using online interventions.* 2018.
41. AIHW, *Mental health services in Australia: in brief 2019*. 2019, AIHW: Canberra.
42. AIHW, *Mental health services in Australia*. 2020, Australian Institute of Health and Welfare: Canberra.
43. Johnson, S.E., et al., *Service use by Australian children for emotional and behavioural problems: Findings from the second Australian Child and Adolescent Survey of Mental Health and Wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 887-898.
44. Whiteford, H.A., et al., *Estimating treatment rates for mental disorders in Australia.* Australian Health Review, 2014. **38**(1): p. 80-85.
45. Sheppard, R., F.P. Deane, and J. Ciarrochi, *Unmet need for professional mental health care among adolescents with high psychological distress.* Australian & New Zealand Journal of Psychiatry, 2018. **52**(1): p. 59-67.
46. Saxena, S., et al., *Resources for mental health: scarcity, inequity, and inefficiency.* The lancet, 2007. **370**(9590): p. 878-889.

47. Lasalvia, A., et al., *Global pattern of experienced and anticipated discrimination reported by people with major depressive disorder: a cross-sectional survey.* The Lancet, 2013. **381**(9860): p. 55-62.
48. Henderson, C., et al., *Mental health-related stigma in health care and mental health-care settings.* The Lancet Psychiatry, 2014. **1**(6): p. 467-482.
49. Whiteford, H.A., A.J. Ferrari, and T. Vos, *Challenges to estimating the true global burden of mental disorders.* The Lancet Psychiatry, 2016. **3**(5): p. 402-403.
50. Patel, V., et al., *Mental health of young people: a global public-health challenge.* the Lancet, 2007. **369**(9569): p. 1302-1313.
51. Hemphill, S.A., A. Kotevski, and J.A. Heerde, *Longitudinal associations between cyber-bullying perpetration and victimization and problem behavior and mental health problems in young Australians.* International journal of public health, 2015. **60**(2): p. 227-237.
52. Borowsky, I.W., L.A. Taliaferro, and B.J. McMorris, *Suicidal thinking and behavior among youth involved in verbal and social bullying: Risk and protective factors.* Journal of adolescent health, 2013. **53**(1): p. S4-S12.
53. Yen, C.-F., et al., *Risk and protective factors of suicidal ideation and attempt among adolescents with different types of school bullying involvement.* Archives of Suicide Research, 2015. **19**(4): p. 435-452.
54. Bauman, S., R.B. Toomey, and J.L. Walker, *Associations among bullying, cyberbullying, and suicide in high school students.* Journal of adolescence, 2013. **36**(2): p. 341-350.
55. Sampasa-Kanyinga, H., P. Roumeliotis, and H. Xu, *Associations between cyberbullying and school bullying victimization and suicidal ideation, plans and attempts among Canadian schoolchildren.* PloS one, 2014. **9**(7): p. e102145.
56. Messias, E., et al., *Sadness, suicide, and their association with video game and internet overuse among teens: results from the youth risk behavior survey 2007 and 2009.* Suicide and Life-Threatening Behavior, 2011. **41**(3): p. 307-315.

57. Pirkis, J.E., et al., *Suicidal ideation and suicide attempts as predictors of mental health service use.* Medical journal of Australia, 2001. **175**(10): p. 542-545.
58. Elgar, F.J., et al., *School bullying, homicide and income inequality: a cross-national pooled time series analysis.* International journal of public health, 2013. **58**(2): p. 237-245.
59. Reiss, F., *Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review.* Social science & medicine, 2013. **90**: p. 24-31.
60. Ravens-Sieberer, U., et al., *Socioeconomic inequalities in mental health among adolescents in Europe.* Social cohesion for mental well-being among adolescents, 2008: p. 26-42.
61. Weinberg, D., et al., *Adolescent Socioeconomic Status and Mental Health Inequalities in the Netherlands, 2001–2017.* International journal of environmental research and public health, 2019. **16**(19): p. 3605.
62. Bartram, M. and J.M. Stewart, *Income-based inequities in access to psychotherapy and other mental health services in Canada and Australia.* Health policy, 2019. **123**(1): p. 45-50.
63. Hafekost, J., et al., *Methodology of young minds matter: The second Australian child and adolescent survey of mental health and wellbeing.* Australian & New Zealand Journal of Psychiatry, 2016. **50**(9): p. 866-875.
64. Lawrence, D., et al., *The mental health of children and adolescents: report on the second Australian child and adolescent survey of mental health and wellbeing.* 2015.
65. Jones, R.M., et al., *Friendship characteristics, psychosocial development, and adolescent identity formation.* Personal Relationships, 2014. **21**(1): p. 51-67.
66. Mbalinda, S.N., et al., *Using Andersen's Behavioral Model of Health Care Utilization to Assess Contraceptive Use among Sexually Active Perinatally HIV-Infected Adolescents in Uganda.* International Journal of Reproductive Medicine, 2020. **2020**.
67. Travers, J.L., K.B. Hirschman, and M.D. Naylor, *Adapting Andersen's expanded behavioral model of health services use to include older adults*

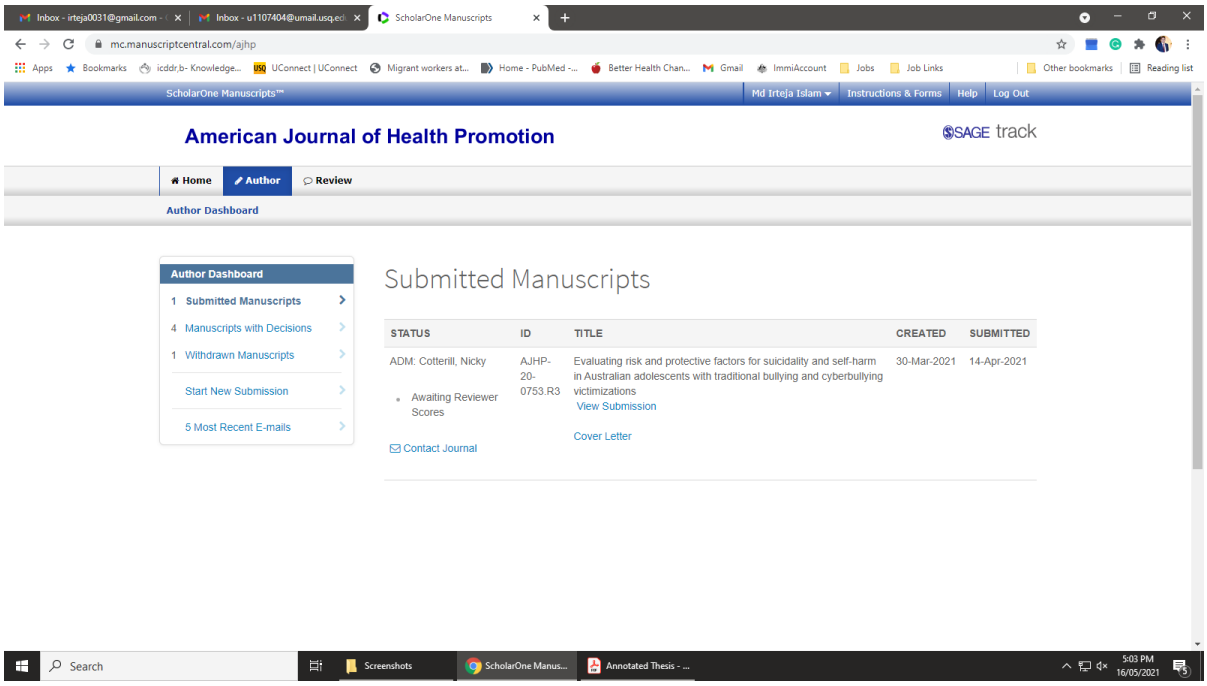
receiving long-term services and supports. BMC geriatrics, 2020. **20**(1): p. 1-16.

68. Krieger, N., *Theories for social epidemiology in the 21st century: an ecosocial perspective.* International journal of epidemiology, 2001. **30**(4): p. 668-677.
69. Krieger, N., *Embodiment: a conceptual glossary for epidemiology.* Journal of Epidemiology & Community Health, 2005. **59**(5): p. 350-355.
70. Solar, O. and A. Irwin, *A conceptual framework for action on the social determinants of health*. 2010, WHO Document Production Services.
71. Committee on Educating Health Professionals to Address the Social Determinants of Health; Board on Global Health; Institute of Medicine; National Academies of Sciences, E., and Medicine, *A framework for educating health professionals to address the social determinants of health*. 2016, Washington DC: National Academies Press US.
72. Alegría, M., et al., *Disparities in child and adolescent mental health and mental health services in the US*, in *New York, NY: William T. Grant Foundation*. 2015.
73. Mok, P.L., et al., *Family income inequalities and trajectories through childhood and self-harm and violence in young adults: a population-based, nested case-control study.* The Lancet Public Health, 2018. **3**(10): p. e498-e507.
74. Wichstrøm, L., et al., *Predicting service use for mental health problems among young children.* Pediatrics, 2014. **133**(6): p. 1054-1060.
75. Frick, L., *PhD by publication–panacea or paralysis?* Africa Education Review, 2019. **16**(5): p. 47-59.
76. Guerin, C., *Connecting the dots: Writing a doctoral thesis by publication*, in *Research literacies and writing pedagogies for masters and doctoral writers*. 2016, Brill. p. 31-50.
77. Anderson, E.L., E. Steen, and V. Stavropoulos, *Internet use and Problematic Internet Use: A systematic review of longitudinal research trends in adolescence and emergent adulthood.* International Journal of Adolescence and Youth, 2017. **22**(4): p. 430-454.

78. Perales, F., et al., *Family structure and childhood mental disorders: new findings from Australia.* Social psychiatry and psychiatric epidemiology, 2017. **52**(4): p. 423-433.
79. Shepherd, C.C., et al., *Socioeconomic disparities in the mental health of Indigenous children in Western Australia.* BMC Public Health, 2012. **12**(1): p. 756.
80. Flanders, W.D., et al., *Assessing the direction of causality in cross-sectional studies.* American journal of epidemiology, 1992. **135**(8): p. 926-935.
81. Lima, F., S. Sims, and M. O'Donnell, *Harmful drinking is associated with mental health conditions and other risk behaviours in Australian young people.* Australian and New Zealand journal of public health, 2020. **44**(3): p. 201-207.
82. Rosenman, R., V. Tennekoon, and L.G. Hill, *Measuring bias in self-reported data.* International Journal of Behavioural and Healthcare Research, 2011. **2**(4): p. 320-332.
83. Kessler, R.C. and E.E. Walters, *Epidemiology of DSM-III-R major depression and minor depression among adolescents and young adults in the national comorbidity survey.* Depression and anxiety, 1998. **7**(1): p. 3-14.
84. Cornell, D. and S. Bandyopadhyay, *The assessment of bullying.* The international handbook of school bullying, 2009: p. 265-276.
85. Fleury, M.-J., et al., *Predictors of healthcare service utilization for mental health reasons.* International journal of environmental research and public health, 2014. **11**(10): p. 10559-10586.

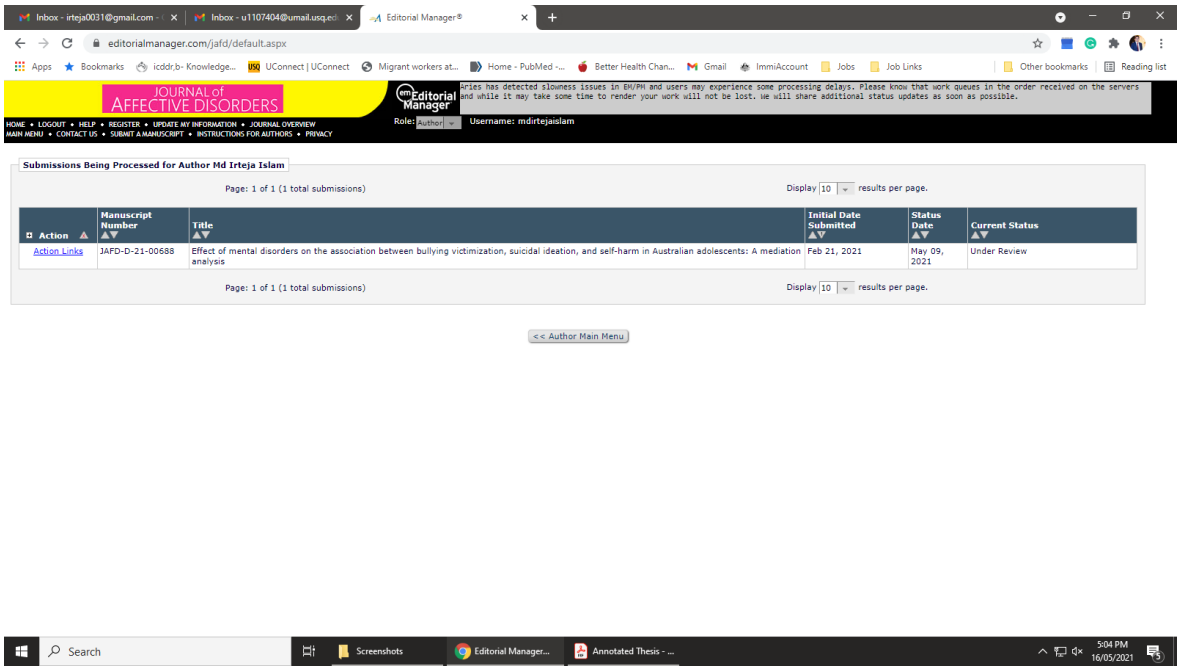
APPENDIX - 1

Screenshot of Study 1 – Submitted to American Journal of Health Promotion



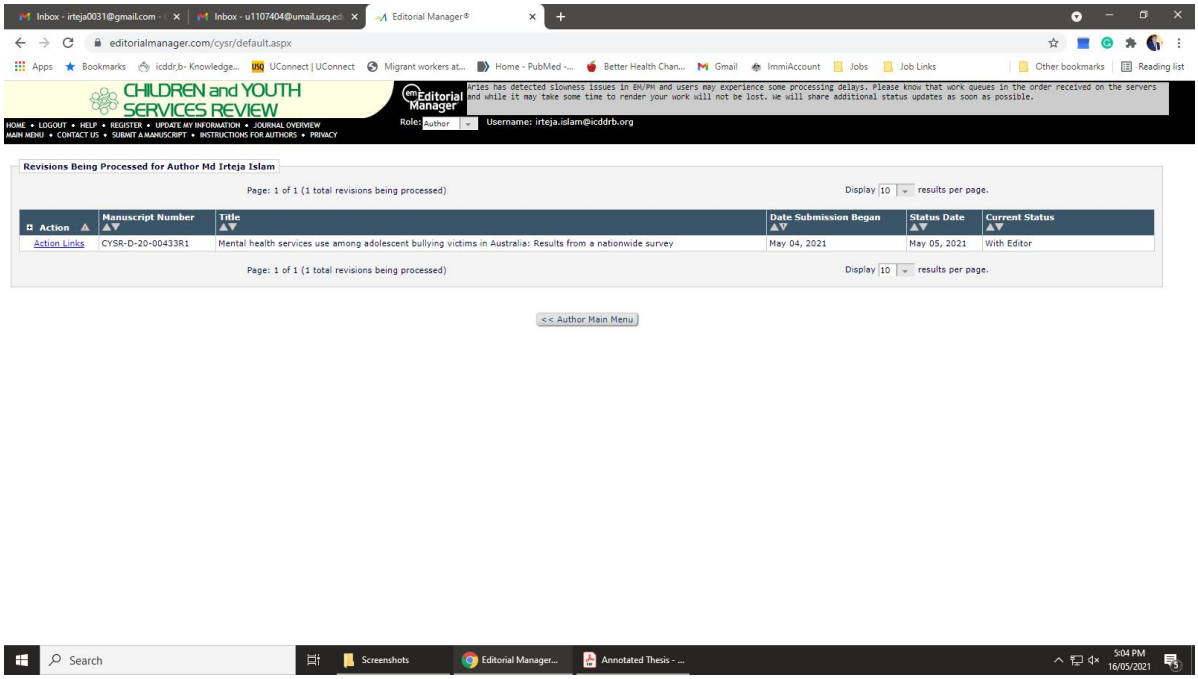
APPENDIX - 2

Screenshot of Study 3 – Submitted to Journal of Affective Disorders



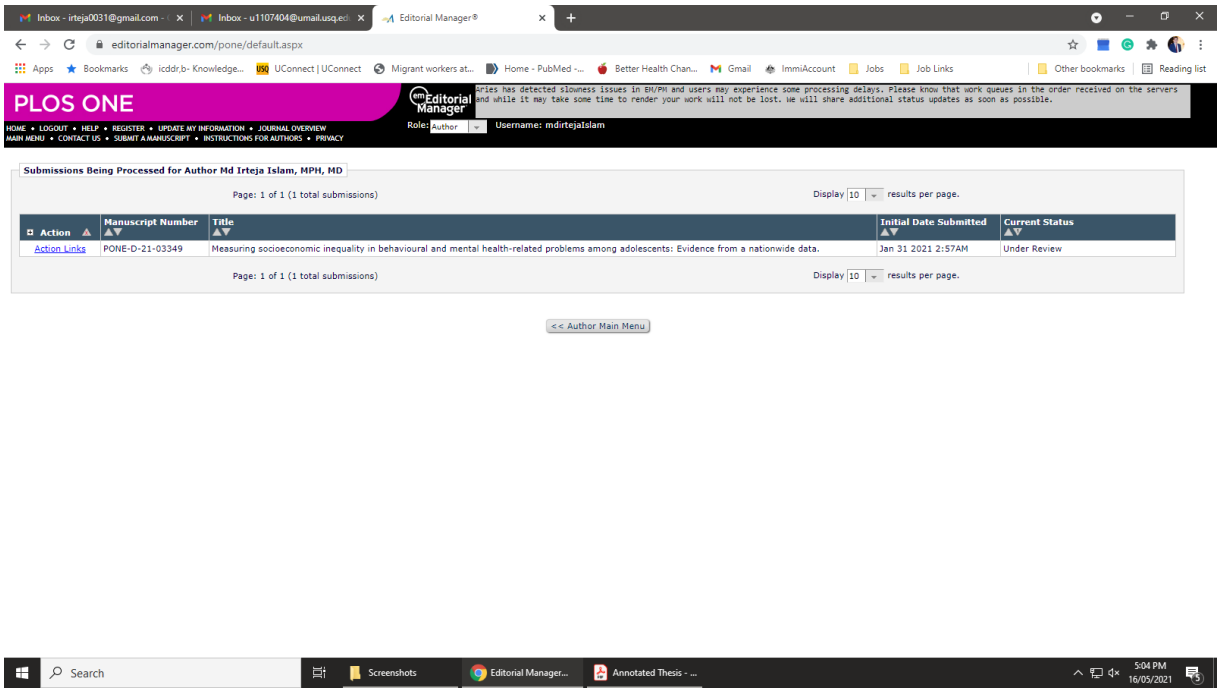
APPENDIX - 3

Screenshot of Study 4 – Submitted to Children and Youth Services Review Journal



APPENDIX - 4

Screenshot of Study 7 – Submitted to Plos One Journal



APPENDIX - 5

Screenshot of Study 8 – Submitted to Public Health Journal