The Impact of Major Depressive Disorder on the Academic Achievement of Australian Adolescents.

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This thesis is submitted in partial fulfillment of the Honours degree of Bachelor of Psychological Science (Honours)

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September 2021

Word Count: 9, 444

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Abstract

Academic achievement attained by adolescents is important for future career success as well as personal and social growth. Major Depressive Disorder (MDD) has the potential to adversely affect both academic outcomes and personal development. This thesis investigated the association between MDD and academic achievement in Australian adolescents. The thesis analysed de-identified data describing 13 to 15 year old's, who participated in the second Australian Child and Adolescent Survey of Mental Health and Wellbeing (n=1077), undertaken in 2013 to 2015. Academic achievement was assessed using linked National Assessment Program Literacy and Numeracy (NAPLAN) scores of the students, and MDD was assessed using parent reports from the Diagnostic Interview Schedule for Children version IV (DISC-IV). It was hypothesised that adolescents with MDD would have lower levels of academic achievement, and a higher percentage of days absent from school. Bivariate and multivariate logistic regression were conducted to assess the strength of the association between MDD and NAPLAN scores, and to identify if the association was modified by school absence. Although limited by a small number of participants with MDD, there was some evidence to support these hypotheses. The results suggested that adolescents aged 13 to 15 years with MDD may be more susceptible to lower academic outcomes, and higher school absence, as compared to their peers. The results contribute to the awareness and understanding of the association between MDD and academic achievement at a national scale.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

27th September 2021

Contribution Statement

In writing this thesis, my supervisors, Dr Alyssa Sawyer and E.Prof Michael Sawyer and I collaborated to generate the research question of interest, that could be investigated using pre-collected data from the Second Australian Child and Adolescent Survey of Mental Health and Wellbeing (Young Minds Matter Report), collected in 2013 to 2015 (Lawrence et al., 2017). This data provided participant recruitment, the sample, and methodology. My supervisors and I further collaborated to design appropriate analyses of the data. I completed the ethics application, conducted the literature search, and was responsible for data analysis and thesis write-up. Finally, my supervisors assisted in editing and proofreading this thesis.

Acknowledgements

I would like to kindly acknowledge and thank my supervisors, Dr Alyssa Sawyer and E. Prof Michael Sawyer for their generous support and assistance over the course of this thesis. Thank you for your continuous encouragement, guidance, and approachability over this past year. I am beyond grateful for the opportunity to have worked with you this year, and I have learnt more than I could have imagined.

I would also like to warmly acknowledge my family, friends, and partner for their immense support and kindness over this year. Thank you for your continuous encouragement, understanding, optimism, and patience.

Chapter 1: Introduction

Academic achievement plays a significant role in the growth and development of adolescents. Major Depressive Disorder (MDD) has the potential to adversely impact academic progress, producing a challenge for individuals. Previous literature presents a well-established awareness of the impact that MDD has on overall and future life satisfaction (Fergusson & Woodward, 2002), and the impact that mental disorders and difficulties can have on academic achievement (Goodsell et al., 2017). However, much of the research to date has not focused on MDD exclusively, and there is a lack of studies which utilise a diagnostic measure of MDD. There are also no studies that have examined this association exclusively using a diagnostic measure, with a nationally representative sample of adolescents.

This thesis aims to investigate the association between MDD, academic achievement, and school absence among adolescents aged 13 to 15 years. The importance and awareness of MDD is significant, especially given that MDD is often missed, or misdiagnosed in adolescence (Birmaher et al., 2007; Zuckerbrot et al., 2018). The adverse impact that MDD has can be life long, if not diagnosed and treated early (Fergusson & Woodward, 2002). Academic achievement is one of the best objective measures used to identify the school performance of individuals, and grades specifically reflect academic achievement (Morris et al., 2021). Poor academic achievement itself is associated with adverse outcomes (Spengler et al., 2015), and paired with MDD, poor academic achievement has been demonstrated to impact on the future of adolescents (Fergusson & Woodward, 2002). It is therefore important to further understand the association between MDD exclusively and academic achievement, which can help inform clinicians, educational systems, parents, and policy makers.

1.1 The Importance of Academic Achievement Throughout Adolescence

Academic achievement plays an important role in the educational, personal, and social growth of adolescents, equipping them as they progress into adulthood and future careers. While academic achievement is a multifaceted construct, addressing numerous domains of learning, measured in differing ways, and for distinctly different purposes (Hattie & Anderman, 2013), grades remain a significant and notable predictor for future academic success (Morris et al., 2021).

Adolescence is the phase of life between childhood and adulthood, from 10 to 19 years (World Health Organisation, 2017). During this period, education becomes increasingly targeted towards future goals (Haines & Mueller, 2013). Adolescence is also a heightened period of development (Haines & Mueller, 2013), where individuals develop increased self-regulation (Perels et al., 2009), cognition (Kuhn, 2009), and develop abstract thoughts about real-life and hypothetical ideas (Piaget, 1972). The adolescent period also brings about development of intrinsic awareness and individual identity (Kapoor & Tomar, 2016). At the same time, contextual changes occur, including an increased risk of peer pressure (Gardner & Steinberg, 2005), access to alcohol and drugs (Johnston et al., 2012), and the need for social approval, acceptance, and connectedness (Kapoor & Tomar, 2016). Perhaps the most prominent, is the transition from primary to secondary (high) school (Gustafsson et al., 2010; Eccles & Roeser, 2009). Considering academic achievement within the period of adolescence is valuable, as it offers insight into future academic and life outcomes for an individual (Geisser et al., 2007).

Academic achievement helps adolescents succeed in future academic endeavours, and heighten life satisfaction. Education is a key social determinant of health (Low et al., 2005; Clark & Royer, 2013), and a strong predictor of future career success (Spengler et al., 2015). While higher earning potential is the most visible benefit of academic achievement beyond

high school, better academic achievement has been shown to reduce levels of unemployment
(The Australian Bureau of Statistics, 2004), and promote improved health and longer life
expectancy (Kristoffersen, 2018). Adolescents who are academically competent develop
heightened skills and knowledge, conducive to learning, enabling positive attitudes and
values (Kristoffersen, 2018; Ross & Van Willigen, 1997). Therefore, adolescents who
succeed in their academic studies are not only setting themselves up for their career success,
but also life success.

Adolescents spend much of their time at school, and therefore, the educational
environment can exert a significant influence on the future of adolescents (Kapoor & Tomar,
2016). According to Bronfenbrenner's ecological systems model (1979), school is part of an
adolescents' 'microsystem' which comprises of an individual's immediate environment
(Bronfenbrenner, 1979), in the same domain as peer and family influences. Consequently,
school has a predominant influence on psycho-social development (Bronfenbrenner, 1979).

Academic achievement can promote increased self-esteem, protect against poor
mental health, and foster growth in two interconnected domains: social-emotional functioning
and school functioning (Suldo et al., 2014). There is a considerable base of evidence
demonstrating the positive association between level of education and most quality-of-life
measures (Kristoffsen, 2018). An overarching trend in the literature suggests that school
enjoyment is strongly and positively associated with achievement (Morris et al., 2021), and
reduced level of school enjoyment may potentially lead to mental disorders such as MDD
(Morris et al., 2021).

Academic Achievement is not only important for the future educational outcomes for
adolescents, but also for wellbeing, social, and emotional functioning. Promoting academic
achievement and engagement among adolescents is important, as it has the potential to

prevent the development of poor social and health outcomes, and protect against mental disorders.

1.2 Academic Achievement and Major Depressive Disorder

MDD is a common mental disorder worldwide, characterised by a depressed mood most of the day, nearly every day (Mullen, 2018), and adolescence is a key period in the presentation and development of first symptoms (Twenge, 2002). A recent national study showed that 4.3% of males and 5.8% of females aged 12 to 17 years, experienced MDD in the previous 12 months (Department of Health, 2015).

MDD impacts approximately 3% of the school-aged population worldwide, with countless more experiencing subthreshold symptoms (Polanczyk et al., 2015). In adolescents, symptoms may include sadness, irritability, feeling negative and worthless, diminished interest or pleasure in normal activities, and poor performance, or poor attendance at school (Mullen, 2018). Goodsell (et al., 2017) revealed that by year 9, 3.8% of male and 5.8% of female students presented with MDD in the previous 12 months, equivalent to 1 in 20 students. Further, an estimated 12.8% of the United States population in 2016, aged 12 to 17 years, had been diagnosed with at least one MDD episode (National Institute of Mental Health, 2017).

Consistent evidence suggests that young people who present with early-onset MDD or depressive symptoms are at risk for several adverse outcomes including reduced academic achievement (Fergusson & Woodward, 2002). However, paediatric MDD is often underdiagnosed and undertreated, with only 50% of adolescents diagnosed before adulthood (Zuckerbrot et al., 2018; Birmaher et al., 2007). It is therefore recognised that treatment of mental disorders is needed as early as the adolescent period to prevent long durations of disorder, and foster adaptive coping behaviours (Skinner & Saxton, 2019; Department of Health, 2015). MDD can present significant consequences when onset occurs in adolescence,

producing a challenge for the future educational and personal goals of an individual (Mullen, 2018).

Academic achievement is one of the fundamental and potentially modifiable pathways linking MDD to long term adversity (Davies et al., 2018 ; Riglin et al., 2014). Understanding the role of MDD in academic achievement, holds potential to inform prevention and early intervention strategies aimed at adolescents to improve both MDD symptoms and academic achievement (Davey, 2019). Symptoms associated with MDD interfere with adolescents gaining academic competence (i.e. skills, attitudes, and achievement) (Suldo et al., 2014), a salient task for adolescents as they prepare for the future (Masten et al., 2005). It is possible that depressive symptoms undermine academic success, by interfering with cognitive functions, and decreasing or eliminating motivation to succeed (the adjustment erosion hypothesis) (Weidman et al., 2015). Similarly, these effects may compound over time with poor academic achievement, increasing risk of developing depressive symptoms (the academic incompetence hypothesis) (Verboom et al., 2014). It is also possible that poor academic achievement may result in negative feedback from teachers, peers, and parents, which then reduces children's self-worth and may lead to depressive symptoms (Verboom et al., 2014).

Previous research has revealed a negative association between depressive symptoms and academic achievement (e.g. López-López et al., 2021; Shen et al., 2020; Askeland et al., 2020; Verboom et al., 2014; Fletcher, 2010; Mcleod and Kaiser, 2004; Needham et al., 2004), and between MDD and academic achievement, in both community (Goodsell et al., 2017; Fergusson & Woodward, 2002) and clinical samples (Schrack et al., 2020; Jaycox et al., 2009). Mental health difficulties, and depressive symptoms in particular, are often measured on a continuous scale, providing an indication of the frequency or severity of symptoms. The Center for Epidemiological Studies Depression Scale (CES-D) is one example (Radloff,

1977), used in various studies investigating the association between depressive symptoms

and academic achievement (e.g. Shen et al., 2020; Fletcher, 2010; Mcleod & Kaiser, 2004).

Alternatively, mental disorders, and in particular MDD, can be measured using a categorical

approach, utilising diagnostic criteria as used by clinicians. The categorical approach

provides an indication of individuals who meet full criteria for MDD as opposed to those who

do not. The Diagnostic Interview Schedule for Children (DISC-IV) is one example, used in

limited studies investigating the association between MDD and academic achievement

(Goodsell et al., 2017; Jaycox et al., 2009; Fergusson & Woodward, 2002). The present study

utilised the DISC-IV measure to investigate the impact of MDD in Australian adolescents in

the community meeting diagnostic criteria for MDD, on academic achievement.

Berndt (et al., 2000) suggests a possible reason for the previously observed negative

association between MDD and academic achievement, is because MDD substantially reduces

social, physical, and cognitive functioning. Learning involves cognition, and

the cognitive theory of MDD states that individuals who are more predisposed to MDD are

characterised by cognitive vulnerability (Lakdawalla et al., 2007; Haaga et al., 1991). A

report by Goodsell (et al., 2017) assessed students' academic achievement and mental

disorders using data from the National Young Minds Matter report. It was found that average

test scores were reduced for all students with MDD, with the largest performance gap found

for the year 9 numeracy subject domain (Goodsell et al., 2017). Reading and writing subject

domains did not show a significant performance gap (Goodsell et al., 2017).

A seminal study in this field was conducted by Fletcher (2010), who used a

longitudinal sibling-fixed effects model to examine the association between adolescent

depressive symptoms and human capital accumulation (defined as the economic value of a

worker's experience and skills) (Fletcher, 2010). The results from this study provided

evidence that depressive symptoms decrease human capital accumulation, decrease years of

schooling completed and probability of higher education enrolment, and increase the probability of dropping out of high school (Fletcher, 2010). While the results from Fletcher (2010) are highly influential and may assist in devising appropriate interventions for adolescents with MDD, it is important to note that this study did not include a diagnostic measure of MDD, but rather, a continuous measure of depressive symptoms. The present study will address this limitation, by using a diagnostic measure of MDD.

A similar study conducted by Fergusson & Woodward (2002), used longitudinal data to investigate whether adolescents with MDD (DISC-IV assessed) in mid adolescence (aged 14 to 16), were at an increased risk of psychosocial outcomes in later adolescence and adulthood (aged 16 to 21). The results from this study suggested that adolescents previously diagnosed with MDD, were an at-risk group for adverse outcomes, including subsequent MDD, suicidal behaviours, and academic and employment difficulties (Fergusson & Woodward, 2002). However, this study was limited to a New Zealand cohort, which was not nationally representative, and results may not be generalisable. The present study will address this limitation, by using a nationally representative community sample of Australian adolescents.

1.3 School Absence and Major Depressive Disorder

Across the world it is recognised that consistent attendance at school is an important component for educational engagement, and a key pre-requisite for academic success (Hancock et al., 2016; Gottfried, 2010). Recent evidence suggests that higher attendance rates are associated with higher levels of academic achievement, and academic achievement consistently declines with increasing rates of absence (Hancock, Shepherd, Lawrence, & Zubrick, 2013; Gottfried, 2010). Adolescents spend a large proportion of time at school, and recent reports have requested that schools assist in the promotion of positive mental health, the identification of students who might be experiencing mental health difficulties, and

referring services where required (Department of Health and Department for Education, 2017; YoungMinds, 2017). Specifically, as suggested by the UK Department of Education, school attendance records may assist in recognition of at-risk students of lower mental health (Department of Education, 2016).

Given the substantial amount of daily adaptive functioning that is attributed to attending school, mental disorders have the potential to influence school attendance (Dray et al., 2017; Neufield et al., 2017). School absenteeism is a multifaceted occurrence for adolescents attending school, influenced by an array of factors including individual, family, and school characteristics (Gubbels et al., 2019; Ingul et al., 2012; Kearney, 2008). A major individual factor that is associated with school absence among community and clinical samples is mental disorders (Lawrence et al., 2019; Jones et al., 2009; Egger et al., 2003; McShane et al., 2001), and mental health difficulties (Ingul et al., 2012). MDD stands as an important risk factor for school absences (Finning et al., 2019; Green et al., 2005), especially given the nature of symptoms. It is likely that the symptoms characteristic of MDD including loss of motivation, lack of energy, and difficulties concentrating, may impact an adolescent's ability to attend school, exacerbating feelings of worthlessness and self-esteem, and subsequently increase depressive symptoms, and school non-attendance (Askeland et al., 2020; Finning et al., 2019).

Previous research has revealed a positive association between depressive symptoms and school absence (Askeland et al., 2020), and MDD and school absence (Finning et al., 2019; Lawrence et al., 2019; Jones et al., 2009; Egger et al., 2003). A recent study by Askeland (et al., 2020), investigated school absence among 16 to 18 year old's, finding that depressive symptoms were significantly associated with number of hours and days of school absence (Askeland et al., 2020). Further, adolescents with the highest absence rates had the highest levels of depressive symptoms (Askeland et al., 2020). Additionally, Lawrence (et al.,

2019) recently published a study observing patterns of school attendance among students with and without mental disorders, using a representative sample of Australian children and adolescents. Their results showed that approximately one-fifth of males and one-third of females in high school with a mental disorder have missed more than 20 days in the school year (Lawrence et al., 2019), a level of absence which is considered substantial, likely impacting students' learning and mental health (Hancock et al., 2017; Gottfried, 2010). In the same study, MDD was associated with a much higher absence rate in years 7 to 10 compared to years 1 to 6 which was evident in both males and females (Lawrence et al., 2019). Further, there was no significant difference between MDD, anxiety disorders, and conduct disorder, in the high school years, with them all having similarly high levels of absenteeism (Lawrence et al., 2019). Conversely, in a community sample of two high schools in Norway investigating both internalising and externalising difficulties and school absence, Ingul (et al., 2012), found that internalising difficulties (including depressive symptoms) did not predict school absenteeism. Results indicated that externalising difficulties were more important than internalising difficulties in predicting school absenteeism (Ingul et al., 2012). The authors did however note that this result could have been due to the correlation between both internalising and externalising difficulties being high, leading to a reduction in predictive power for internalising difficulties (Ingul et al., 2012).

While it is important to understand broadly the impact of internalising and externalising difficulties on school absence, this broad categorisation limits conclusions being made about specific disorders, such as MDD exclusively. The present study aims to focus on school absence, academic achievement, and MDD, which will clarify the impact for the disorder specifically.

Given the increasing prevalence of MDD among adolescents, it is important to understand its association with school absence. In addition, there is little research addressing

the impacts of mental disorders on attendance, and attendance on mental disorders, more generally, as previous studies have focused on truancy, chronic absenteeism, and school refusal, often drawing their samples from specialist programs (Lawrence et al., 2019). Therefore, similar to Lawrence (et al., 2019), the present study examines school absence in general as well as chronic absenteeism (defined as absences of more than 20 days). It has been previously noted that adolescents who are absent from school occasionally, are able to 'catch up' on missed work, whereas persistent absence or chronic absenteeism may markedly disrupt students' education (McCluskey, Bynum & Patchin, 2004; Coventry et al., 1984; Zubrick et al., 1997).

It is likely that absences from school partly attributable to mental disorders, could reinforce poor mental health through a self-perpetuating cycle, resulting with reduced levels of academic achievement, connectedness, and engagement (Lawrence et al., 2019). Therefore, given the previous evidence that mental disorders lead to higher school absence, and lower academic performance, it is important for the present study to investigate this association with a diagnostic measure of MDD, using a nationally representative sample of Australian adolescents. Given the increasing prevalence of MDD among adolescents and its impact on academic achievement and school absence, further insight into this association has the potential to inform prevention and practise.

1.4 The Present Study

The aim of the present study is to investigate the association between MDD and levels of academic achievement in adolescents aged 13 to 15 years. Five domains of academic achievement are assessed: numeracy, writing, grammar, reading, and spelling. Previous research has revealed a negative association between mental disorders and academic achievement, however majority of studies do not focus on MDD exclusively, and rarely use a valid and reliable diagnostic measure of MDD. Importantly, many previous studies also do

not utilise a representative sample of adolescents in the community, limiting generalisability of results.

This study will investigate the association between MDD and academic achievement in a large representative sample of Australian adolescents, who completed a routine objective academic achievement assessment in year 9 (The National Assessment Program Literacy and Numeracy, NAPLAN). MDD was measured by parent report, using a diagnostic measure of mental disorders (Diagnostic Interview Schedule for Children version IV, DISC-IV). This study will also consider school absences, as an additional confounder of the association between MDD and academic achievement.

1.4.1 Aims and Hypotheses

This study investigates the association between MDD and level of academic achievement for Australian adolescents aged 13 to 15 years. The strength of this association will be analysed for three levels of MDD, threshold (meeting full criteria), subthreshold (meeting partial criteria), and no disorder (meeting no criteria for MDD). Five domains of academic achievement will be included: numeracy, writing, grammar, reading, and spelling.

Hypotheses:

1. Adolescents with threshold level Major Depressive Disorder, will have lower levels of academic achievement than adolescents who have subthreshold level or no Major Depressive Disorder

2. Adolescents with threshold level Major Depressive Disorder will have a higher absence rate, than adolescents who have subthreshold level or no Major Depressive Disorder

3. After adjusting for school absence rates, there will be no difference between the academic achievement of adolescents with threshold level Major Depressive Disorder and those with subthreshold level or no Major Depressive Disorder.

Chapter 2: Method

2.1 Study Sample

The present study draws on a sample from the Young Minds Matter National Mental Health Survey (YMM), the second Australian Child and Adolescent Survey of Mental Health and Wellbeing (Lawrence et al., 2015). The survey was conducted in 2013 to 2014, on behalf of the Australian Government Department of Health, by the Telethon Kids Institute at the University of Western Australia, in partnership with Roy Morgan Research (Lawrence et al., 2015). The principal aims of the YMM survey were to identify the prevalence, nature and impact of mental disorders among Australian children and adolescents, and to identify the use and efficacy of mental health services (Lawrence et al., 2015).

The YMM study utilised a multi-stage, area-based sampling approach, selecting households where there was one or more children occupying the household. The data were collected by use of structured face-to-face diagnostic interviews with the primary carer of each selected survey child, and where the selected child was over the age of 11, they also completed a self-report questionnaire (Lawrence et al. 2015). Eligibility criteria excluded very remote and indigenous Australian populations as these groups were not considered to be accurately represented within the sample (Lawrence et al., 2015). A total of 6,310 families with children aged 4 to 17 completed the survey (response rate of 55%), with a total of 5,051 of these also giving consent to disclose NAPLAN results, and 2,967 giving consent to a self-report adolescent survey (Lawrence et al., 2015).

Participants for the present study have been drawn from this large, nationally representative, randomly selected community sample. Participants aged 13 to 15 were included in this study, as this age bracket is representative of the year level 9 in all states within Australia (ACARA, 2016), when the year 9 NAPLAN test was performed. Further, students were included if they had a completed parent DISC-IV report for MDD, and a

NAPLAN assessment within a 2-year time frame. The present study included 847

participants who had complete data for all variables required for analysis. A flowchart

presented in Figure 1 shows the inclusion criteria for the complete case.

Figure 1

Flowchart of Participants
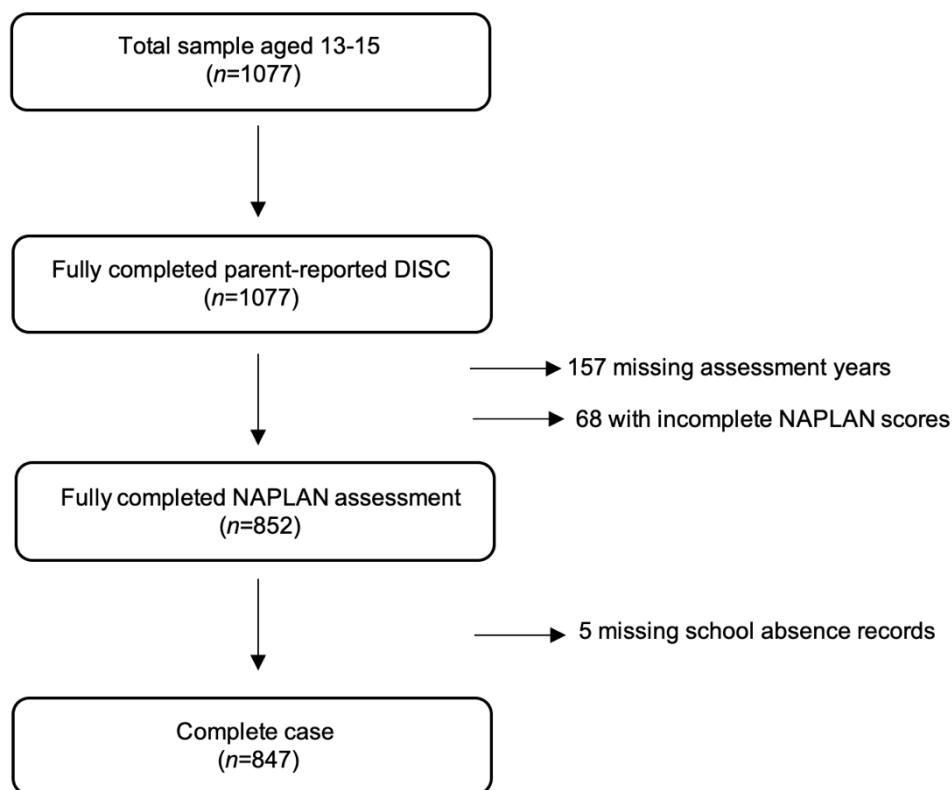
2.2 Measures

2.2.1 Major Depressive Disorder

MDD was assessed in the present study using the Diagnostic Interview Schedule for

Children version IV (DISC-IV), a standardised diagnostic instrument used worldwide to

assess mental disorders in large samples (Shaffer et al., 2000; Fisher et al., 1993). The DISC-

IV has a structured face-to-face interview format, and governs the assessment for over 30

psychiatric disorders (Shaffer et al., 2000). The DISC-IV implements criteria for mental

disorders as specified in the Diagnostic and Statistical Manual of Mental Disorders, fourth

edition (DSM-IV; American Psychiatric Association, 2000), and identifies whether a child

had met criteria for a specific disorder during the past 12 months.

The DISC-IV includes questions that are relatively short, simple, and responses are

predominantly limited to yes/no and are (with the exception of a few) closed questions

(Shaffer et al. 2000). The questions in the DISC-IV are read exactly as are written in the

interview manuscript, and have been devised to be easily understood by school-aged children

(Shaffer et al. 2000). Only the MDD DISC-IV module was used for the present study. The

key feature of MDD according to the DISC-IV, was the presence of (1) depressed mood, (2)

loss of interest or pleasure, or (3) being grouchy, irritable, and in a bad mood (Telethon Kids

Institute, 2015). If none of these three essential features of the disorder were present, the

respondent was not asked further questions in the module (Telethon Kids Institute, 2015).

The present study included all three diagnostic categories of MDD including threshold,

subthreshold and no disorder. Threshold level described adolescents meeting full criteria,

subthreshold described adolescents meeting partial criteria, and no disorder described

adolescents meeting no criteria for MDD.

2.2.2 Academic Achievement

Academic performance was assessed using linkage with de-identified test results from

the National Assessment Program Literacy and Numeracy (NAPLAN). The adolescents

themselves and their parents were asked for consent to access their Medicare and

pharmaceutical benefits scheme records and their NAPLAN results. The NAPLAN test is a

nationally recognised, standardised, and consistent measure used to determine if students are

meeting important educational outcomes (ACARA, 2016). Students in years 3, 5, 7 and 9 are

tested across five learning domains which are reflective of the Australian curriculum, and

adhere to skills that young people need to succeed in school and beyond (ACARA, 2016).

The included domains are writing, reading, grammar and punctuation, and spelling and

numeracy. Each domain is assessed separately, designed to isolate skill performance,

however the test criteria does overlap at some points in terms of knowledge base or style of

application (ACARA, 2016). For more information on what was tested and expected for each

domain, see Appendix 1. For this analysis all domains were used.

The NAPLAN scores were assessed using scaled scores, categorised into 'below

national minimum standard', 'at national minimum standard', and 'above national minimum

standard' for each of the five subject domains (ACARA. 2016). The scoring bands are ranked

in a way that majority of the students meet the 'above' standard (approximately 60%)

(ACARA, 2016). Scores that indicate the student is 'at the national minimum standard'

suggest that the students meet the learning expectations of Year 9 (ACARA, 2016). Scores

that indicate the student is 'below the national minimum standard' suggest that the student

has failed to meet the expected learning requirements of Year 9 (ACARA, 2016), and may

require considerable learning assistance.

2.2.3 Demographic Characteristics

The demographic characteristics assessed in the present study were sex, age, family

composition, and household demographics and income. Age was assessed in years (i.e. 13,

14, 15), and sex was categorised into male and female. Household demographics included

number of parents living in the household (no parent, one parent, or two parents) and

household income per annum (less than $52,000, $52,000-$129,000, and $130,000 or more).

Family composition was classified according to the Australian Bureau of Statistics family

blending classification variable, aiming to broadly represent different stages of family

transformation and reformation (Australian Bureau of Statistics, 2016). The categories are as

follows: intact family (reference category, where the children are natural, adopted, or foster

child of both partners in the couple and there are no step children), lone parent family, blended family (two or more adolescents where at least one is natural or adopted and one is a stepchild), step family, and other family (where no adolescents are the natural, adopted, foster, or step adolescent of either parent or carer. These include families with adolescents being raised by relatives).

2.2.4 Days Absent From School

The education model included in the survey asked parents whether their child went to school, and if so, what grade they were in, and how many days their child had been absent from school since the start of the school year excluding school holidays (Hafekost et al., 2016). Based on the interview date, number of school days in the school year were calculated in each jurisdiction (Hafekost et al., 2016). The attendance rates were then calculated based on reported days absent, and number of possible days attended (Hafekost et al., 2016). The attendance data was then extrapolated to a full year, on a pro-rata basis, allowing for a consistent comparison across student absence (Telethon Kids Institute, 2015).

2.3 Procedure

The YMM interview was developed with guidance from a survey reference group comprised of over 20 experts in the mental health of children and adolescents (health, education, and community sectors), in addition to consumer and community representatives (Lawrence et al., 2015). The interviews were conducted between June 2013 and April 2014, by trained interviewers. All of the survey respondents (n=6,310) completed a face-to-face interview, and where there was more than one child in a household, one child was selected at random, for their parent or caregiver to be interviewed. When the child was aged 11 years or older, they were also invited to answer a confidential questionnaire on a tablet computer (n=2,967) (Lawrence et al., 2015). Both the parent and youth questionnaire included the MDD DISC-IV assessment, and the parent questionnaire included the school absence report.

A comprehensive explanation of procedures and surveys used in the original study have been made public, which can be found online via the Young Minds Matter website (see Lawrence et al., 2015). The Year 9 NAPLAN assessments were collected before and after the survey data collection, and were linked to the final data set.

2.4 Ethical Considerations

Ethics approval for the original YMM report was received from the Department of Health Departmental Ethics Committee (DOH HERC) (Project 17/2012), in accordance with the National Health and Medical Research Council (NHMRC) (Lawrence et al., 2015). The study participation was voluntary and participants provided written consent. Access to the Confidentialised Unit Record File (CURF) for this study was approved by the University of Adelaide Human Research Ethics Committee (HREC) (Number 21/11).

2.5 Statistical Analyses

The data set was analysed using the Statistical Package for the Social Sciences (SPSS, Version 26). Hypothesis 1 was investigated by examining the percentage of NAPLAN scores below the national minimum standard (NMS) for adolescents with threshold, subthreshold, and no MDD. All NAPLAN domains were assessed (numeracy, writing, grammar, reading, spelling). Hypothesis 2 was investigated by examining the percentage of days absent for adolescents with threshold, subthreshold, and no MDD. Days absent was categorised into 0, 1-10, 11-20, 21-30, and 30 days and above. Confidence intervals provided precision estimates and identified the extent to which the difference between proportions were statistically significant. Hypothesis 3 was investigated using bivariate and multivariate logistic regression, to adjust for school absence as a confounder to the association between MDD and academic achievement. School absence was included in the multivariate logistic regression, to examine whether absence from school reduced or diminished the association

between the level of MDD as indicated by the DISC-IV, and the likelihood of scoring below

NMS on each NAPLAN domain. Also included in the multivariate analysis was age, gender,

family composition, and household income.

Chapter 3: Results

3.1 Descriptive Statistics

3.1.1 Demographic Characteristics

Frequencies and percentages of demographic characteristics for the response and complete case sample are presented in Table 1. Minor differences are evident between the characteristics of participants across both samples. Age is comparable in both samples, with an even distribution across 13, 14, and 15 year old's. Males are slightly overrepresented in both the response (53.2%) and complete case samples (53.4%). For the complete case, majority live in a two parent household (77.3%) and have an intact family (61.5%). The response sample displayed a similar pattern of results. Additionally, household income is similar in both samples, with majority of adolescents living in a household earning $52,000 - $129,000 (44.3%) or less than $52,000 (21%). School absence rates are also similar across samples.

Table 1

Demographic Characteristics and DISC-IV Major Depressive Disorder for the Response (n=1077) and Complete Case Samples (n=847)

		Response Sample		Complete Case	
Characteristics		*n*	%	*n*	%
Adolescent Demographics					
Sex					
	Male	572	53.1	452	53.4
	Female	505	46.9	395	46.6
Age					
	13	353	32.8	274	32.3
	14	378	35.1	299	35.3
	15	346	32.1	274	32.3
Household demographics					
Number of parents living in the household					
	No parent	17	1.6	11	1.3
	One parent	230	21.4	181	21.4
	Two parents	830	77.1	655	77.3
Family composition					
	Intact family	659	61.2	521	61.5
	Lone parent family	230	21.4	181	21.4
	Blended family	23	2.1	18	2.1
	Step family	148	13.7	116	13.7
	Other family[a]	17	1.6	11	1.3
House Income per annuum					
	Less than $52,000	233	21.6	178	21.0
	$52,000 - $129,999	467	43.3	375	44.3
	$130,000 or more	330	30.6	268	31.6
	Not stated	47	4.4	26	3.1
Major Depressive Disorder (DISC-IV)					
Parent rating					
	No disorder	982	91.2	779	92.0
	Subthreshold	58	5.4	43	5.0
	Threshold	37	3.4	25	3.0
Percentage of days absent from school in the past 12 months					
	0	92	8.6	72	8.5
	1-10	853	79.5	691	81.5
	11-20	83	7.7	60	7.1
	21-30	27	2.7	16	1.9

	More than 30 days	15	1.5	8	0.9

ª 'Other family' refers to children being raised by their grandparents or other relatives.

3.1.2 Demographic Characteristics of Adolescents with Parent Reported Major Depressive Disorder

Demographic characteristics for parent reported MDD are presented in Table 2. Comparably, there is a similar distribution for threshold level MDD across male (48%) and females (52%). Males are slightly overrepresented in subthreshold level MDD (55.8%), and no disorder (53.4%), but this is likely due to the overrepresentation of males in the sample as a whole. Majority of adolescents in the threshold level MDD group are aged either 14 (44%) or 15 (44%), with the minority being aged 13 (12%). This distribution is similarly observed in the subthreshold level MDD group, however a higher percentage of adolescents are aged 13 (25.6%). For the no disorder group, there is an even distribution between 13 (33.4%), 14 (34.9%) and 15 (31.7%) year old's.

Of note, it can be seen in Table 2, that for threshold level MDD, there is an even spread of intact (40%), and lone parent families (40%). This is different compared to subthreshold (48.8% intact and 23.3% lone parent), and no disorder (62.9% intact and 20.7% lone parent) level MDD groups. Therefore, this pattern of effect indicates that those with threshold level MDD may be more likely to be in a one parent household. This could potentially impact on their academic performance, and will be explored in subsequent analyses.

In regards to percentage of days absent, there is a higher percentage of adolescents in the threshold level MDD group that have more than 20 days (4%) and more than 30 days (4%), as compared to the no disorder group for more than 20 days (1.8%), and more than 30 days (0.5%). The subthreshold level MDD group has the highest percentage of days absent for more than 20 days (4.6%), and more than 30 days (4.6%). The majority of adolescents

across all groups were absent for 1-10% of school days, however this percentage was highest

for no disorder (82.6%), whereas for subthreshold and threshold level MDD, 79.1% and 56%

adolescents were absent for 1-10% of school days respectively. These results are consistent

with hypothesis 2, indicating that adolescents in threshold and subthreshold level MDD

groups are more likely to be absent from school, as compared to the no disorder group.

Further, adolescents in the threshold and subthreshold level MDD groups, are more likely to

fall under the category of chronic absenteeism, which is defined by absences of more than

20% or 30% of school days. However, these results must be interpreted with caution due to

the low sample size in both threshold and subthreshold level MDD groups, and the wide

overlapping confidence intervals. For example, it is likely that there is more precision for the

estimates of no disorder 21-30 percentage of days absent (1.5%, 95%CI: 0.8-2.6), compared

to threshold percentage of days absent (4%, 95%CI: 3.7-11.7). Therefore, it could be

speculated that if the sample size was larger for threshold level, a higher percentage of

adolescents in the group may have a greater percentage of days absent from school.

Table 2

Demographic Characteristics For Parent Reported Adolescents With Threshold, Subthreshold, and No Disorder

(n=847; Threshold n=25; Subthreshold n=43; No disorder n=779)

		Parent reported MDD					
		Threshold		Subthreshold		No disorder	
Characteristics		*n*	*%(95%CI)*	*n*	*%(95%CI)*	*n*	*%(95%CI)*
Adolescent demographics							
Sex							
	Male	12	48.0 (28.4-67.6)	24	55.8 (41.0-70.7)	416	53.4 (49.9-57.0)
	Female	13	52.0 (32.4-71.6)	19	44.2 (29.4-59.0)	363	46.6 (43.1-50.1)
Age							
	13	3	12.0 (0.7-24.7)	11	25.6 (12.6-38.7)	260	33.4 (30.1-36.7)
	14	11	44.0 (24.5-63.4)	16	37.2 (22.8-51.6)	272	34.9 (31.6-38.2)
	15	11	44.0 (24.5-63.4)	16	37.2 (22.8-51.6)	247	31.7 (28.4-35.0)
Household Demographics							
Number of parents living in the household							
	No parent	1	4.0 (0.3-11.6)	1	2.3 (2.1-6.9)	9	1.2 (0.4-2.0)
	One parent	10	40.0 (20.8-59.2)	10	23.3 (10.7-36.0)	161	20.7 (17.9-23.5)
	Two parents	14	56.0 (36.5-75.5)	32	74.4 (61.4-87.4)	609	78.2 (75.3-81.0)
Family composition							
	Intact family	10	40.0 (20.8-59.2)	21	48.8 (3.4-63.7)	490	62.9 (59.5-66.3)
	Lone parent family	10	40.0 (20.8-59.2)	10	23.3 (10.7-36.0)	161	20.7 (17.9-23.5)
	Blended family	0	0.0 (0.0-13.7)	0	0.0 (0.0-7.0)	18	2.3 (1.2-3.4)
	Step family	4	16.0 (1.6-30.4)	11	25.6 (12.6-39.0)	101	13.0 (10.6-15.4)
	Other family[a]	1	4.0 (0.3-11.6)	1	2.3 (2.1-6.9)	9	1.2 (0.4-2.0)
Household Income per annuum							
	Less than $52,000	6	24.0 (7.3-40.7)	14	32.6 (18.6-47.0)	158	20.3 (17.5-23.1)
	$52,000 - $129,999	12	48.0 (28.4-67.6)	15	34.9 (20.1-49.1)	348	44.7 (41.2-48.2)
	$130,000 or more	4	16.0 (1.6-30.4)	12	27.9 (14.5-41.3)	252	32.3 (29.0-35.6)
	Not stated	3	12.0 (0.7-24.7)	2	4.7 (1.6-11.0)	21	2.7 (1.6-3.8)
Percentage of days absent from school in the past 12 months							
	0	5	20.0 (4.3-35.7)	0	0.0 (0.0-7.0)	67	8.6 (6.6-10.6)
	1-10	14	56.0 (36.5-75.4)	3	79.1 (66.9 91.2)	643	82.6 (80.0-85.3)
	11-20	4	16.0 (1.6-30.4)	5	11.7 (2.0-21.2)	51	6.5 (4.8-8.2)
	21-30	1	4.0 (3.7-11.7)	2	4.6 (1.6-11.0)	13	1.8 (0.8-2.6)
	More than 30 days	1	4.0 (3.7-11.7)	2	4.6 (1.6-11.0)	5	0.5 (0.0-1.1)

ᵃ 'Other family' refers to children being raised by their grandparents or other relatives.

3.2 Major Depressive Disorder and NAPLAN domains

3.2.1 Academic Achievement and Major Depressive Disorder

Table 3 presents the percentage of adolescents scoring below, at, and above NMS, for parent reported MDD. There is a higher percentage of adolescents scoring below NMS in the threshold level MDD across numeracy, writing, and spelling domains, providing support for hypothesis 1. Scores in the writing domain show the largest pattern of effect, with 20% (95%CI: 6.8-40.7) of adolescents in the threshold level MDD group scoring below NMS, compared to 9.8% (95%CI: 7.8-12.1) in the no disorder group. The difference between scores below NMS for threshold level and no disorder MDD groups were minimal for numeracy, and comparable for reading. Additionally, there were no adolescents scoring below NMS in the threshold level MDD group for Grammar, however, the threshold level MDD group had the highest percentage (7%) of adolescents scoring below NMS for grammar. It appears that the grammar domain was most impacted by subthreshold level MDD, and the writing domain by threshold level MDD. It is important to note that although the differences between below NMS scores were minimal between threshold level and no disorder MDD groups across all domains except writing, the results suggest that the no disorder group had a higher percentage of adolescents scoring above NMS across all domains. The only exception to this was in the grammar domain where adolescents in the subthreshold MDD group scored higher in the above NMS range (88.4%) compared to the no disorder group (82.9%). This suggests that adolescents with threshold and subthreshold level MDD are less likely to score above NMS across all domains.

It is important to note, that while overall the results in Table 3 suggest a pattern of effect supporting hypothesis 1, this effect is small, and the small sample size of the threshold (n=25) and subthreshold (n=43) level groups limits the precision. Further, 95% confidence

intervals (CIs) for the threshold and subthreshold level groups are wide and overlapping, suggesting the precision of the estimate is low, and the findings may be due to chance. However, the nature of the CIs are likely a reflection of the small sample size, and it is possible that with an increased sample size, the pattern of effect might have been larger and more precise.

Table 3

Percentage *(95%CI) of Adolescents Scoring Below, At, and Above National Minimum Standard on all NAPLAN domains by Parent Rated DISC-IV Major Depressive Disorder (n=847; Threshold n=25; Subthreshold n=43; No disorder n=779)*

NAPLAN Domain		Parent reported MDD					
		Threshold		Subthreshold		No disorder	
		n	*% (95%CI)*	*n*	*% (95%CI)*	*n*	*% (95%CI)*
Numeracy	Below	1	4.0 (1.0-20.4)	1	2.3 (1.0-12.3)	27	3.5 (2.3-4.9)
	At	5	20.0 (6.8-40.7)	8	18.6 (8.4-33.4)	102	13.1 (10.8-15.7)
	Above	19	76.0 (54.9-90.6)	34	79.1 (64.0-90.0)	650	83.4 (80.6-86.0)
Writing	Below	5	20.0 (6.8-40.7)	1	2.3 (1.0-12.3)	76	9.8 (7.8-12.1)
	At	5	20.0 (6.8-40.7)	9	20.9 (10.0-36.0)	132	16.9 (14.4-19.8)
	Above	15	60.0 (38.7-78.9)	33	76.7 (61.4-88.2)	571	73.3 (70.0-76.4)
Grammar	Below	0	0.0 (0.0-13.7)	3	7.0 (1.5-19.1)	31	4.0 (2.7-5.6)
	At	5	20.0 (6.8-40.7)	2	4.7 (0.6-15.8)	102	13.1 (10.8-15.7)
	Above	20	80.0 (69.3-93.2)	38	88.4 (74.9-96.1)	646	82.9 (80.1-85.5)
Reading	Below	1	4.0 (1.0-20.4)	1	2.3 (1.0-12.3)	32	4.1 (2.8-5.7)
	At	4	16.0 (4.5-36.1)	9	20.9 (10.0-36.0)	107	13.7 (11.4-16.4)
	Above	20	80.0 (59.3-93.2)	33	76.7 (61.4-88.2)	640	82.2 (79.3-84.8)

	Below	2	8.0 (1.0-26.0)	2	4.7 (0.6-15.8)	50	6.4 (4.8-8.4)
Spelling	At	5	20.0 (6.8-40.7)	6	14.0 (5.3-27.9)	87	11.2 (9.0-13.6)
	Above	18	72.0 (50.6-87.9)	35	81.4 (66.6-91.6)	642	82.4 (79.6-85.0)

3.2.1 Academic Achievement and Family Composition

Table 5 presents the percentage of adolescents scoring below, at, and above NMS, for family composition. Table 2 showed that a higher proportion of adolescents in the lone parent family group, were in the threshold level MDD group, compared to no disorder. Therefore this Table is included to understand the association between family composition and academic achievement.

There is a higher percentage of adolescents below NMS in the lone parent family group, across all domains. This pattern of effect is highest in the writing domain, where 11.6% adolescents in the lone parent family group are below NMS, compared to 6.9% in the intact family group. Further, the other family group has the highest percentage of adolescents below NMS for writing (27.3%), which is significantly higher than the intact family group. However, the other family group has a small sample size (n=11), and wide CIs, suggesting a low precision estimate.

The results from Table 5 further suggest that adolescents in lone parent and other family groups, are less likely to score above NMS, compared to adolescents in an intact family group. The results suggest that adolescents in the other family group are most unlikely to score above NMS in the writing (54.5%), reading (63.6%), and spelling (63.6%) domains. This Table provides some suggestion that family composition may impact on the academic performance of adolescents, across all domains. Therefore, it will be adjusted for in the multivariate logistic regression, due to it potentially confounding the association between MDD and academic achievement.

Table 4

Percentage *(95%CI) of Adolescents scoring Below, At, and Above national minimum standard on levels of Family Composition (n=847; Lone parent family n=181; Other family n=11; Step family n=116; Blended family n=18; Intact family n=521)*

NAPLAN Domain		Lone parent family		Other family		Step family		Blended family		Intact family	
		n	*% (95%CI)*	*n*	*% (95%CI)*	*n*	*% (95%CI)*	*n*	*% (95%CI)*	*n*	*% (95%CI)*
Numeracy	Below	11	6.1 (3.1-10.6)	0	0.0 (0.0-28.5)	7	6.0 (2.5-12.0)	0	0.0 (0.0-18.5)	11	2.1 (1.1-3.7)
	At	31	17.1 (11.9-23.4)	3	27.3 (6.0-61.0)	15	12.9 (7.4-20.4)	3	16.7 (3.6-41.4)	63	12.1 (9.4-15.2)
	Above	139	76.8 (70.0-82.7)	8	72.7 (39.0-94.0)	94	81.0 (72.7-87.7)	15	83.3 (58.6-96.4)	447	85.8 (82.5-88.7)
Writing	Below	21	11.6 (7.3-17.2)	3	27.3 (6.0-61.0)	18	15.5 (9.5-23.4)	4	22.3 (6.4-47.6)	36	6.9 (4.9-9.4)
	At	35	19.3 (13.9-25.9)	2	18.2 (2.3-51.8)	28	24.1 (16.7-33.0)	3	16.7 (3.6-41.4)	78	15.0 (12.0-18.3)
	Above	125	69.1 (61.8-75.7)	6	54.5 (23.4-83.3)	70	60.3 (50.8-69.3)	11	61.1 (35.7-82.7)	407	78.1 (74.3-81.6)
Grammar	Below	11	6.1 (3.1-10.6)	0	0.0 (0.0-28.5)	8	6.9 (3.0-13.1)	2	11.1 (1.4-34.7)	13	2.5 (1.3-4.2)
	At	24	13.3 (8.7-19.1)	3	27.3 (6.0-61.0)	17	14.7 (8.8-22.4)	3	16.7 (3.6-41.4)	62	11.9 (9.2-15.0)
	Above	146	80.7 (74.1-86.1)	8	72.2 (39.0-94.0)	91	78.4 (69.9-85.5)	13	72.2 (46.5-90.3)	446	85.6 (82.3-88.5)
Reading	Below	11	6.1 (3.1-10.6)	1	9.1 (0.2-41.3)	7	6.0 (2.5-12.0)	2	11.1 (1.4-34.7)	13	2.5 (1.3-4.2)
	At	29	16.0 (11.0-22.2)	3	27.3 (6.0-61.0)	21	18.1 (11.6-26.3)	3	16.7 (3.6-41.4)	64	12.3 (9.6-15.4)
	Above	141	77.9 (71.1-83.7)	7	63.6 (30.8-89.1)	88	75.9 (67.0-83.3)	13	72.2 (46.5-90.3)	444	85.2 (81.9-88.2)
	Below	14	7.7 (4.3-12.6)	2	18.2 (2.3-51.8)	11	9.5 (4.8-16.3)	0	0.0 (0.0-18.5)	27	5.2 (3.4-7.5)

Spelling	At	22	12.2 (7.8-17.8)	2	18.2 (2.3-51.8)	20	17.2 (10.9-25.4)	3	16.7 (3.6-41.4)	51	9.8 (7.4-12.7)
	Above	145	80.1 (73.5-85.7)	7	63.6 (30.8-89.1)	85	73.3 (64.3-81.1)	15	83.3 (58.6-96.4)	443	85.0 (81.7-88.0)

3.2.2 The Association Between Major Depressive Disorder and NAPLAN Adjusting for School Absence and Family Composition

Table 6 presents the bivariate and multivariate odds ratios (95%CI) showing the association between parent rated MDD, NAPLAN ratings, and school absence. The multivariate logistic regression also adjusted for family composition, as prior analyses presented in Table 2 and 5 showed differences in family composition between parent reported MDD, and across scores on the NAPLAN domains. Given the small sample size of threshold (*n*=25) and subthreshold (n=43) level groups, for analyses in Table 6 these two groups were combined.

Although the odds ratios are small across all domains, it is suggested that for numeracy, writing, reading, and spelling domains, adolescents with no disorder are less likely to score below NMS. Further, the results suggest that in the grammar domain, adolescents who are at threshold or subthreshold level MDD, are at an increased likelihood of scoring below NMS. However it should be noted that the CIs are wide across domains, due to small sample sizes, limiting the precision of estimates. The writing domain may provide the most precise estimate, as the CIs are not as wide as other domains.

There are no differences in the size of odds ratios between model 1 and model 2, suggesting that when adjusting for family composition, the strength of the association between MDD and academic achievement remains the same. There were however, minor differences between model 2 and model 3, across all domains except for spelling. This suggests that school absence potentially confounds the association between MDD and academic achievement.

Overall, adjusting for covariates did not significantly influence the association between MDD and academic achievement below NMS. This is evident by the similarity

between bivariate and multivariate odds ratios across all subject domains, providing evidence

for the association after adjustment of potential confounders.

Table 5

Bivariate and Multivariate Odds Ratios (95%CI) Showing Association Between Parent Rated

Major Depressive Disorder, and NAPLAN Ratings (n=847)

NAPLAN Domain		Parent reported MDD		
		Bivariate	Multivariate	
		Model 1	Model 2	Model 3
Numeracy	Below NMS	0.8	0.8	0.7
		(0.2-3.6)	(0.2-3.3)	(0.2-3.0)
	At/Above NMS	1.0	1.0	1.0
Writing	Below NMS	0.9	0.9	0.8
		(0.4-2.1)	(0.4-2.1)	(0.3-2.0)
	At/Above NMS	1.0	1.0	1.0
Grammar	Below NMS	1.1	1.1	1.0
		(0.3-3.7)	(0.3-3.5)	(0.3-3.4)
	At/Above NMS	1.0	1.0	1.0
Reading	Below NMS	0.7	0.7	0.6
		(0.2-3.0)	(0.2-2.8)	(0.1-2.5)
	At/Above NMS	1.0	1.0	1.0
Spelling	Below NMS	0.9	0.9	0.9
		(0.3-2.6)	(0.3-2.5)	(0.3-2.7)
	At/Above NMS	1.0	1.0	1.0

Note. Multivariate logistic regression analyses include Family composition in model 1, and Family composition and School Absence in model 2. 1.0 is the reference category. Numeracy: Below n=29; At/Above n=818, Writing: Below n=82; At/Above n=765, Grammar: Below n=34; At/Above n=813, Reading: Below n=34; At/Above n=813, Spelling: Below n=54; At/Above n=793.

Chapter 4: Discussion

4.1 Overview

The present study aimed to investigate the association between MDD and academic achievement among Australian adolescents aged 13 to 15 years. Previous research has identified a negative association between depressive symptoms and MDD, and academic achievement. However, the majority of studies focus on levels of depressive symptoms rather than the presence (or absence) of MDD. Further, many studies are limited by their use of non-representative samples. To this end, the present study utilised both a diagnostic measure of MDD, and a nationally representative community sample to investigate the association. It was hypothesised that adolescents meeting criteria for MDD, would have lower academic achievement, and higher school absence, compared to those who did not have MDD. Although limited by a small number of participants with MDD, there was some evidence to support these hypotheses. The results suggest that adolescents aged 13 to 15 years with MDD are more susceptible to lower academic outcomes, and higher school absence, as compared to their peers without MDD. The results contribute to the awareness and understanding of the association between MDD and academic achievement at a national scale.

4.2 Summary of Findings

The present study provides evidence to suggest that MDD is associated with decreased academic outcomes, and increased school absence rates. There is some indication that adolescents with MDD also less frequently exceed the National minimum standard (NMS) as required by the NAPLAN. The foremost expectation of education is that students develop the knowledge and skills relevant to fundamental areas of the school curriculum (Atweh et al., 2011). Students with MDD may therefore be identified as a group being less

likely to attain the educational requirements for their age, as often as their peers. However, given the wide confidence intervals, the precision of the estimates in this study are limited, making it difficult to draw definite conclusions. There are three possible explanations for the small association found.

Firstly, the present study had a small number of adolescents who were reported to have exceeded the threshold for MDD or who scored in the subthreshold range for MDD. Further, the overlapping CIs indicate that this could have been a chance finding. This is a likely explanation to the small association found, as previous research using larger sample sizes have identified a strong negative association between MDD and academic achievement. For example, Fergusson & Woodward (2002), utilised a diagnostic measure among a group of adolescents in Christchurch, finding that longitudinally, adolescents with MDD were at a reduced likelihood of entering university, or pursuing another form of tertiary education. As well, López-López (et al., 2021) found that depressive symptoms were associated with reduced academic achievement up to the age of 16, and Fletcher (2010) found that this association lasted further than age 16. If the associations found in the present study were to last throughout the later years of high school, it is likely that those adolescents may have similar difficulties with future educational attainment and employment, given the impact of symptoms. Put together, these results suggest that MDD in adolescence can not only cause an impact in the early years of high school as evident by the present study, but it can further impact into the later years of an adolescents' development.

The present study also provides evidence to suggest that MDD is associated with an increased level of days absent from school, and that adolescents with MDD are more likely to exhibit chronic absenteeism. This finding is consistent with previous evidence (Finning et al., 2019; Goodsell et al., 2017). A recent systematic review and meta-analysis was conducted in this area, and found a small positive association between MDD and school absence (Finning

et al., 2019), which compliments the findings of the present study. The small sample size is a likely explanation for the small association found in the present study, because previous research using larger samples have found a similar, but stronger association (López-López et al., 2021; Goodsell et al., 2017; Fletcher, 2010; Fergusson & Woodward 2002).

Secondly, the present study utilised a categorical diagnostic measure of MDD, which may have resulted in a weaker association between MDD and academic achievement than would have been revealed using a continuous measure such as levels of depressive symptoms. In addition, consistent with previous research (López-López et al., 2021; Fletcher, 2010), the control group in the present study included adolescents with no MDD, and did not include screening for comorbid disorders. Even though the diagnostic framework plays a key role in policy, service provision, and understanding the influence of MDD on schooling (Verboom et al., 2014), one explanation for the small association found is that using the diagnostic measure precluded some students. These could have been students who were likely close to meeting criteria, but because of the rigour associated with diagnosis, they were categorised as not meeting criteria. Further, the diagnostic categories may limit the power of the study in identifying the impact MDD has on core functioning and academic outcomes, because likely in reality symptoms exist on a continuum. Continuous assessments of mental health symptoms are valuable, in that they provide unique insight into the rate of mental health difficulties as considered by the general population (Goodman et al., 2000). Therefore, given that the present study utilised three distinct diagnostic groups of MDD, the small association may be explained by a small difference between these groups. As a result, it could be speculated that if both a diagnostic categorical measure and a continuous measure of depressive symptoms were used, then more information would be provided for adolescents based on level of severity of MDD symptoms, and level of NAPLAN achievement.

Finally, given the weak association found in the present study, it could be proposed that adolescents with MDD, may still be able to attain the NMS. Further, MDD may not impact on school attendance. The NMS in the NAPLAN is a low level of achievement, and when an adolescent does not meet the required level, they are categorised as being unable to meet the learning requirements for the particular year level, in a specific subject area or domain (ACARA, 2016). In line with previous research, results from the present study suggest that even though adolescents with MDD are more likely to score below NMS, and less likely to exceed NMS, MDD does not necessarily preclude these adolescents from scoring at or even above NMS in certain subject domains (Goodsell et al., 2017). Goodsell (et al., 2017) identifies that the numeracy, grammar, and spelling domains are most impacted by MDD experienced by students, and the present study further adds to this by considering writing as an additional area of reduced achievement for these adolescents. It should also be noted that literacy and numeracy are the only part of the school curriculum measured by the NAPLAN assessment (Pendergast & Swain, 2013). Further, the standards are intended to be a glimpse of typical achievement, and do not describe the complete range of what students are taught, or what they may achieve (ACARA, 2016). Therefore, it may be likely that students with MDD may perform differently in other areas, that are not assessed by the NAPLAN. As for school attendance, it is unlikely that MDD does not impact upon school absence, given that previous research has shown a significantly higher level of absence for adolescents with MDD in year 9 (Goodsell et al., 2017).

The evidence in this area consistently suggests that adolescents with MDD are at an increased risk for reduced academic outcomes and attainment, and higher school absence. The evidence does suggest however, that although adolescents with MDD are more at risk, they are not necessarily precluded from scoring at or even above NMS. Therefore, early prevention, identification, and strength-based support is recommended.

4.3 Implications

MDD commonly presents during adolescence, and this research highlights the negative impact that it can have on students' academic progress and school attendance. Given the wide CIs leading to imprecise estimates, it is possible that with a larger sample size, the power of the study and estimate precision would increase. Nevertheless, the findings from this study can help enrich national awareness and understanding, and offer nuance to the current literature which seeks to understand the impact that MDD has on school achievement and absence.

Although the sample size was small for adolescents meeting criteria for MDD, the present study is well placed for providing an estimate of the impact of MDD on academic achievement, at a national level. This study highlights the importance of mental health prevention efforts, and early identification of symptoms, in order to reduce their impact during critical developmental stages. This is fundamental, as indicated by previous research, showing that students with MDD find it progressively more difficult to achieve at same level of their peers with no MDD (Goodsell et al., 2017). Research into child and adolescent development and school support, consistently suggests that if students are supported positively and early, and maintain their developmental trajectory, this is more beneficial and effective than trying to bridge the gap after students fall behind (Goodsell et al., 2017). Not only is this detrimental to the adolescent, but also to their peers and teachers. Gaps in academic ability have the potential to disrupt classroom functioning, complicating the teacher-student learning expectations (Brophy & McCaslin, 1992). Further, in longitudinal studies it has been found that higher academic achievement protects against subsequent depressive symptoms (Shen et al., 2020). Therefore, it is important to first implement prevention to reduce manifestation and progression of symptoms, and then work on

identification and intervention as early as possible, in the hopes to minimise the impact on future employment opportunities and the wellbeing of adolescents.

Further, the present study highlights that adolescents with MDD may be absent from school for more days than their peers without MDD. Although it is increasingly being recognised that every day of school attendance is important (Ingul et al., 2019), there is still no consensus as to how much absence from school is too much absence, and when to intervene (Chu et al., 2019; Ingul et al., 2019). In Australia, each state and territory has its own education department responsible for overseeing policy, and these differ across states (Lawrence et al., 2019). Without a firm consensus, it is therefore likely that many students are missing significant amounts of school, without much recognition of this. This is a concern, and especially for adolescents with MDD, who are already at-risk for reduced academic outcomes. However, some states have developed tools and policies, aiming to highlight the importance of attendance at school. For example, the Queensland Government Department of Education and Training has developed the 'Every Day Counts' strategy (Queensland Government Department of Education Training and Employment, 2016). This strategy focuses on promoting the importance of attending school every day, implementing a range of resources targeting students, parents, and school communities (Queensland Government Department of Education Training and Employment, 2016). Also under the banner of 'Every Day Counts', other states in Australia including Victoria, Western Australia, and the Northern Territory have also produced strategies aimed at the promotion of school attendance (Lawrence et al., 2019). However, it should be noted that these strategies are targeted towards all students, and not those just those with MDD. It is important to understand that the underlying reasons for absence related to MDD will likely vary, and as a result, the strategies implemented to improve school attendance will also need to vary accordingly. Teachers are in an important position to help with the identification of students

who may need required support, and also to notice patterns of non-attendance. Although teachers are not expected to be mental health experts, they can play an important role in providing support for students with MDD. Firstly, in the identification of students who are having difficulties emotionally, academically, or with school attendance, and secondly, to help bridge the gap for these students to reach equality in the classroom.

4.4 Strengths and Limitations

A major strength of this study was the use of a randomly selected, nationally representative community sample. The Australian Child and Adolescent Survey of Mental Health and Wellbeing was the second national report of adolescent mental health, following the first in 1988 (Lawrence et al., 2015). The magnitude of this sample allows for an effective, unique, and rigorous insight into a range of demographic outcomes within the Australian population. These include family composition, socio-economic status, household income, levels of education, and areas of residence. This sample ensures that the present study sample of adolescents aged 13 to 15 years, are representative of the majority of adolescents aged 13 to 15 in the true Australian population. Previous research did not show this level of generalisability. Utilising a representative national sample, enables the findings from the present study, to aid in understanding and prevention, identification and intervention efforts at a national level.

This study was also strengthened by the use of a diagnostic measure of MDD: the DISC-IV. By utilising this highly structured interview with the parent, the DISC-IV enabled close adherence to the DSM-IV diagnosis for MDD. Further, the DISC-IV was designed for use among children and adolescents, and was originally developed for use in large-scale epidemiological surveys, to determine rates of psychiatric diagnoses in children and adolescents (Hersen & Thomas, 2004). Only few studies investigating the association between MDD and academic achievement utilise this measure. By using this measure of

MDD in a large nationally representative sample, it puts the present study in a good place to understand the overall prevalence, and impact of MDD on academic achievement in the majority of Australian 13 to 15 year old's.

This study was limited by use of a cross-sectional design and small sample size of adolescents meeting the criteria for MDD. The cross-sectional nature of the present study meant that MDD, school absence, and academic achievement were measured at a single time point. This design prevented the ability to draw conclusions about the directional association between academic achievement and MDD, and MDD and school absence. This limits the results, making the direction of effect unclear. Further, it is quite likely that both MDD and reduced academic achievement occur simultaneously, an association which has been identified previously (Lopez-Lopez, 2021; Verboom et al., 2014). Adolescent mood is also known to fluctuate (López-Lopez, 2021), and therefore the measurements taken at a single time point, may not reflect the full picture for adolescents.

The study was further limited by the sample size of adolescents with threshold and subthreshold MDD. Only a proportion of adolescents were aged 13 to 15 years (n=1077), and the sample size was further reduced when excluding adolescents from the complete case sample who had some missing data (n=847). While excluding adolescents with missing data allowed for statistical clarity, it also meant that the smaller sample size increased variability in scores, as indicated in the results by wide CIs and small associations. Although the results did show a strong pattern of effect, it is likely that a larger sample size would have reduced the size of CIs, leading to greater power in the study, and more precise estimate of the prevalence and impact of MDD in a community sample. This would have allowed more distinct conclusions to be made.

Furthermore, it should also be noted that a significant amount of adolescents were excluded from analysis due to gaps in their NAPLAN reports (n=225 out of n=1077).

According to the NAPLAN guidelines, exempt students from specific domains are presumed to have not met the NMS (ACARA, 2016). Therefore, the proportion of adolescents with reduced academic performance in this study may be a slight underestimation of the greater population with reduced levels of academic performance.

4.5 Directions For Future Research

The present study allowed for investigation into the association between MDD and academic achievement, in a nationally representative sample using a diagnostic measure. Guided by the present study, recommendations are considered for future research, enabling further investigation into this association.

Firstly, it was out of the scope for this study, but future research should aim to use both parent and youth reports of MDD. By using only a parent report, the present study is subject to recall errors, and lacks the perspective from the youth report. Especially given the nature of MDD symptoms, youth report would be important to understanding both sides of the story. Previous research highlights that it is more difficult for a parent to report symptoms of MDD, and as such adolescents may be better informants of their experience of MDD symptoms (Orchard et al., 2019). For example, in a recent study, parents were less likely than their child to identify the depressive symptoms of suicidal thoughts, sleep disturbances, and fatigue (Orchard et al., 2019).

Secondly, future research should aim to use a diagnostic measure of MDD in conjunction to a continuous measure, such as the Strengths and Difficulties Questionnaire (SDQ) (Goodman & Scott, 1999), enabling for further understanding into depressive symptoms and MDD, which likely exist on a continuum. Third, the present study did not include comorbid symptoms and disorder in the analyses, but acknowledges their importance in this context. It was also out of scope for the present study, but future research should aim to include measures of comorbidity, especially for anxiety and externalising disorders, which

have been shown to commonly present simultaneously with MDD (Schrack et al., 2020). Finally, the present study used a cross-sectional design, and future research aiming to extend this research, would greatly benefit from a longitudinal design, which would enable measurement of MDD and academic achievement over time.

4.6 Conclusion

The present study suggested that there were a higher proportion of Australian adolescents aged 13 to 15 years with MDD who scored below the NMS. This suggested that those adolescents with MDD were more likely assessed as being below the standard academic outcomes for year 9, and less likely to exceed these standards, compared to their peers without MDD. The results further suggested that adolescents with MDD were more likely to be absent from school compared to their peers without MDD. This study contributes to the awareness and understanding of this association at a national level. It calls for early prevention and identification, to reduce symptoms reaching diagnostic level, and early support for adolescents presenting with MDD. It is further suggested from this research that adolescents with MDD are not necessarily precluded from scoring above national standards in all domains. Therefore, a strength-based approach to helping these students may be favourable. The present study certainly illustrates that adolescents with MDD are an at-risk group, and ongoing work is required to further understand this association, enabling guidance for how to best support these adolescents to flourish in their academic studies.

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Appendix

Appendix 1

Description of NAPLAN Domains and Year 9 NMS

NAPLAN domain	Description
Numeracy	Tests mathematic ability of students across three content strands: number and algebra, measurement and geometry and statistics and probability. The online numeracy tests contain multiple-choice, constructed response items, and technology-enhanced items. For example in the number domain of numeracy, at NMS, year 9 students are generally able to apply common strategies to calculate simple proportions, percentages, and simple rates.
Writing	Tests writing ability of students across three main text types: imaginative writing, informative writing and persuasive writing. Students are provided with a writing prompt, and are asked to write a response using a particular writing type. Students are tested on either narrative or persuasive writing, with informative writing not yet being tested by NAPLAN. At NMS, year 9 students are generally able to write stories with a beginning, complication and ending, with organisation of paragraphs focusing on one idea. Students are also generally able to develop context and provide detail about specific characters and settings.
Grammar	The language convention tests assess spelling, grammar and punctuation, essential in the development of reading and writing. At NMS, year 9 students are generally able to identify the tense of a short passage, and correctly use comparative adjectives. Students are also generally able to recognise correct use of punctuation, and identify the purpose of italics and dashes in sentences.
Reading	Tests literacy ability across the English language. Students are provided with a magazine containing a range of texts that illustrate different writing styles, and then asked to provide answers. In year 9, reading texts include those that describe, instruct, narrate and argue, often in combination. At NMS, these students are generally able to infer main ideas in more complex texts, and connect ideas across the text.
Spelling	The language convention tests assess spelling, grammar and punctuation, essential in the development of reading and writing. At NMS, year 9 students are generally able to identify and correct errors in most multi-syllable words with regular spelling patterns, and some irregular spelling patterns.

Source: ACARA. Australian Curriculum, Assessment and Reporting Authority (2016). *NAPLAN*. Retrieved from https://www.acara.edu.au/assessment/naplan