Heterogeneity in Adolescent Depression and the Role of Social Supports

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Declaration

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Table of Contents

List of Tables

Literature Review

Research Report

List of Figures

Research Report

Development, Trends, and Heterogeneity of Depression in Adolescence: A Review of Current Literature

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Literature Review

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Abstract

The aim of this review is to summarise and critique current knowledge in psychology on Major Depressive Disorder and its associated symptoms throughout adolescence. Depression occurring during this critical period of vulnerability is associated with the risk of long-term negative consequences at both subclinical and diagnostic levels. The progression of depression symptom development, differences in symptom presentation, overall trends in population prevalence, and heterogeneity in longitudinal patterns are examined. Methodological challenges in conducting surveys and longitudinal research with adolescent populations are discussed, and recommendations for future research are made in light of their application in developing and strengthening intervention programs.

Introduction

Adolescence is a developmental period involving unique changes in biology, psychology, and social dynamics that mark the transition between childhood and adulthood. During this time youth are more vulnerable to emergent depressive symptoms and the onset of clinical-level depressive disorders. Research in this area has aimed to capture national-scale prevalence rates as well as map longitudinal trends and patterns in the experience of depression and its associated symptoms. Understanding the patterns in development and onset of depressive symptoms during this period assists in conceptualising disorders as a spectrum whereby only a small percentage of any population reach a clinical threshold. Further, identifying risk and protective factors associated with the progression of depression can assist in developing targeted and universal intervention programs and shaping therapeutic interventions for youth. Such investigations are necessary within psychology given that depression in adolescence is associated with significant disease burden and disability, as well as long-term negative outcomes related to health and lifestyle factors, and safety risks including self-harm and suicide.

Defining Adolescence as a Developmental Period

Adolescence is a critical developmental period during which young people undergo significant physiological changes, develop new psychological skills in reasoning and emotional control, and experience shifts in the content and activities of their social relationships and connections (Dahl, 2004; P. M. Lewinsohn, Rohde, & Seeley, 1998). The World Health Organisation classifies *adolescence* as the span of time between ages 10 and 19 but caution that age is only one of many criteria that form the boundaries of this developmental period (World Health Organisation, 2018). As Jaworska and MacQueen (2015) highlight, *adolescence* may be better understood as a contextually based period between childhood and adulthood,

rather than a fixed age-specific period. The transition from childhood to adolescence is marked by the hormonal and biological changes that occur during puberty, while the transition to adulthood may be socially defined in Australia and elsewhere as the legal threshold of age 18. While changes that begin in adolescence continue into young adulthood, it would not be appropriate to extend the upper limit of this period to 25 years due to the substantially different nature of developmental change associated with the adolescent-adulthood transition (Jaworska & MacQueen, 2015). For the purposes of this review, *adolescence* will, therefore, refer to the second decade of life within the context of biological, social, and psychological changes that occur during this period.

Defining Depression in Psychological Research

Adolescence is a time where youth are particularly vulnerable to the onset of mental health conditions such as depressive disorders. The American Psychiatric Association (2013) classifies several depressive conditions that can be diagnosed in adolescence including Persistent Depressive Disorder (Dysthymia) and Premenstrual Dysphoric Disorder. However, Major Depressive Disorder (MDD) is the most commonly cited disorder in epidemiological surveys and census data as a measure of population-level prevalence rates (Sawyer et al., 2001). MDD is marked by a period of at least two weeks during which there is depressed mood or loss of interest in activities, as well as symptoms such as changes in sleep and appetite (American Psychiatric Association, 2013).

In the published literature, *depression* has been used to encompass both clinical populations with MDD (or other depressive disorder) and general population samples who experience the emotions, thoughts, or behaviours present in the lead up to an episode of depression (prodromal symptoms) and symptoms that fall below the full diagnostic criteria (subclinical symptoms) of depressive disorders. Therefore, throughout this review, the terms *depression* and *depressive symptoms* are used interchangeably to refer to any symptoms or

experiences that are included within this broad conceptualisation, rather than as an applied diagnostic category.

Overall Trends in Prevalence and Progression of Adolescent Depression

Despite the identification of adolescent mental health as an important area of research, surveys of youth mental health are relatively new. As outlined by Sawyer et al. (2000), *The National Survey of Mental Health and Wellbeing: Child and Adolescent Component* conducted in Australia was one of the first national studies of its kind in the world and followed on from only a handful of state-based surveys examining mental health trends in youth. The initial 1997 survey was replicated in 2013-2014 without the inclusion of Dysthymia due to a lack of information on this form of depression. MDD was maintained as the primary measure of depression in youth and comparison between the two surveys suggests an increase in prevalence. The MDD prevalence across all children and adolescents was 2.1% in the 1997 survey compared with 3.2% in the replication survey (Lawrence et al., 2015). A closer examination of trends across childhood and adolescence indicates the emergence of new cases as children enter this second decade. When comparing age cohorts within the 2013/2014 survey, 7.7% of young people aged 11-17 years meet the criteria for MDD, compared to only 1.1% of children age 4-11 years (Lawrence et al., 2015). These findings suggest both an increase in prevalence over time as well as the emergence of new cases in adolescence. However, these findings may reflect cohort effects and further data collection points are required to map long-term trends at a population level accurately.

These surveys are limited further by commonly found methodological constraints of epidemiological studies. For example, the second *National Survey* excluded categorisation based on Indigenous status due to the unique challenges of measuring mental health within this population and weaknesses in their sampling pattern (Lawrence et al., 2015). This population

is of interest given that adult Indigenous Australians report nearly twice the rates of mental distress compared to their non-Indigenous counterparts (Australian Bureau of Statistics, 2010), and a broad survey of emotional and behavioural difficulties in Indigenous children age 4-17 found that approximately one-quarter were at risk of clinically significant difficulties (Shepherd, Li, Mitrou, & Zubrick, 2012). Ultimately further large-scale epidemiological surveys are required to capture prevalence rates across youth based on different demographic characteristics.

While population-level trends have been identified through cross-sectional studies that draw comparisons of depression rates between different cohorts at fixed time points, researchers have also been interested in longitudinal investigations into adolescent depression. The average progression of depressive symptoms within a sample tracked over time has generally shown an increase in symptom severity and cases meeting the diagnostic threshold over the course of adolescence (Holsen, Kraft, & Vitterso, 2000; Oldehinkel, Wittchen, & Schuster, 1999).

Depression Symptom Profiles

In addition to measuring rates of MDD, researchers have attempted to classify common symptom clusters in the expression of depression, and prodromal symptoms, that predict the onset of a new episode. In one study of adolescent depression, Bennik, Nederhof, Ormel, and Oldehinkel (2014) re-categorised the major symptoms of MDD to explore the interactive effects of anhedonia and depressed mood. They showed that the presence of either symptom cluster was associated with the later development of the other over time. Further, anhedonia decreased in overall prevalence but became stable by age 19, while depressed mood increased in severity in reports from girls across adolescence. In a different conceptualisation of depression, Iacoviello, Alloy, Abramson, and Choi (2010) examined the depressive symptoms

that were likely to occur prior to an acute episode of MDD in a sample of late adolescents (18-19 years). They found that sad mood, decreased interest in activities, concentration problems, hopelessness, worry, low self-esteem, and irritability served as early warning signs. These findings are consistent with an earlier study by Roberts, Lewinsohn, and Seeley (1995) who examined the phenomenology of MDD in adolescence and found depressed mood, and problems with cognition and sleep to be the most prevalent symptoms. More generally, depressed mood has been identified across several studies to be the most commonly reported symptom related to depression (Iacoviello et al., 2010; P. M. Lewinsohn, Petit, Joiner, & Seeley, 2003; Roberts et al., 1995). Additionally, Roberts et al. (1995) identified that around 30% of adolescents had at least one symptom of depression while only 2.6% received a diagnosis. These findings indicate a broad gap between the experience of any depressive symptoms and the clinical threshold.

Heterogeneity in Adolescent Depression

Longitudinal Trajectories

Recent developments in statistical methods have shed new light on the nature and progression of depressive symptoms across adolescence. Studies using these methods suggest that the experiences of adolescents are more varied than the overall trends found in population-level research. The development of Growth Mixture Modelling (GMM; (Muthén, 2006)) and Group Based Trajectory Analysis (GBTM; (Nagin, 1999) has provided an opportunity to better understand individual differences by identifying subgroups within a population distinguished by different patterns of symptom stability and severity (Musliner, Munk-Olsen, Eaton, & Zandi, 2016; Shore, Toumbourou, Lewis, & Kremer, 2018).

Insert Table 1 about here

One consistent feature across the trajectory studies is the identification of a 'low and stable' group who report low symptoms of depression which do not fluctuate over time. These low-stable groups generally comprise the majority of participants (a pooled effect estimate of 56% (Shore et al., 2018)). This result may be an artefact of the measurement tool used as many researchers use clinical diagnostic screening measures, such as the Children's Depression Inventory (Brendgen, Wanner, Morin, & Vitaro, 2005; Duchesne & Ratelle, 2014; Mezulis, Salk, Hyde, Priess-Groben, & Simonson, 2014). Given that most samples are taken from the general population and most of the population do not have a depressive disorder at a clinical level, there may be a floor-effect whereby variation within the low range is not captured by the measure leading to an inflated low-symptom group. Measures that are more sensitive to variation in the low end of depressive symptomology may be better suited to examine symptoms within non-clinical populations.

Although most studies identify a low-stable symptom group, there is no agreement in the number and shapes of the remaining trajectories with all combinations of severity and stability identified. The variance in these studies has partly been attributed to differences in sampling methods and the impact of culture on the sample population (Shore et al., 2018). However, this conclusion is inconsistent with research examining population prevalence and disorder rates which shows consistent patterns in depressive disorders cross-culturally (World Health Organisation, 2017).

Methodological differences may explain some of the variance. While GMM and GBTM are similar methods with a goal to identify such subgroups in a heterogeneous population over time, the two approaches differ in their underlying assumptions. GMM assumes that there are literal and distinct populations within the examined group which can be categorised by within-class variance (Frankfurt, Frazier, Syed, & Jung, 2016; Nagin & Odgers, 2010), while GBTM

statistically defines subgroups that have no literal counterpart but can provide a useful mechanism for further investigation once the data have been neatly summarised (Frankfurt et al., 2016; Nagin & Odgers, 2010). Twisk and Hoekstra (2012) suggest that GBTM leads to the identification of more subgroups than GMM within the same sample, which may account for some of the variances between studies. As shown in Table 1, studies using GBTM methods have resulted in 3-6 trajectory groups while those using GMM methods have led to the identification of between 3 and 4 groups, and a difference in statistical method alone cannot explain this overlap.

There is further variation in the data collection method (survey vs. interview) and the reporter (self, teacher, parent) used in these different studies which may impact the trajectories that are identified. As depression is an internalising disorder, the experience of symptoms may not be readily observable by teachers or parents (Telethon Kids Institute, 2015). Therefore, while having many different data collection approaches can be useful in assessing a phenomenon as they provide information from different viewpoints, variance in the trajectories identified may reflect these different perceptions. A lack of consistency in approaches and measurement tools make it difficult to compare results between studies, and standardisation of these approaches may benefit future research.

Finally, while these studies are targeted at adolescent mental health, the ages used as measurement time points vary greatly. Researchers have started data collection as early as 4 years of age, while others have conducted regular follow-up through to the age of 30 (Dekker et al., 2007; Olino, Klein, Lewinsohn, Rohde, & Seeley, 2010; Yaroslavsky, Pettit, Lewinsohn, Seeley, & Roberts, 2013). Extending the view of adolescence to include childhood and early adulthood may change the number and pattern of trajectories observed. Further, there is an inconsistency between studies around the number and timing of data collection points. For

example, Dekker et al. (2007) used five collection points for a single cohort over a 14-year span from age 4 to 18, while Costello, Swendsen, Rose, and Dierker (2008) captured three rounds of data for multiple cohorts at baseline, one and five-year follow up resulting in trajectories spanning age 12 to 25. The spacing and number of capture points may influence the shape of the trajectory patterns whereby inconsistent and large gaps may weaken the conclusions reached by trajectory studies.

Overall, the body of literature on trajectory studies in adolescent depression has highlighted marked variation in the course and progression of depressive symptoms over this critical period. While there has been no consensus around the total number or pattern of trajectory groups, the growing number of these studies have consistently found that multiple subgroups within sample populations explain the longitudinal trends better than a single, overall trend. Equivocal results across trajectory modelling studies on adolescent depression resulting from differences in study design and methodology may be improved by standardisation of recruitment method, modelling method, measurement tools, ages covered, and the gap between each collection point.

Gender Differences

In addition to exploring heterogeneity over time, researchers have also been interested in characteristics that are associated with variance in the experience of depression. There has been broad consensus in the research community that gender is a unique factor that contributes to variance in the experience of depression. Several studies of adolescent populations have shown divergence in prevalence rates by gender, with girls twice as likely to experience depression as boys (Andersen & Teicher, 2008; Government of South Australia, 2017; Paus, Keshavan, & Giedd, 2008). The increased rate of female depression has been shown to first appear around age 14 (Hankin et al., 1998; Wade, Cairney, & Pevalin, 2002). Research has

also challenged this conclusion, as Compas et al. (1997) found that gender differences in depressive symptoms were only prevalent in a clinical sample, while a general population sample displayed equivalent rates of symptoms by gender.

Within a clinical sample of boys and girls, the variance of depression by gender is revealed by differences in symptom profile and expression. Data from a study by Bennett, Ambrosini, Kudes, Metz, and Rabinovich (2005) showed that adolescent boys are more likely to experience anhedonia (emotional numbness) and morning fatigue, while girls are more likely to report low self-esteem and associated body concerns during episodes of MDD.

Additionally, several trajectory studies have split their sample by gender and identified different patterns in depressive symptoms for boys than for girls, although there are inconsistencies between studies on the final number of trajectories and their pattern (Chaiton et al., 2013; Dekker et al., 2007; Fernandez Castelao & Kroner-Herwig, 2013; Mazza, Fleming, Abbott, Haggerty, & Catalano, 2010; Whalen et al., 2016). In general, symptoms in girls tend to increase over the course of adolescence while boys have more stability or decrease in their symptoms over time (Holsen et al., 2000).

The causes responsible for these gender differences in the experience and rates of adolescent depression remain unclear. Researchers have indicated that the difference in identified depression rates by gender may be an artefact of differences in symptom profiles and socialised emotional expression (Bennett et al., 2005; Compas et al., 1997), hormonal changes (Angold & Worthman, 1993), or differing rates of adverse social experiences (e.g. peer rejection) which are risk factors for developing depression (Petersen, Sarigiani, & Kennedy, 1991). A common argument is that early menarche in girls is a risk for higher depression symptoms (Petersen et al., 1991). However, recent studies have discounted this conclusion

suggesting that pubertal timing and gender do not follow such a straightforward pathway (Angold & Worthman, 1993; Negriff & Susman, 2011).

Although the particular pathways in which gender influences the experience and expression of depression are unclear, gender should continue to be a key characteristic used in studies.

Risk Factors and Long-Term Outcomes

Depression is a complex mental health condition, and in addition to mapping depressive symptoms, a key aim of research within this area has been to identify characteristics and modifiable factors that predict the onset or risk of developing depression.

Risk Factors Unique to Adolescence

Several changes occur during adolescence which involve moving from the cognitive and biological stages of childhood to the development of requisite features of adulthood. Puberty is probably the most readily identifiable sign that adolescence has commenced. It involves an ongoing process of maturation involving physical growth and emergence of secondary sex characteristics (e.g. breast growth in girls and deepened voices in boys), and the development of the endocrine system (Cance, Ennett, Morgan-Lopez, & Foshee, 2012). While there is variation in the timing and sequence of puberty within a population, normal onset occurs around age 12 (Parent et al., 2003). As observed by Negriff and Susman (2011), being out of sync with peers by having early or late pubertal onset has been linked to higher rates of depressive symptoms.

In addition to the observable physical changes, further biological changes occur during adolescence involving neural changes to the level of white and grey brain matter and associated connectivity of brain regions (Paus et al., 2008). This neurological development is related to

the psychological skills of emotion regulation, response inhibition, social cognition, and problem-solving (Allott et al., 2013). As these changes occur over time, there is an increased degree of vulnerability during adolescence to environmental stressors, particularly when the necessary skill has not been fully grasped or a previous insult to the brain has limited the development of one or more of these skills (Andersen & Teicher, 2008). For example, depression has been shown to be associated with poor emotion regulation potentially reflecting developmental deficits in brain regions associated with adolescent emotion generation and affect regulation (Ahmed, Bittencourt-Hewitt, & Sebastian, 2015). Furthermore, hormonal and neural changes associated with alterations to the motivation and reward systems have been implicated in the onset of anhedonia – a depressive symptom involving emotional numbness (Paus et al., 2008).

Adolescence is also a time of social transition and psychological advancement. As adolescents experience newfound leaps in identity formation and independence (Crocetti, 2017), they are required to develop more sophisticated coping strategies, problem-solving tools, emotional regulation techniques, and interpersonal management (Ahmed et al., 2015). Adolescents go through contextual changes including the transition from primary to secondary school, commencement of romantic pursuits, and a general shift in social dynamics, where less time is spent with family and more with peers (Larson, Moneta, Richards, Holmbeck, & Duckett, 1996). These changes provide opportunities for increased stress due to adverse events, such as peer bullying and romantic relationship stress, which may influence the onset of depression (Anderson, Salk, & Hyde, 2015; Platt, Kadosh, & Lau, 2013). A lack of appropriate psychosocial coping strategies to deal with these new situations may put adolescents at further risk of depressive symptoms.

General Risk Factors

While there are unique developmental changes associated with adolescence that act as risk factors for the onset of depressive symptoms, additional general factors have been identified. In a broad summary of risk factors that adolescents have control over, Cairns, Yap, Pilkington, and Jorm (2014) identified health behaviours such as low exercise and physical activity, smoking, and poor sleep as potential targets for change. Breton et al. (2015) identified that non-productive coping was a key risk factor associated with high rates of depression including elements of self-blame, rumination and worry, and ignoring or avoiding problems. More systemic challenges such as low socioeconomic status have also been consistently identified in the literature as a risk factor for depression (Musliner et al., 2016; Wickrama, Noh, & Elder, 2009). Within the literature on trajectories of depression, a multitude of risk factors have been examined with very little replication between studies. As Table 1 highlights, these studies regularly include several risk factors in their analysis from biological, social, psychological, and contextual origins. Overall, there has been a lack of repetition of the same factors to build up a strong evidence base and risk profile for the identified trajectories. However, there is a general understanding that being female and having multiple risk factors are associated with membership to high symptom groups across the studies (Shore et al., 2018).

Negative Outcomes

Depressive symptoms in adolescence have been associated with ongoing risks and challenges with negative short and long-term outcomes. Adolescent-onset depression has been linked to the experience of depression across the lifespan. Research on adult mental health suggests that between half and three-quarters of adults with a depressive disorder retrospectively identify the experience of symptoms prior to age 19 (Kessler et al., 2005; Patton et al., 2014; Wilcox & Anthony, 2004). Further, Pine, Cohen, Cohen, and Brook (1999) showed that subclinical levels of depression in adolescence predicted episodes of MDD in adulthood.

Population-level research shows that the disease burden for depression is significant. By age 15, depressive disorders rank as the third highest cause of disease burden in Australia for boys and the second highest for girls (Australian Institute of Health and Welfare, 2016), and have the highest ranking of disease burden across the lifespan based on World Health Organisation estimates (World Health Organisation, 2017).

At this age, the presence of depressive symptoms has been linked to poor school attendance (Lawrence et al., 2015), delinquency (Diamantopoulou, Verhulst, & van der Ende, 2011), low physical health (Naicker, Galambos, Zeng, Senthilselvan, & Colman, 2013), illicit substance abuse and dependence (McLeod, Horwood, & Fergusson, 2016), and a higher degree of overall functional impairment compared with other mental health conditions (Lawrence et al., 2015). Of particular concern is the association between high rates of depression and instances of self-harm and suicidal ideation or attempt (Lawrence et al., 2015; Telethon Kids Institute, 2015). In the long term, Naicker et al. (2013) found that symptom severity and reoccurrence, poor health, and low social support persisted for up to 10 years after adolescence. Additional risks of exposure to intimate partner violence and unplanned pregnancy have been identified in girls who had high rates of depression at age 14-16 (McLeod et al., 2016). Adolescents who do not meet the diagnostic threshold of MDD may also be suffering significant levels of distress and depressive symptoms that require intervention to prevent progression to a more severe condition (P. M. Lewinsohn et al., 1998; Oldehinkel et al., 1999).

Protective Factors

In addition to risk factors, protective factors have been explored as predictors of lower rates of depression. There are two major theories around how protective factors interact with outcomes of depressive symptoms: The Stress-Buffering Effect whereby the protective factor

moderates the impact of a risk factor, and the Direct Effect whereby the protective factor itself influences the depressive symptoms (Rueger, Malecki, Pyun, Aycock, & Coyle, 2016).

Protective factors may be biological, social, or psychological and can be categorised as internal (e.g. coping strategies, resilience) or external (e.g. access to health care), as well as fixed (e.g. gender) or modifiable (e.g. optimism). In the literature on depression in youth, a number of protective factors which are predictive of lower rates of depression have been identified. Colman et al. (2014) found that mastery, physical activity, and education level were protective against the development of depression even in the presence of significant stressors. Family cohesion, positive self-appraisal, and good interpersonal relationships are associated with the development of resilience in adolescence which in turn acts as a protective factor for depression (Carbonell et al., 2002). Social support from parents, siblings, peers, school contexts and community have also been identified as protective and promotive factors related to adolescent depression (Davies, Parry, Bascoe, Martin, & Cummings, 2018; Jose & Pryor, 2010; Rueger et al., 2016).

Consistent with the trend of gender influencing patterns of depression, Breton et al. (2015) suggest that there are gender differences in the predictive effect of protective factors. They reported that girls were more likely to have lower rates of depression through thought exercises focusing on positivity, while boys were more likely to benefit from self-discovery.

Intervention and Prevention of Adolescent Depression

Although adolescence presents a time of increased risk and prevalence of depression, it also presents a window of opportunity for early prevention and intervention programs aimed at reducing depression onset and severity. While depressive symptoms may be effectively targeted in childhood, the biological and psychosocial changes experienced in adolescence present risks and challenges that young people must go through independent of any early

experiences (Dahl, 2004). Further, at the end of adolescents' teenage years, their experiences of depression appear to stabilise and become predictive of adult episodes of MDD, suggesting intervention during this time may have a significant impact on disrupting symptom progression (Bennik et al., 2014; Kessler et al., 2005; Pine et al., 1999).

Early intervention involves providing therapeutic psychological treatments to reduce the length and severity of an episode of depression after it has reached the diagnostic threshold of a clinical disorder (Zubrick, Silburn, Burton, & Blair, 2000). Cognitive Behaviour Therapy (CBT) has the strongest evidence base as a therapeutic intervention for depressive disorders in adolescents, alongside web-based CBT and Interpersonal Therapy (IPT) (Australian Psychological Society, 2018; Reyes-Portillo et al., 2014). These therapies involve a clinical psychologist working one-on-one with the adolescent, often in conjunction with their parents/guardians and school to accommodate appointments and homework activities.

However, due to barriers in accessing individual psychological therapy, clinicians and researchers are increasingly being asked to contribute to the development of large-scale targeted or universal programs. Adolescents have reported low levels of help-seeking regarding mental health problems due to stigma and poor mental health literacy. Further, the discrepancy between adolescent self-report and parent/guardian report of psychological distress is broad and may result in a lack of access to care that requires the adolescent to be accompanied by an adult (Lawrence et al., 2015; Zubrick et al., 2000). To combat some of these challenges, researchers have also examined preventative programs that use clinical psychology principles to address subclinical symptoms. Prevention refers to targeting subclinical/prodromal symptoms and factors associated with the onset of MDD (or other depressive disorder) to reduce the number of cases that result in a diagnosis. Small, positive benefits have been found for the use of CBT, third wave CBT, and IPT for preventing the onset of depressive disorders,

although further high-quality studies using a randomised control design are required to support this conclusion (Hetrick, Cox, Witt, Bir, & Merry, 2016). Psychoeducational interventions and risk-based programs targeting cognitive and emotional mechanisms involved in depression have also shown promise (Bevan Jones et al., 2018; Rice & Rawal, 2011). Additionally, many prevention programs are being delivered through schools in order to target subclinical concerns and overcome the barriers by bringing the strategies to youth (Calear & Christensen, 2010; Carnevale, 2013; Dray et al., 2017; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Lawrence et al., 2015; Werner-Seidler, Perry, Calear, Newby, & Christensen, 2017). The specific mechanisms that make these programs effective remain unclear as evidence tends to show small and weak support for each program which can vary in focus from psychoeducation, to teaching core concepts like resilience and self-esteem, or drawing upon whole community systems to provide support for youth.

Overall, incorporating knowledge on the normative development of depressive symptoms across adolescence alongside the examination of risk and protective factors is necessary to inform the creation of such intervention and prevention programs. There is an ongoing need for large-scale randomised-control trials to evaluate the efficacy of these treatments in reducing the severity and impact of depression.

Conclusion and Recommendations for Future Research

Overall, adolescence presents a unique period of developmental vulnerability and opportunity for intervention to reduce the severity and impact of depressive symptoms at clinical and sub-clinical levels.

While there is a vast literature on adolescent depression with many unknowns that require further examination, it is clear that depression has significant negative impacts on long-term quality of life and achievements. There is a general trend of increasing depressive

symptoms and rates of diagnosis across adolescence, particularly for girls. However, as emerging literature on trajectories of depression has indicated, not all young people experience the same progression of symptoms in the same patterns over time. Furthermore, a number of risk and protective factors have been associated with adolescent depression, although replication within a context of heterogeneity in adolescent depression is a necessary next step to solidify this evidence base.

Several additional methodological concerns emerged from this review. Firstly, there is a need for further consistent, population-level surveys which capture global trends in prevalence rates at regular intervals. Obtaining larger sample sizes is necessary for this work to identify at-risk demographic populations such as Indigenous Australian adolescents. With regard to the longitudinal trends, there is a need for researchers to explicitly report on their statistical assumptions and develop a standardised way of conducting trajectory analysis. Conclusions drawn from studies using these two methods have a significant impact on how the research community view the development of depression during adolescence.

The utilisation of an applied lens in the study design is necessary to ensure that research can be incorporated in practice to assist in the development and improvement of programs aimed at reducing depression for all young people.

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Tables

Table 1

Summary of Studies that Involve Trajectory Modelling to Identify Subgroup Profiles of Adolescent Depression

Reference	No. of Groups	Trajectory Method	Predictors Examined
Brendgen, et al. (2005)	4	GBTM	Problematic relationship with parents, same- and other-sex peers
Dekker, et al. (2007)	6M, 6F	GBTM	-
Sallinen, et al. (2007)	4	GBTM	Spill-over from parental work, the parent-adolescent relationship (intimacy, companionship, conflict) and number of stressful life events
Costello, et al. (2008)	4	GBTM	Race/ethnicity, parent education, substance use, delinquent behaviour, two-parent family, connection (parents, peers, and school as a composite) and self-esteem
Mazza, et al. (2010)	5 M, 5F	GBTM	Anxiety, peer rejection, social competency, stressful life events, family conflict, low income, academic performance, parent depression, being shy/withdrawn, attention difficulties, and anti-social behaviour
Chaiton, et al. (2012)	3 M, 3F	GBTM	-
Duchesne & Ratelle (2014)	4	GBTM	Attachment security to mother and father
Whalen, et al. (2016)	3 M, 3 F	GMM	Cumulative social adversity/risk (single-parent household, maternal psychopathology, foster care, physical or sexual abuse, parental arrest, poverty), family history of affective disorders, functional impairment, and preschool onset ODD/CD
Ellis, et al. (2017)	4	GMM and GBTM	Gender, socioeconomic status (SES), temperament profile, childhood neglect, and abuse
Mezulis, et al. (2013)	3	GMM	Negative affectivity, pubertal timing, gender, cognitive style, and rumination
Cumsille, et al. (2015)	4	GMM	Adolescent irritability, maternal warmth, demandingness, and disrespect
Fernandez Castelao & Kroener-Herwig (2013)	3M, 4F, and 4 total	GMM	Mother's depressive symptoms, number of life events and loss events
Yaroslavsky, et al. (2013)	3	GMM	Family social support, friend social support, academic problems, health problems, coping, dysfunctional attitudes, interpersonal dependency, loneliness, self-esteem, parental lifetime diagnosis

The Role of Social Support in Differentiating Trajectories of Adolescent Depressed Mood

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Abstract

This study explored to what extent social support from school, peer, and family contexts differentiated identified trajectories of depressed mood in 3,210 Australian adolescents (49% girls) based on self-reported data collected at four annual time points from Grade 6 to 9 (ages 10-16). Group Based Trajectory Modelling was used to identify four trajectory groups for girls (*Low Stable, Moderate Decreasing, Moderate Increasing and High Increasing*) and boys (*Low Stable, Moderate Stable, Moderate Decreasing, High Stable*). Multinomial Logistic Regression revealed that higher rates of family support, school climate, and peer belonging were associated with membership in low and moderate symptom groups compared to high symptom groups for both genders. Implications for early intervention and prevention programs aimed at reducing the onset and severity of depression in adolescence are discussed.

Introduction

Adolescence is a critical developmental period marking the transition between childhood and adulthood, during which young people are at increased risk for the onset of depression. Population-based research have estimated an increase in the prevalence of depressive disorders from 1.1% in childhood (ages 4-11) to 7.7% in adolescence (ages 11-17) with girls twice as likely to develop a disorder compared to boys by the time they reach age 14 (Andersen & Teicher, 2008; Dahl, 2004; Lawrence et al., 2015; Paus, Keshavan, & Giedd, 2008; Sawyer et al., 2000; Telethon Kids Institute, 2015). This pattern and gender divide continue to increase in severity and stability into late adolescence and early adulthood (Hankin et al., 1998; Wade, Cairney, & Pevalin, 2002). Further research on adult mental health suggests that between half and three-quarters of adults with a depressive disorder retrospectively identify the experience of symptoms prior to age 19 (Kessler et al., 2005; Patton et al., 2014; Wilcox & Anthony, 2004). In addition to cases meeting the diagnostic threshold for a depressive disorder, research suggests that around 30% of adolescents have at least one symptom of depression and around 19.9% report high levels of psychological distress (Lawrence et al., 2015; Roberts, Lewinsohn, & Seeley, 1995).

These findings are a concern due to the significant negative impact of depression across the lifespan. The presence of depressive symptoms in adolescence, even at subclinical levels, has been linked to poor school attendance (Lawrence et al., 2015), delinquency (Diamantopoulou, Verhulst, & van der Ende, 2011), self-injurious or suicidal behaviour (Telethon Kids Institute, 2015), low physical health (Naicker, Galambos, Zeng, Senthilselvan, & Colman, 2013), illicit substance abuse and dependence (McLeod, Horwood, & Fergusson, 2016), and a high degree of overall functional impairment (Lawrence et al., 2015).

Therefore, the emergence of any depressive symptoms in adolescence is a mental health challenge that requires exploration to assist in mapping normative trends and critical points of

onset. Identifying such patterns, alongside consideration of early predictive factors, may assist in the development and conceptualisation of intervention programs aimed at reducing the severity and onset of depressive disorders during this vulnerable time.

Longitudinal Patterns of Adolescent Depressive Symptoms

When examining the longitudinal trends in adolescent depression, researchers have identified an increase in symptom severity and cases meeting the diagnostic threshold over the course of adolescence (Holsen, Kraft, & Vitterso, 2000; Oldehinkel, Wittchen, & Schuster, 1999). However, recent research using trajectory modelling methods developed by Nagin (1999, 2005) and Muthén (2006) has challenged this conclusion, by identifying heterogeneity in the progression of depressive symptoms. Such studies have consistently found that multiple subgroups better explain the patterns in adolescent depression than a whole-sample trend (Shore, et al., 2018 for review). These studies draw upon general population samples rather than clinical samples, to identify developmental trends of all degrees of depressive symptoms across adolescence.

To date, there has been no consensus on the specific number of groups or the patterns across adolescence, with anywhere between three and six groups identified in a given sample (Chaiton et al., 2013; Dekker et al., 2007; Whalen et al., 2016; Yaroslavsky, Pettit, Lewinsohn, Seeley, & Roberts, 2013). Further, while most studies identified a large low and stable group (a pooled effect estimate of 56% (Shore et al., 2018)), the remaining groups vary significantly with increasing, decreasing, and u-shaped patterns with varying proportions identified across studies, highlighting the need for further investigation.

A further point of commonality across studies of trajectory groups in adolescent depression is the inclusion of gender as a predictor of group membership. For studies that use a sample with both girls and boys, girls were consistently shown to be more likely than boys

to be in high symptom groups or a group with an increasing pattern (Brendgen, Wanner, Morin, & Vitaro, 2005; Costello, Swendsen, Rose, & Dierker, 2008; Cumsille, Martínez, Rodríguez, & Darling, 2015; Musliner, Munk-Olsen, Eaton, & Zandi, 2016; Yaroslavsky et al., 2013). In broader literature examining the influence of gender on the experience of depression, researchers have identified that in addition to experiencing higher rates and increases in depressive symptoms over time, there is evidence that girls experience different expressions of depressive symptoms (Andersen & Teicher, 2008; Government of South Australia, 2017; Paus et al., 2008). Data from a study by Bennett, Ambrosini, Kudes, Metz, and Rabinovich (2005) showed that adolescent boys are more likely to experience anhedonia (emotional numbness) and morning fatigue, while girls are more likely to report low self-esteem and associated body concerns during episodes of Major Depressive Disorder. Further, researchers have suggested that differences in the socialised emotional expression, hormonal changes associated with menarche, and differing rates of adverse social experiences may contribute to gender differences in the experience of depressive symptoms (Angold & Worthman, 1993; Bennett et al., 2005; Compas et al., 1997; Petersen, Sarigiani, & Kennedy, 1991).

It is, therefore, possible that the influence of gender found in trajectory studies reflects uniqueness in the number and shape of depression symptom trajectories for girls compared to boys. In line with this consideration, several studies have undertaken their trajectory analysis by splitting their sample to separate girls and boys. In a study of German school children, Fernandez Castelao and Kroner-Herwig (2013) found that girls and boys both had three subgroups of similar shape and severity (a low increasing, moderate, and high decreasing group) but that girls had a unique extra subgroup that they labelled as very high stable. Two further studies have identified the same number of groups for both girls and boys but with different patterns. Several studies have shown that girls' experiences of depressive symptoms were better captured by higher onset symptoms and both gradual and rapidly increasing

patterns, while boys' trajectory patterns showed lower severity groups that tend to decrease across adolescence (Dekker et al., 2007; Whalen et al., 2016). Contrary to these findings, Mazza, Fleming, Abbott, Haggerty, and Catalano (2010) split their sample by gender but found the same number of groups and patterns of progression for girls and boys.

While all trajectory studies agree that there are differences in adolescent depression that are better explained by multiple groups rather than an overall sample average, findings on whether developmental patterns are gender specific are mixed and require further investigation.

Influence of Early Protective Social Supports

While mapping the progression of adolescent depression is important to better understand the development and onset of symptoms, examination of predictive influences is also required to identify characteristics that differentiate group membership.

Social support in early adolescence has been shown to have a direct promotive effect on lowering rates of depression as well as acting as a buffer when adverse events are experienced (Rueger, Malecki, Pyun, Aycock, & Coyle, 2016). In the wider literature on adolescent depression, high-quality parental relationships have been shown to be correlated with lower levels of depression in adolescents (Babore, Trumello, Candelori, Paciello, & Cerniglia, 2016; Johnson & Galambos, 2014). Hu and Ai (2016) suggest this is in part due to the impact of the parental relationship on the development of self-esteem which in turn acts as a protective factor in reducing depressive symptoms. From an attachment perspective, Schwendemann, Kuttler, Mossle, and Bitzer (2018) suggest that good attachment to parents was correlated with opportunities for prosocial involvement and lower rates of depression. The role of family involvement is supported by another study which shows that family ritual was positively associated with social connectedness and negatively associated with depression (Malaquias, Crespo, & Francisco, 2015). While much of this research explores a direct impact

of parental support on depression, there is also evidence that having positive parental support can minimize the negative impacts of adverse life events such as peer victimization (DeLay, Hafen, Cunha, Weber, & Laursen, 2013) and the stress of newfound romantic relationships (Anderson, Salk, & Hyde, 2015), as well as protect against suicide attempt (Consoli et al., 2013; Soylu, Taneli, & Taneli, 2013). Additionally, Raffaelli et al. (2013) found that family support played a unique role in buffering against the impact of stress on depression.

Peer support and friendships also play a role in adolescent depression. Kochel, Bagwell, Ladd, and Rudolph (2017) suggest that friendship may be protective in reducing exposure to peer victimisation and rejection as well as minimising the negative impact of such rejection. These authors suggest that having friendships reduces the desirability of the person as a target for bullying, which is usually aimed at the easiest target. Further, if bullying did occur, having a friend to talk to and receive comfort from served as a protective factor between the adverse event (bullying) and the outcome (in this case, depressive symptoms). However, Burke, Sticca, and Perren (2017) found no mediating association and instead suggest that friendships have an overall promotive effect associated with lower levels of depressive symptoms over the long term. A direct effect is supported by Reindl, Gniewosz, and Reinders (2016) who found that young people learnt adaptive coping strategies from their best friends which led to improved emotional regulation and lower rates of depression.

Adolescents spend a large portion of their time in school and this provides an additional social context for support. Evidence suggests that having a positive school environment and relationships with teachers can also help lower rates of youth depression. Markowitz (2017) found that school connectedness, measured as a sense of belonging and perceived receipt of support, was both a promotive and protective factor for adolescents. This is supported by Briere, Pascal, Dupere, and Janosz (2013) who found that the positive experience of school

climate indicated by measures of fairness, safety, learning opportunities, clarity of rules in Grade 8 was associated with lower rates of depression in Grade 10-11. When school support is examined in more detail, there is evidence that teacher-led support may be the most important predictor related to youth wellbeing within a school context (Allen, Kern, Vella-Brodrick, Hattie, & Waters, 2016).

While some research reduces social support into a general variable (Colman et al., 2014), other studies have focused on comparing and testing the relative influence of different origins of social support throughout adolescence. The results of these studies are not consistent. While adolescence has been considered a time where youth detach from their family, experience high rates of conflict at home, and prefer companionship with peers (Larson, Moneta, Richards, Holmbeck, & Duckett, 1996), the family environment may still function as a more stable environment for support than changing peer dynamics during adolescence (Khatib, Bhui, & Stansfeld, 2013). This conclusion is supported by Jose and Pryor (2010) who suggest that family connectedness was the most powerful influence on adolescent well-being compared to peer, school, and community support. However, Murshid (2017) found that low levels of parent support were not protective against developing depressive symptoms while having even a single close friend was. Further, Zhang, Yan, Zhao, and Yuan (2015) found that friend support was the only moderator between stress and depressive symptoms when compared with family support.

Furthermore, gender differences have been identified in social support. Lewis et al. (2015) found that while both girls and boys benefited from an emotional connection to parents, the effect was stronger for girls. Wang, Zhang, Pan, and Gao (2014) found that both girls and boys benefited from family-based support but girls experienced additional benefits from school-based support.

While many trajectory studies have examined the predictive role of negative social relationships marked by conflict, abuse, and rejection (Brendgen et al., 2005; Ellis et al., 2017; Mazza et al., 2010; Sallinen, Rönkä, Kinnunen, & Kokko, 2007; Whalen et al., 2016), few have examined social support as a protective factor which differentiates trajectory group membership. Costello et al. (2008) explored perceived support from parents and friends as well as a sense of school connection in a combined measure of social support. They found that participants with higher levels of social support were more likely to be in the 'no depressed mood' group compared to the 'low' and 'early high' groups identified in their study. This finding is supported by Brendgen et al. (2005) who identified that poor social support from parents was associated with three elevated depression trajectories compared with a low symptom group. However, other researchers have identified no relationship between trajectory groups and connection and support from parents or friends (Sallinen et al., 2007; Yaroslavsky et al., 2013).

The mixed results from trajectory studies may reflect methodological limitations in exploring multiple predictive factors from different biopsychosocial origins in the one study. For example, Yaroslavsky et al. (2013) found no effect of family or friend support but also examined academic problems, health problems, coping style, dysfunctional attitudes, interpersonal dependency, loneliness, self-esteem, and parental lifetime diagnosis of mental health condition. Further, while Costello et al. (2008) found evidence in favour of social support, the use of a composite score does not reflect the differences between contexts of social support found in the wider literature. Further examination of social supports is required to explore their predictive value.

Current Study Aims

The current research aims to extend the knowledge in the field of adolescent depression by examining the trajectories of depressive symptoms across a sample of Australian

adolescents and evaluating the predictive value of social support from school, peer and family contexts. Given the strong predictive value of gender across all research in this area, it was anticipated that splitting the sample by gender would result in different number or shape of trajectory groups for girls compared to boys. Based on the findings of previous studies, it was anticipated that there would be between 3 and 6 groups for each gender, a low symptom group in both, and at least one group that showed increasing symptoms for girls and one that showed a decreasing trend for boy across adolescence.

This study aimed to further extend knowledge on the protective value of support by isolating support from other risk and protective factors, and examining support from school, family, and peers as separate predictors of group membership. It was anticipated that different origins of social support would be salient for girls and boys although no specific hypotheses were created, and analysis was exploratory in this area.

Additional variables associated with population-level risk were considered. Ethnicity and socioeconomic status have been identified as predictors of group membership in previous trajectory studies (Costello et al., 2008; Wickrama, Noh, & Elder, 2009) while Indigenous and Torres Strait Islander youth within Australia experience higher rates of emotional distress (Australian Bureau of Statistics, 2010; Shepherd, Li, Mitrou, & Zubrick, 2012). Therefore, Indigenous Status, Culturally and Linguistically Diverse Background, and Socio-economic Status were controlled for in the analyses.

Method

Procedure

The data used for this study were from the Wellbeing and Engagement Collection (WEC), a population-level survey of adolescent wellbeing conducted annually by the South Australian Government Department for Education. The WEC broadly aims to add to

population-level data on students, which has largely emphasised academic achievement, by compiling measures of psychosocial well-being and contextual assets that can be used to inform intervention programs and evaluate their effectiveness. Each year since 2014, all Government, Catholic and Independent schools across South Australia were invited to participate in the annual survey (see Gregory et al. (2018) for details of recruitment procedure and participation rates). Opt-out parental consent procedures were used, followed by active consent from students. The survey was conducted online during school hours under teacher instruction and took approximately 20-45 minutes to complete. After submission of the questionnaire, all participants were provided with the opportunity to complete a 'Help for student' form to refer any issues arising from participation to a school counsellor. For the purposes of this study, data were extracted from the WEC records from 2014 to 2017 inclusive, providing four, annual waves of data.

Measures

The WEC utilises a version of the Middle Years Development Instrument (MDI) adapted for use with Australian adolescents (Gregory et al., 2018). The MDI is a 71-item self-report questionnaire that explores key areas of wellbeing across five domains: (a) social and emotional development, (b) connectedness to adults and peers, (c) school experiences, (d) physical health and wellbeing, and (e) use of after-school time. The survey was designed by using shortened forms of existing psychometric scales to enable implementation in large-scale population data collection. The MDI was originally validated for Canadian school children and has been recently adapted to the Australian context (Gregory et al., 2018). It shows good overall psychometric properties and is suitable for the purposes of this research. Detailed information about the creation and validation of the MDI is published extensively elsewhere (Guhn et al., 2012; Schonert-Reichl et al., 2013). Selected measures, as follows, were extracted from the overall dataset to meet the current study aims.

Depressive symptoms. Averages of depressive symptoms were collected at each of the four data collection waves (2014, 2015, 2016 and 2017) via the 3-item *Depressed Mood* (Sadness) scale in the MDI. This scale was adapted from the depression sub-scale of the Seattle Personality Questionnaire and included 3-items such as "I feel upset about things" on a 5-point Likert scale (1=Disagree a lot, 5 = Agree a lot). The internal consistency of the scale was acceptable (Cronbach's alpha ranged from 0.67-0.87). To maximise the availability of data for this study, averages across the three items were calculated if at least one item was answered.

As depressed mood formed the core measure for this study, additional analysis of missingness was undertaken. Data were missing for Depressed Mood scores at Grade 6 (0.09%), Grade 7 (26.07%), Grade 8 (37.73%), and Grade 9 (49.19%). Analysis of missingness for Depressed Mood was conducted using Little's MCAR test χ^2 (19) = 24.86, p=0.17 (Little, 1988), indicating that there is no evidence to suggest that the data were not missing completely at random. Therefore, the data were considered suitable for use in this study without further adjustment.

School support. School support was explored via two separate subscales in the MDI. First, a measure of *School Climate* (Supportive School Environment) involved 3 items such as "People care about each other in this school" rated on a 5-point Likert scale (1= Disagree a lot, 5=Agree a lot). Second, a measure of perceived *Teacher Support* was taken from the Connectedness to Adults at School scale which included 3-items such as "At my school, there is a teacher or another adult who listens to me when I have something to say". This scale was measured on a 4-point Likert scale (1= Not at all true, 4=Very much true). The scale scores for each variable were calculated as the average score across all items in that scale if all items were answered.

Family support. *Family support* was measured by a single scale relating to perceived Connectedness to Adults at Home. Similar to the Connectedness to Adults at School scale, this scale involved 3-items relating to how much a participant felt that "In my home, there is a parent or another adult…who I can talk to about my problems" and similar statements. This scale was measured on a 4-point Likert scale where 1= Not at all true and 4=Very much true and a scaled score was taken if all items were answered by the participant.

Peer support. Peer Support was assessed using two separate measures capturing different aspects of peer relationships. General peer support was measured using the *Peer Belonging* scale from the MDI. This 3-item scale included statements such as "When I am with other kids my age, I feel I belong" that participants were asked to respond to on a 5-point Likert scale (1=Disagree a lot, 5=Agree a lot). The construct of close friendships or individual relationships was measured via the *Friendship* (Friendship Intimacy) scale. This scale was composed of 3 items, such as "I have a friend I can tell everything to" assessed on a 5-point Likert scale (1=Disagree a lot, 5=Agree a lot). Consistent with other support measures, higher scores for both scales indicated higher levels of perceived peer support and averages were calculated where all items had been completed.

Data for all social support factors were collected from the 2014 survey wave for all participants. No more than 1% of data were missing for each social support factor. Therefore, missing data is unlikely to have any substantive impacts on the conclusions drawn.

Demographic information. Information on participant age, gender, Australian Aboriginal and/or Torres Strait Islander status (hereafter *Indigenous* status), language spoken at home, and postal code of residence in 2014 were obtained from the Department for Education administrative records or the brief demographic questions at the start of the MDI. Age was calculated from the date of birth and the month of survey completion for each wave of data

collection. Language spoken at home was re-coded to a Yes/No variable where Yes indicated a language other than English was spoken at home and was used as an identifier for Culturally and Linguistically Diverse (CALD) participants. Postal codes were used to assign an area-level estimate of socioeconomic status (SES) to each participant based on the Index of Relative Disadvantage calculated by the (2013). The ABS use information about income, education, employment, occupation, and housing from the five-yearly Australian census to create area-based SES deciles which were then collapsed into quintiles for this study (where 1= most disadvantaged communities, 5=least disadvantaged communities).

Participants

The sample for this study was the cohort of participants who were in Grade 6 for the 2014 WEC. Data for these participants were linked across four annual waves of data collection corresponding to Grade 7 (in 2015), Grade 8 (in 2016) and Grade 9 (in 2017). Although an initial 4,450 participants completed the WEC in this cohort, the Department for Education was only able to link participant data over time for adolescents who attended a government/public school (n=3,210, 72%) and these participants made up the analysis sample for this study. Table 1. provides a summary of the demographic breakdown of the sample and the distributions by gender. Participants ranged from 10 to 16 years of age across the waves of data collection. The linked sample contained 118 participants (3.7%) who identified as Indigenous along with around 15.7% who identified as CALD. Participants were reasonably evenly distributed across socioeconomic disadvantage backgrounds with around 15-25% of participants falling into each SES quintile, although there were relatively more participants in the most disadvantaged group (27.09%) and fewer in the least disadvantaged group (14.16%).

Statistical Analysis

Following the provision of a linked data set by the Department for Education, initial data cleaning and conversion of postcode to SES quintile was undertaken by researchers in SPSS Statistics 25 (IBM Corp., 2017).

Group Based Trajectory Modelling (GBTM) was conducted by using the PROC TRAJ program (Jones, 2012) (available via https://www.andrew.cmu.edu/user/bjones/) as a plugin for Stata version 15 (StataCorp., 2017). GBTM is a statistical method for identifying developmental trajectories in general population samples (Nagin, 1999, 2014). This model identifies subgroups within a population that have similar longitudinal patterns, providing a useful way of defining participant data for further investigation (Frankfurt, Frazier, Syed, & Jung, 2016; Nagin & Odgers, 2010). Unlike other trajectory modelling methods, GBTM does not allow for within-class variance; the individual trajectories within each latent subgroup are assumed to be homogeneous. Heterogeneity between individuals is instead accounted for by differences in probabilities of group membership, which are estimated for each individual subject.

The PROC TRAJ program accounts for missingness in the Depressed Mood variable by utilising maximum likelihood estimation. The discrete trajectory groups are fitted using general regression modelling, of which higher-order polynomials can be specified. For the trajectories of Depressed Mood scores, of which data was available for up to four time points, a quadratic model was initially selected. In line with the research aims of this study, trajectory analysis was conducted separately for girls and boys using a Censored Normal model. GBTM allows for any number of trajectory groups to be modelled. Models ranging in size from two trajectory groups up to six trajectory groups were examined. Starting from the two-group model, group size was increased in increments of 1, and the overall model fit was assessed at each stage. The two best-fitting models as identified using the Bayesian Information Criteria

(BIC) score for all observations were compared to each other using additional model fit criteria as suggested by Nagin (2005). These criteria were (a) the absolute difference between estimated and actual group membership, which should be as close as possible to 0; (b) the Average Posterior Probabilities (APPA) which should be close to 1 but a value of 0.7 or higher for all groups indicates good model fit; and (c) the Odds of Correct Classification (OCC), which should be greater than 5 for all groups. Furthermore, as per Jung and Wickrama (2008), no group should have membership size comprising less than 1% of the sample. Once the number of groups was selected, a further step was taken to vary the shape of the trajectory given that number of groups (i.e. varying the order of the polynomial, from intercept only (zero), linear (first-order), or quadratic (second-order)) by examining all possible permutations. The trajectory slopes in the final models for girls and boys were then given labels based on the qualitative features of stability of symptoms (stable, increasing, decreasing) and severity of symptoms (high, moderate, low).

Using the final trajectory models selected for girls and boys, all participants were assigned to the trajectory group for which they had the highest estimated probability of membership. The assigned group membership was then treated as an observed categorical variable and was used as the outcome for further analyses conducted using Stata, version 15(StataCorp., 2017). Multinomial Logistic Regression (MLR) was used to examine the predictive effect of social support on group membership, separately for girls and boys. The trajectory group with the highest overall level of depressive symptoms was set as the referent category for each model. To account for the clustering of students within schools, robust standard errors were specified. Univariable models initially specified to separately test the association between each form of social support and membership into the different trajectory groups. Second, a set of pre-specified demographic variables (Indigenous, CALD, and SES status) were added to each of the univariable models to explore whether the association

between each social support and trajectory group membership changed after adjusting for the background characteristics of the participants. Finally, a multivariable model with all predictor variables included was run to test the relative effects of different origins of social support. Effect sizes (Relative Risk Ratios, RRR) were obtained from each MLR and can be interpreted as the effect of a 1-point increase in the predictor variable (e.g. Peer Belonging) on the odds of belonging to one of the lower depression trajectory groups compared to highest depression symptom group (the referent group).

Results

Description of Sample

As a whole, the sample showed moderate levels of depressive symptoms across all four years, with girls showing slightly higher averages at each data collection point (Table 2). Over the four years, boys showed a tendency to decrease in severity of symptoms while girls show a tendency to increase. Average levels of social supports in Grade 6 suggest that Family Support and the two forms of Peer Support were rated highly and that all contexts of social supports were rated with moderate to high scores across both genders.

Insert Table 2 about here

Estimating Trajectory Models

The appropriate number of trajectory groups to be modelled was selected on the basis of BIC. Compared to a two-group model, the addition of groups improved the BIC for models with to 5 groups, after which model fit did not improve with the addition of more groups (Table 3). As the four-group and five-group models had similar BIC scores, additional criteria for model fit were applied to further compare these two candidate models.

Insert Table 3 about here

Insert Table 4 about here

For girls, a four-group model provided the best model fit due to low APPA across the five-group model (Table 4). However, for the boys this distinction was unclear and a comparison of the subjective difference in the plotted models was examined. While the 5-group model revealed a unique low- increasing pattern, this group only contained 17 participants (representing 1.04% of the sample). Although Jung and Wickrama (2008) indicate that 1% is the lowest recommended group size, having such a small group was deemed unsuitable for fitting a multinomial regression model. Therefore, the 4-group model was ultimately selected for boys (where the smallest group comprised 6.6% of the sample).

Figure 1. provides a visual representation of the final estimated trajectory group models for both girls and boys after varying the shapes within the 4-group models. The final model for girls had a small group of participants (accounting for an estimated 7.4% of the sample) that maintained a *Low Stable* level of symptoms across time. Two groups with linear slopes were identified that started with moderate levels of symptoms that either increased or decreased over time. These were labelled as *Moderate Decreasing* (representing an estimated 35.9% of the sample) and *Moderate Increasing* (representing an estimated 48.5% of the sample). A final group that began with a high level of depressed mood that steadily increased in a linear fashion over time was labelled *High Increasing* and accounted for an estimated 8.2% of the sample.

The final model for boys also had an identified *Low Stable* group that accounted for an estimated 6.6% of the sample. Two further stable groups were identified with a moderate level of symptoms and an elevated level of symptoms, although the elevated level did not reach the

highest level of symptoms possible within the range. These were labelled as *Moderate Stable* and *High Stable* and represented an estimated 38.8% and 12.9% of the sample of boys, respectively. A fourth group was identified that had moderate symptoms initially (similar to the *Moderate Stable* group) but showed a steady decline in symptom severity over time. This group was labelled *Moderate Decreasing* and accounted for the largest proportion of the sample (representing an estimated 41.7% of boys).

Insert Figure 1 about here

Multinomial Logistic Regression

Girls. After assigning each participant to their most likely group membership (as estimated by the model), there were 5.9% of girls in the *Low Stable* group (n=93), 53.36% in the *Moderate Increasing* group (n=841), 34.64% in the *Moderate Decreasing* group (n= 546) and 6.09% in the *High Increasing* group (n=96). The *High Increasing* group was used as the referent group for all MLR models.

The results from the univariable (unadjusted) models showed that higher levels of all forms of social support were associated with increased odds of being in one of the moderate or low depressed mood trajectory groups (Table 5). The exception was the effect of Friendships where the level of reported support differentiated the *High Increasing* group from the *Moderate Decreasing* (RRR=1.55, $p<0.001$) and *Low Stable* (RRR=2.06, $p<0.05$) groups but not the *High Increasing* and *Moderate Increasing* group (RRR=1.09, *ns*). When the univariable models were adjusted for the demographic factors (see Methods), no marked changes in significance or magnitude of effect were observed for any of the social supports. This indicated that there was little confounding in the effect estimated due to these factors. As such, the adjusted univariable models are not reported here.

Insert Table 5 about here

The multivariable model for girls indicated that the demographic and social support variables explained 10% of the variance in depressed mood trajectories (R^2= .10, p<0.001). Model adequacy was assessed using the Hosmer-Lemeshow test (based on 9 groups) and the results indicated good overall fit (p= 0.523). While Teacher Support and Friendship were significant predictors of group membership in the univariable models, their effects became smaller and non-significant after adjusting for the influence of other social support variables in the multivariable model (Table 5). There was evidence for strong effects for the predictors School Climate, Peer Belonging, and Family Support in differentiating groups within the multivariable model. Compared to those in the *High Increasing* symptom group, participants in the *Moderate Decreasing, Moderate Increasing,* and *Low Stable* groups were more likely to report higher levels of Peer Belonging and Family Support. School Climate differentiated the *High Increasing* group from the *Low Stable* (RRR=2.04, p<0.001) but not the *Moderate Decreasing* (RRR=1.27, *ns*) and *Moderate Increasing* groups (RRR=1.00, *ns*).

Boys. After assigning the most likely group membership to each participant, there were 3.98% of boys allocated to the *Low Stable* group (n=65), 38.13% in the *Moderate Stable* group (n=623), 45.04% in the *Moderate Decreasing* group (n=736) and 12.85% in the *High Stable* group (n=210). The *High Stable* group was used as the referent group for all MLR models.

The results from the univariable models showed that higher levels of all forms of social support were associated with increased odds of being in one of the moderate or low depressed mood trajectory groups, compared to the *High Stable* group (Table 6). The multivariable model for boys indicated that the demographic and social support variables combined explained 8.5% of the variance in depressed mood trajectories (R2= .085, p<0.001) and showed good overall

model fit according to the Hosmer-Lemeshow test (based on 9 groups, p= 0.204). The effects of social support from School Climate, Peer Belonging, and Family Support remained significant in the multivariable model, while Teacher Support and Friendships showed smaller, non-significant effects. However, School Climate and Family Support were non-significant in differentiating the *High Stable* and *Moderate Stable* trajectory groups. Peer Belonging differentiated all trajectory groups (Table 6).

Insert Table 6 about here

Discussion

Trajectories of Depressed Mood

Consistent with our hypotheses, splitting the sample by gender revealed different patterns of depressed mood for girls and boys, although the number of trajectory groups was matched. Both girls' and boys' rating of depressed mood across the four years of data collection were best described by a four-group model. The number of groups identified is consistent with previous trajectory studies using both gender-divided and combined samples (Brendgen et al., 2005; Costello et al., 2008; Cumsille et al., 2015; Duchesne & Ratelle, 2014; Ellis et al., 2017; Sallinen et al., 2007), strengthening the evidence for the existence of such subgroups.

Within the separate four-group models there were recognisable differences in the distribution and shapes of the trajectory groups by gender. The four-group model for girls revealed most participants had a moderate level of depressive symptoms in Grade 6 with two divergent patterns that either increased or decreased across adolescence. A further increasing group was identified who had high depressive symptoms in Grade 6 that progressed to a higher level by Grade 9. Although this group totalled a small proportion of the total sample of girls, it is concerning that more than 1 in 20 participants already had high symptoms at the beginning

of adolescence that worsened over time, suggesting that further research is required to track these patterns starting at an earlier age. The identification of high levels of depressive symptoms and two groups with increasing patterns are consistent with research that shows an overall trend of increase in depressive symptoms in girls over the course of adolescence (Andersen & Teicher, 2008; Paus et al., 2008). However, there was no indication of a particular spike in symptoms apparent around age 14 (approximately Grade 8) as suggested by Hankin et al. (1998) and Wade et al. (2002). The identification of a large group of girls who experience a decrease in depressive symptoms is in contrast to previous literature and warrants further investigation.

The four-group model for boys revealed more stability in the progression of depression over adolescence. Three groups with relatively no fluctuation were identified at different levels of severity: high, moderate, and low. While it is promising to find that there was not a dramatic increase in any group, it is concerning that there were very little fluctuations across this time and that there was a consistently high symptom group, particularly as long-term depressive symptoms can have significant negative consequences (McLeod et al., 2016; Naicker et al., 2013). The fourth group, comprising nearly half of the participants, began with moderate symptoms that decreased to match the *Low Stable* group by Grade 9. This group is consistent with previous research that suggest a tendency for boys to resolve their depressive symptoms over the course of adolescence (Dekker et al., 2007; Holsen et al., 2000; Whalen et al., 2016).

Both girls and boys had a small percentage of participants who fell into a low and stable group with almost no fluctuation in symptoms over time. The finding of a small, *Low Stable* group in both the girls' and boys' model is contrary to previous studies where the lowest symptom group had the largest number of participants (Shore et al., 2018). This may be an artefact of the measurement tools used within this study, as the Australian validation study shows that the Depressed Mood scale on the MDI is normally distributed (Gregory et al., 2018),

whereas most depression scales are strongly positively skewed with floor effects, whereby a significant proportion of the population score the minimum possible score.

While previous trajectory studies which use a combined male/female sample have consistently identified that being female increases the odds of being in a high-symptom group (Brendgen et al., 2005; Costello et al., 2008; Cumsille et al., 2015; Musliner et al., 2016; Yaroslavsky et al., 2013), the results from the present study suggest that this may reflect gender-specific patterns in trajectories. Boys showed a tendency for stability in their depressive symptom groups while girls showed fluctuations and higher, increasing patterns over the four-year span. Future research should continue to split their sample by gender to avoid overlooking this aspect of heterogeneity.

Predictive Value of Social Support

In addition to identifying the longitudinal patterns in depressed mood through adolescence, this study examined the role of early social supports in differentiating group membership. As hypothesised, different profiles of adolescent depressed mood were associated with differences in the level of social support from school, family, and peer contexts, such that an increase in social supports was associated with membership in a moderate or low symptom group compared with the high symptom groups for girls and boys.

The results from this study showed that the context of social support that differentiated group membership for girls and boys were the same, but the magnitude and the relative effect of those supports differed by gender. In the first instance, support from all contexts – family, peer, and school - differentiated group membership when examined individually. However, support from Friendships and Teacher Support were not significant for girls or boys after adjusting for supports from other contexts. When adjusting for all contexts of social supports, Peer Belonging, Family Support, and School Climate were associated with differentiating

group membership for both girls and boys, suggesting that despite differences in the longitudinal patterns of adolescent depression, the same contexts of social supports are important for both genders.

For girls, a strong effect of Family Support was identified. This suggests that even with the changing relationships found within parent-child dynamics through adolescence, early positive connections at home are associated with long-term patterns of low depressive symptoms. These findings supported previous research that highlights initial parent-child relationships as important in protecting against higher depressive symptoms throughout adolescence, particularly for girls (Brendgen et al., 2005; Lewis et al., 2015).

For boys, the strongest influence was identified for Peer Belonging, but Friendship was not a significant predictor. This was unexpected as many of the previous research studies suggest that the individual quality relationships (best friendships) are significant, rather than an overall sense of belonging (Burke et al., 2017; Kochel et al., 2017; Murshid, 2017). However, a high level of peer popularity has shown to have a protective effect on boys (Teunissen et al., 2011) and future research should investigate the potential mechanisms of this association.

When comparing the influence of supports from within a school context, Teacher Support was less influential than School Climate. This suggests that the sense of belonging and fairness in the school as a whole is more important in protecting against depression than an individual relationship. While this finding is consistent with previous studies that identified school climate as a promotive and protective factor for adolescents (Briere et al., 2013; Markowitz, 2017), it is contrary to Allen et al. (2016) who suggest that teachers are the influencing factor in schools.

While the level of social support reported at the start of data capture differentiated membership in the *High Increasing* (girls) and *High Stable* (boys) groups from the other identified groups, the findings from this study do not imply causality or direction of the effect. Adolescents who have high levels of depressive symptoms may withdraw from social settings, experience negative thought patterns that cloud their sense of connection, or have a literal lack of support around them (Ciarrochi, 2004; Katz, Conway, Hammen, Brennan, & Najman, 2011). Furthermore, social supports have been shown to fluctuate across adolescence with changes in family dynamics and preferences for peer interactions over time, as well as the transition from primary to secondary schooling which often involves attending a new school altogether (Khatib et al., 2013; Larson et al., 1996). Further research is required to map joint trajectory models of depressive symptoms and social supports over time, as well as explorations into the mechanisms underlying this association.

Implications

The findings of the current study highlight the protective effects of social supports on adolescents' experiences of depressed mood. Integrating these findings into existing therapeutic and prevention-based programs is an important next step to facilitate a reduction in depression during this time. While girls and boys experience the onset and progression of depressive symptoms differently, fostering broad social skills and connections (family cohesion and school and peer belonging) rather than building on individual relationships (friendships and teacher-student relationships) may be beneficial for both genders at the start of adolescence.

On an individual level, these findings highlight the heterogeneity and specific protective factors that interact with gender and the subgroups of depressive symptoms over adolescence. Adapting Cognitive-Behaviour Therapy (CBT) approaches to match these profiles, and focus on negative appraisal of social supports and fosters prosocial behaviours,

with regard to the gender of the individual who is receiving the therapeutic intervention, may benefit adolescents who are experiencing high levels of depressive symptoms at both clinical and subclinical levels (Australian Psychological Society, 2018; Hetrick, Cox, Witt, Bir, & Merry, 2016; Reyes-Portillo et al., 2014).

Additionally, these findings have implications for universal programs that aim to overcome the barriers of stigma and poor help-seeking commonly found in adolescents by bringing psychological care to the person (Lawrence et al., 2015). While there are gender differences in the context of social support and the specific patterns of depressive symptoms, the broad trends suggest that all adolescents may benefit from improving School Climate, Peer Belonging, and Family Support. Mapping developmental patterns across school grade levels is a benefit of this study, allowing for integration into prevention and early intervention programs that are increasingly being delivered through schools, rather than age-specific cohorts (Calear & Christensen, 2010; Carnevale, 2013; Dray et al., 2017; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Lawrence et al., 2015; Werner-Seidler, Perry, Calear, Newby, & Christensen, 2017).

Strengths and Limitations

Providing a closer examination of the predictive effects of different types of social supports is a strength of this study. Previous research has combined social supports into composite scores or assessed their influence alongside multiple other factors, potentially obscuring the unique effects of support from different contexts (Costello et al., 2008; Sallinen et al., 2007; Yaroslavsky et al., 2013). Given that social supports (and demographic factors) accounted for 10% of the variance in depressive groups for girls and 8.5% of the variance for boys, the current study highlights the importance of examining these factors and overcomes these limitations.

The use of a large, general population-based sample embedded in schools is a further strength of this study. As depressive symptoms occur on a spectrum, capturing how these develop in the general population is necessary to examine subclinical presentations and understand the onset of depressive disorders. The large sample also meant that participants could be split by gender while maintaining robust sample sizes for analysis, helping to reveal gender-specific patterns. Additionally, using a general-population sample overcomes the limitations of a previous Australian study that used extensive exclusion criteria to limit their analytic sample and thus the generalisability of their results (Ellis et al., 2017).

Despite the strengths of this study, the results should be interpreted considering several limitations. The use of a measure of depressed mood in adolescents to capture symptoms of depression was suitable for use in this study as depressed mood is a common symptom present across prodromal, subclinical, and clinical presentations and indicating that it may predict episodes of MDD (Bennik, Nederhof, Ormel, & Oldehinkel, 2014; Iacoviello, Alloy, Abramson, & Choi, 2010) and previous trajectory studies have used a shortened form of an existing clinical screening tool and isolated the construct of depressed mood to examine the trajectories of depression in adolescence (Brendgen et al., 2005; Costello et al., 2008; Sallinen et al., 2007). However, this limits the interpretability of the results, and the findings explored here should not be used to classify depression at a clinical level as the course and progression of episodes of MDD may cluster in a different way. Further, as depressed mood is only one symptom of MDD, even the high symptom groups should not be interpreted as a proxy for full criteria.

The use of a self-report measure was considered as a strength of the current study due to findings that internalizing disorders such as depression may be underreported by parents and teachers (Telethon Kids Institute, 2015). Using self-report in research that feeds back into programs and support for adolescents is consistent with the Melbourne Educational Goals

which stipulate that adolescents should have every opportunity to have a voice in research that directly affects their wellbeing (Ministerial Council on Education, 2008). However, this is a methodological limitation as only one data-source was used, and no alternative information source, such as a parent or teacher, was used to inform the validity of self-report.

Conclusions

Further studies are required to examine the directionality and mechanisms of the associations between social supports and depressive symptoms, while maintaining gender-divided samples, to ensure the variation between girls and boys is accurately captured in research.

Nonetheless, the current study adds to existing psychological knowledge on individual and gender-based differences in the development of depressive symptoms across the span of early adolescence and the protective factors that are associated with different developmental patterns. This information provides important preliminary insights that can be incorporated into the creation and targeting of prevention and early intervention programs. In particular, providing programs that focus on improving family supports and promoting a broad sense of belonging are important for both boys and girls to assist in reducing the severity of depressive symptoms.

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Tables and Figures

Table 1

Demographic Breakdown of the Whole Sample and for Each Gender

		Sample (n=3,210)		Boys (n=1634, 51%)		Girls (n=1576, 49%)	
		Mean	Range	Mean	Range	Mean	Range
Age	Grade 6	12.06	10.47, 13.5	12.09	10.47, 13.26	12.03	10.73, 13.5
	Grade 7	12.87	11.22, 14.06	12.9	11.22, 14.06	12.84	11.73, 14.02
	Grade 8	14.04	12.82, 15.47	14.07	12.82, 15.24	14.02	12.86, 15.47
	Grade 9	14.81	13.65, 16.22	14.83	13.65, 15.98	14.78	13.71, 16.22
		Frequency %		Frequency %		Frequency %	
Indigenous (Yes)		3.68		3.49		3.87	
Other Language at Home		15.74		15.13		16.37	
SES	1 (most disadvantaged)	27.09		27.72		26.44	
	2	15.25		15.12		15.39	
	3	18.29		17.03		19.60	
	4	25.21		26.12		24.27	
	5 (least disadvantaged)	14.16		14.01		14.30	

Note: Standard deviation in age for all years and genders ranged 0.34-0.35.

Table 2

Variable Averages and Standard Deviations at all Collection Waves

	Sample (n=3210)		Boys (51%, n=1634)		Girls (49%, n=1576)	
	Mean	SD	Mean	SD	Mean	SD
Depressed Mood						
Grade 6	2.70	0.94	2.67	0.92	2.73	0.96
Grade 7	2.66	0.94	2.60	0.91	2.73	0.98
Grade 8	2.61	1.11	2.43	1.05	2.79	1.16
Grade 9	2.68	1.14	2.43	1.10	2.92	1.13
School Support						
Teacher Support	2.97	0.75	2.88	0.78	3.05	0.72
School Climate	3.77	0.92	3.68	0.96	3.85	0.87
Family Support	3.47	0.67	3.45	0.68	3.49	0.66
Peer Support						
Friendship	4.35	0.90	4.20	0.96	4.51	0.79
Peer Belonging	4.11	0.89	4.12	0.91	4.10	0.88

Note: Teacher Support and Family Support scores range from 1 to 4, Depressed Mood, Peer Belonging, Friendship, and School Climate scores range from 1 to 5.

Table 3

Bayesian Information Criteria (BIC) Scores for Base Trajectory Models with Quadratic Slopes

Number of Groups	Boys	Girls
2	-6463.77	-6684.69
3	-6419.88	-6605.81
4	-6405.44	-6595.49
5	-6404.59	-6594.78
6	-6408.51	-6597.98

Note: BIC scores are based on all observations.

Table 4

Additional Model Fit Criteria for 4 and 5 Group Trajectory Models with Quadratic Slopes

Model	Group	Boys			Girls		
		Mismatch	APPA	OCC	Mismatch	APPA	OCC
4 group	1	1.62	0.78	134	1.72	0.73	96
	2	0.48	0.69	9	3.95	0.78	10
	3	3.63	0.72	8	0.06	0.74	13
	4	1.53	0.74	46	2.17	0.83	163
5 group	1	1.51	0.78	138	0.2	0.67	35
	2	1.41	0.74	424	3.2	0.58	49
	3	1.39	0.68	9	6.6	0.73	9
	4	4.01	0.72	9	1.9	0.65	12
	5	2.44	0.77	69	1.6	0.81	129

Note. Mismatch = the difference between the estimated and assigned group membership percentages, APPA = Average Posterior Probabilities of group membership, OCC = Odds of Correct Classification.

Table 5

Relative Risk Ratios with 95% Confidence Intervals from Multinomial Logistic Regression Models for Girls

Predictor	Teacher Support		School Climate		Family Support		Peer Belonging		Friendships	
	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI
	Univariable Models									
High Increasing (Ref)	-	-	-	-	-	-	-	-	-	-
Moderate Decreasing	1.86***	1.42, 2.44	2.12***	1.66, 2.71	4.95***	3.57, 6.86	3.05***	2.38, 3.90	1.55***	1.22, 1.96
Moderate Increasing	1.52**	1.19, 1.94	1.37**	1.13, 1.64	2.11***	1.66, 2.68	1.62***	1.32, 1.97	1.09	0.87, 1.35
Low stable	3.06***	1.92, 4.89	4.33***	3.03, 6.19	28.25***	11.86, 67.27	5.87***	3.59, 9.59	2.06*	1.17, 3.64
	Multivariable Adjusted Model									
High Increasing (Ref)	-	-	-	-	-	-	-	-	-	-
Moderate Decreasing	0.90	0.63, 1.28	1.27	0.93, 1.73	3.63***	2.56, 5.15	2.33***	1.78, 3.04	0.81	0.62, 1.05
Moderate Increasing	1.08	0.77, 1.50	1.00	0.77, 1.30	1.84***	1.40, 2.41	1.49**	1.16, 1.92	0.82	0.64, 1.06
Low stable	0.99	0.59, 1.68	2.04***	1.39, 3.01	14.57***	5.62, 37.74	3.25***	1.81, 5.81	0.71	0.41, 1.23

Note: The standard errors for all regression models were adjusted for clustering by schools (n=116), RRR= Relative Risk Ratio.

*p<0.05; **p<0.01; ***p<0.001

Table 6

Relative Risk Ratios with 95% Confidence Intervals from Multinomial Logistic Regression Models for Boys

Predictor	Teacher Support		School Climate		Family Support		Peer Belonging		Friendships	
	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI	RRR	95% CI
					Univariable Models					
High Stable (Ref)	-	-	-	-	-	-	-	-	-	-
Moderate Stable	1.53***	1.27, 1.86	1.53***	1.31, 1.78	1.58***	1.28, 1.95	1.87***	1.61, 2.17	1.41***	1.21, 1.65
Moderate Decreasing	2.17***	1.76, 2.68	1.95***	1.65, 2.31	2.68***	2.14, 3.36	2.99***	2.48, 3.60	1.62***	1.39, 1.89
Low Stable	3.19***	1.94, 5.24	3.29***	2.13, 5.10	11.98***	3.17, 45.29	11.26***	5.30, 23.91	2.70***	1.61, 4.51
					Multivariable Adjusted Model					
High Stable (Ref)	-	-	-	-	-	-	-	-	-	-
Moderate Stable	1.09	0.84, 1.40	1.20	0.97, 1.47	1.15	0.89, 1.47	1.75***	1.42, 2.17	0.99	0.82, 1.20
Moderate Decreasing	1.26	0.95, 1.67	1.32*	1.04, 1.67	1.65***	1.26, 2.14	2.62***	2.07, 3.31	0.82	0.66, 1.01
Low Stable	1.15	0.70, 1.90	1.90**	1.21, 2.97	4.68**	1.50, 14.58	7.50***	3.93, 14.32	0.79	0.47, 1.31

Note: The standard errors for all regression models were adjusted for clustering by schools (n=119), RRR= Relative Risk Ratio.

*p<0.05; **p<0.01; ***p<0.001

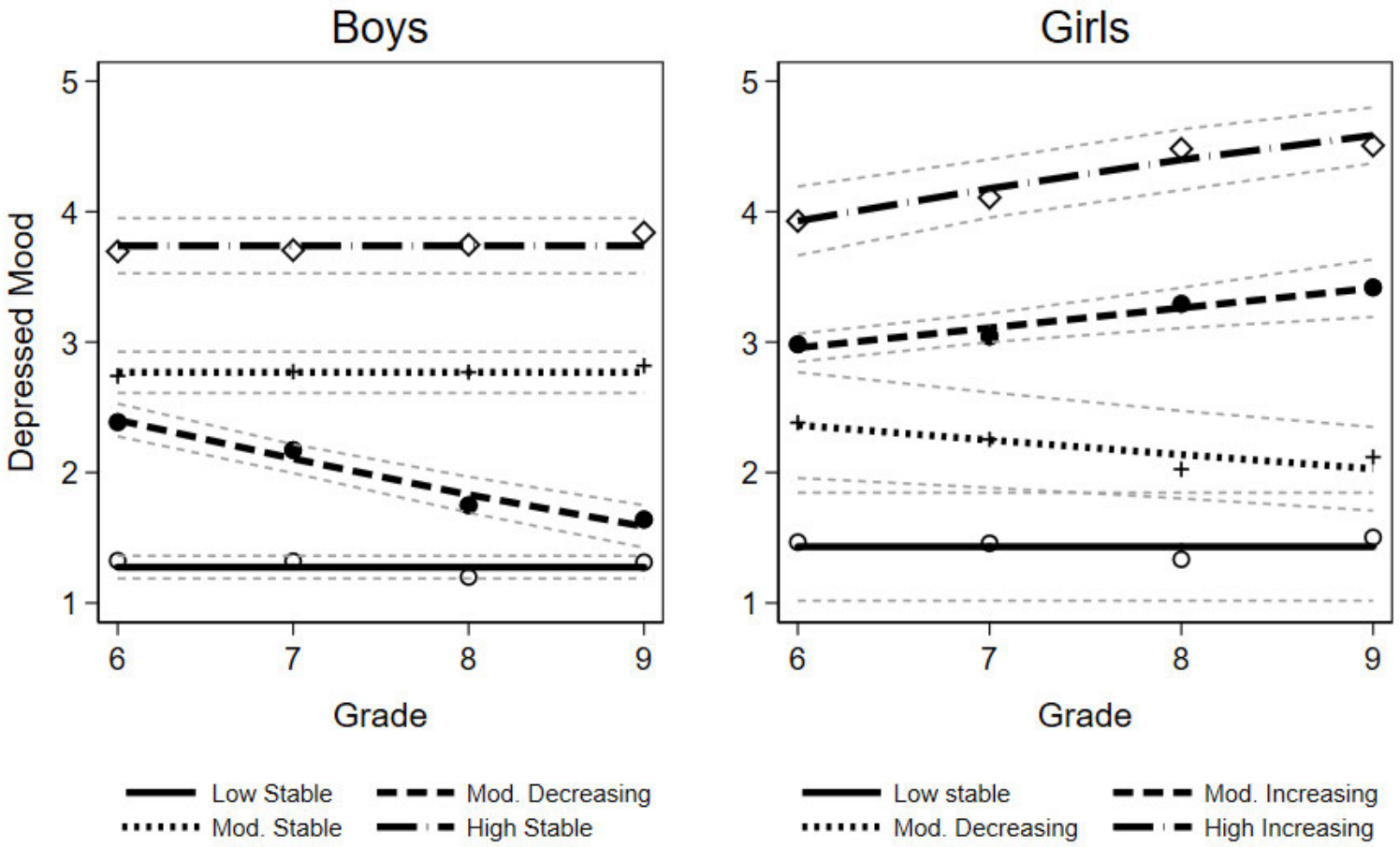

Figure 1. Estimated trajectory groups for the final 4 group models for boys and girls with 95% confidence intervals.

Appendix A: Instructions to Authors: Journal of Research on Adolescence

Editor
Noel A. Card, University of Connecticut

Editorial Scope
JRA seeks to publish innovative and rigorous research that advances understanding of adolescent development. The journal considers manuscripts from the wide range of topics relevant to adolescent development, using rigorous quantitative or qualitative methodologies, and considering samples during the second decade of life (though samples of university students aged about 18-20 years need a strong justification that the sample is not one of convenience). Manuscripts should advance understanding of adolescent development, rather than merely study a phenomenon with an adolescent sample, and should therefore be grounded in developmental theory and prior developmental research. There are no exclusions of particular methodologies, though studies including a diverse and representative sample, with valid and multiple information sources, and/or with best practice quantitative or qualitative analysis strategies are preferred. Manuscripts should clearly articulate the advances in understanding adolescent development and the applications for improving the lives of adolescents.

Audience
Scientists, educators, and practitioners interested in adolescent development, including clinical, social, and developmental psychologists, sociologists, social workers, and those specializing in human development and family studies.

Manuscript Submission
Manuscripts should be submitted online at http://mc.manuscriptcentral.com/jra. Full instructions and support are available on the site and a user ID and password can be obtained on the first visit. Support can be contacted by phone (888-503-1050), or via the red Get Help Now link in the upper right-hand corner of the login screen. If you cannot submit online, please contact the Editorial Office by telephone (734-926-0615) or by e-mail (jraeditorial@wiley.com).

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The Journal of Research on Adolescence considers only original manuscripts in formats described below. Inquiries concerning alternative formats should be addressed to the Editor prior to submission. All submissions are expected to be no more than 40 manuscript pages, including tables, references, and figures (but excluding appendices). Authors are strongly encouraged to submit concise and focused papers in the 25-30 page range. All manuscripts must be written in English and strictly adhere to APA Style (6th edition).

Empirical articles comprise the majority of works appearing in the journal. To be accepted, empirical articles must be judged as being high in scientific quality, contributing to the empirical base of adolescent development, and having important theoretical, practical, and/or

interdisciplinary implications.

Brief reports are reserved for short cutting-edge empirical papers that are no longer than 4000 words in length (approximately 15 pages, including ALL text, tables, footnotes, appendices). Manuscripts in this format should advance understanding in an area through noteworthy but concisely reported findings, new methodologies, extensions of prior research across populations, or informative replication efforts. For manuscripts that require longer descriptions of methods and results, authors should use the empirical article format.

Reviews focus on synthesizing existing knowledge on adolescent development in ways that solidify and advance understanding. Meta-analyses of previous empirical research are especially encouraged, but narrative reviews of research, theoretical syntheses, historic reviews, or other types of reviews are welcome.

Special sections will be considered. Before preparing a submission for a special section, submitters should email the author for initial discussion of the idea and further instructions for submission.

Manuscript Review

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A system of masked reviewing is used. It is the author's responsibility to remove information about the identity of the author(s) and affiliation(s) from the manuscript; such information should appear on the cover letter. The cover letter will not be included when a manuscript is sent out for review (note: a masked version listing revisions to a manuscript invited for resubmission is provided to reviewers). The action editor (Editor in Chief or Associate Editor) responsible for a manuscript will have the discretion to integrate solicited review with the member's own opinions and recommendations into a determinative response. The editorial team retains the right to reject manuscripts that do not meet established ethical standards. The Publications Officer regrets that, in case of rejection, manuscripts cannot be returned.

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