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## PREDICTING FEMALE DEPRESSION ACROSS PUBERTY: A TWO-NATION LONGITUDINAL STUDY

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### Abstract

**Objective**—To prospectively examine the relationship between pubertal stage and the onset and course of depressive symptoms.

**Methods**—The design was a three-wave longitudinal study of health and social development using state-wide community samples in Washington State USA and Victoria Australia. 5769 students initially aged 10 to 15 years were assessed for depressive symptoms with the Short Mood and Feelings Questionnaire. Pubertal status was assessed using a self-report version of the Pubertal Development Scale (PDS).

**Results**—Advancing pubertal stage carried higher risks for depressive symptoms in females in all three study waves. The pubertal rise in female depressive symptoms was due both to higher risk for incident cases and an even greater effect on risks for persistence of depressive symptoms. Report of poor emotional control twelve months earlier carried a two-fold higher risk for incident depressive symptoms and largely explained the pubertal rise in female incident cases. High family conflict and severity of bullying also predicted persistence of depressive symptoms. Pre-existing depressive symptoms were not associated with later increases in the rate of pubertal transition.

**Conclusions**—Advancing pubertal stage carries risks for both the onset and persistence of depressive symptoms in females. Social adversity around puberty predicts the persistence of symptoms but does not account for a pubertal rise in female depression. A report of poor emotional control may be a useful marker of girls at risk for depressive symptoms and as a target for preventive intervention.

### Keywords

Depression; adolescence; puberty

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Re: Predicting Female Depression across Puberty

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## Introduction

Patterns of female depressive symptoms shift markedly in early adolescence so that by the mid-teens rates of depressive disorders are over two-fold higher than in males.<sup>1;2</sup> This higher female incidence in adolescence largely accounts for a persisting higher prevalence of depression in females through the reproductive years.<sup>3</sup>

A number of recent studies have implicated puberty as a transition point in risk for female depression. Age of menarche, a late pubertal event, defined a transition point in risk in one study.<sup>4</sup> The Great Smoky Mountains Study found that higher female rates of depressive symptoms and major depression emerged after Tanner stage 3.<sup>5</sup> A further analysis found that changes in gonadal steroids across pubertal stage correlated closely with the rise in depressive symptoms.<sup>6</sup>

Yet there remains much to explore about the reasons for a pubertal rise in female depression. Psychosocial risks may change across puberty either in prevalence or salience and thereby explain the pubertal rise. Puberty may have different consequence for girls including negative reactions to bodily changes and more difficult transitions in social and sexual roles.<sup>7</sup> Conflict and a lack of closeness with parents, as well as difficulties in adjustment to secondary school and peer victimisation also appear linked to female depression in early adolescence.<sup>8;9</sup> Altered responses to adversity including a propensity to ruminate and adopt self-blaming coping styles may also be involved.<sup>10-13</sup>

Another possibility is that depression might arise from a mismatch between heightened emotional reactions at puberty and the capacity in a younger adolescent to deal with these emotions. Early studies of 'off-time' puberty commonly cited emotional immaturity, perhaps compounded by peer rejection, as the basis of greater emotional problems in early maturing girls.<sup>14;15</sup> More recent understandings that neurodevelopment continues into early adulthood, particularly in regions linked to regulation of behaviour and emotion, have again heightened interest in an idea that the early adolescent rise in emotional problems may in part be due to such a mismatch.<sup>16-18</sup>

A third possibility is that social adversity, emotional distress or unfavourable family relationships may accelerate the onset and progression of puberty<sup>19</sup>. Previous work on the pubertal rise in female depression has been limited to cross-sectional analysis with uncertainty about the directionality of the reported associations. In contrast the current report derives from a large three-wave bi-national study of late childhood and adolescent development in community samples in the USA and Australia. It describes the prospective relationship between pubertal development, as well as relevant psychosocial risk factors, and the onset and persistence of depressive symptoms in a school-based sample initially aged between 10 to 15 years.

## Methods

### Procedure and sample

Data were collected as part of a bi-national study of youth development in the states of Washington, USA and Victoria, Australia. Each state used a two-stage cluster sampling procedure to identify three cohorts of students who were invited to participate in longitudinal data collection conducted at yearly intervals during secondary school. In the first stage, schools at each study grade level were selected at random from a stratified sampling frame of all schools in Victoria (Catholic, Independent and Government) and Washington (Public, Private, and Alternative). At stage two, single intact classes from each school for the three selected grade levels were chosen at random. In a few cases, two classes

from different grade levels were randomly chosen from the same school. In Victoria, 165 classes in 152 schools (65% of eligible classes, N=254) participated. In Washington, 155 classes in 153 schools (73% of those classes approached, N=212) participated. In Victoria, 55 classes participated at grade 5 (10-11-year-olds), 54 at grade 7 (12-13) and 56 at grade 9 (14-15). In Washington, 55 classes participated at grade 5, 50 classes at grade 7, and 50 classes at grade 9.

The study was presented to participants as a longitudinal study of adolescent development. Each state sought active parental consent for student participation. Standard data collection protocols were followed in each state. These protocols were approved by the Institutional Review Board of the University of Washington and Victoria's Royal Children's Hospital's Ethics in Human Research Committee. The student survey protocol consisted of a self-report instrument, adapted and extended from the Communities that Care (CTC) Youth Survey, which has shown good reliability and validity in large samples.<sup>20-22</sup> The instrument included instructions on how to answer the questions and assurances of confidentiality that were presented prior to survey administration by trained study staff. Surveys were administered in classrooms during a 45-to 60-minute period. Students absent from school on the day of the survey were administered surveys later under the supervision of school personnel, or in a small percentage of cases, over the telephone by study staff. Students in Washington received \$10 and students in Victoria received a small pocket calculator upon return of consent forms, regardless of their study participation.

Participation rates across the three waves and each state are shown in Table 1. In the first wave of data collection (2002), student participation rates in Washington (WA) in grade five were 69.2% (n=943), in grade seven 78.3% (n=961), and in grade nine 77.5% (n=981), for an overall participation rate of 74.8%. In Victoria (VIC) participation rates in grade five were 69.0% (n=927), in grade seven 75.6% (n=984), and in grade nine 75.5% (n=973), for an overall participation rate of 73.5%. Reasons for non-participation included failure to return consent forms (WA 11%, VIC 5%) and refusal (WA 14%, VIC 21%). Thus, the total sample size available for analysis at wave 1 was 2,885 students in Washington and 2,884 students in Victoria for a combined sample of 5,769.

At wave two (2003), 2,849 (97.7% of the wave 1 sample) of the baseline participants in Washington and 2,847 (98.5%) in Victoria and completed assessments for an overall response rate of 98.1% of baseline participants. At wave three (2004) funding constraints limited follow-up to half the original sample. 961 (97.8% of baseline) students from the original year 7 Washington sample completed the questionnaire. 1,863 students participated from the original Victorian sample (grade 5 and 7 only) of 1,904, a 97.8% response rate.

## Measures

**Depressive symptoms** were measured using the Short Mood and Feelings Questionnaire designed for epidemiological survey research with adolescents.<sup>23</sup> This single-dimension scale correlates substantially with the Children's Depression Inventory (CDI) and the Diagnostic Interview Schedule for Children's (DISC) depression scale as well as clinical interview in outpatients.<sup>24</sup> High levels of depressive symptoms were defined by a score of 11 or greater.

**Pubertal status** was assessed in both states using a modified self-report version of the Pubertal Development Scale (PDS).<sup>25 26</sup> At baseline the PDS had an internal consistency coefficient of 0.79 in males and 0.69 in females. Combining the 3 age groups, the majority of students reported pubertal stage at the outset as being between II and IV with 7% stage I and 4% in stage V. Pubertal stage was categorised into three levels: early (stages I & II), mid (stage III) and late (stages IV & V). At wave one, 24% were classified as early puberty, 36%

as mid and 40% as late puberty. At wave two, 14% were classified as early, 33% as mid and 53% as late puberty. At wave three, 7% were classified as early, 33% as mid and 60% as late puberty. Regression analysis on pubertal stage suggested that, after adjustment for age, females in Washington tended to report a higher pubertal stage ( $\beta=0.1$  95% CI 0.05, 0.15,  $p<0.001$ ) than females in Victoria at the outset. For males the distribution of pubertal stage in Washington was similar to that in Victoria ( $\beta=0.047$ , 95% CI -0.01, 0.10,  $p=0.1$ ).

Across the three study waves there were 7,524 observations that captured pubertal status on two consecutive occasions. In 179 instances (148 male, 31 female) there was a reported change from mid to earlier puberty. In 325 instances (168 male, 155 female) there was a reported move from late to mid puberty. These 504 (6.7%) transitions were not included in the prospective data analysis so that the focus of those analyses was on the remaining 7,020 observations. For prospective analyses, participants were classified as having made one of five transitions at each follow-up: remained early puberty (673 observations), early to mid puberty (859 observations), remained mid-puberty (1,538 observations), mid to late puberty (1,116 observations), remained late puberty (2,834 observations).

**Social context** was assessed in all students at all waves across family, school and peer relationships using a previously validated set of scales<sup>21</sup>. Assessment of family context focussed on two constructs, family attachment and family conflict. Family attachment was estimated as the mean of three scales assessing parental attachment ( $\alpha=0.75$ ), opportunities for prosocial involvement ( $\alpha=0.75$ ) and recognition for prosocial involvement in the home ( $\alpha=0.74$ ) with a total score on each scale ranging from 1-4. Family conflict was measured with a three item scale ( $\alpha=0.79$ ) with total score ranging from 1-4. School attachment was estimated as the mean of three scales reflecting school commitment, opportunities for prosocial involvement ( $\alpha=0.57$ ) and recognition for prosocial involvement ( $\alpha=0.69$ ) with a total score ranging from 1-4. The experience of bullying was measured with a single item “Have you been bullied recently (teased or called names, had rumours spread about you, been deliberately left out of things, threatened physically or actually hurt)?” with a four-point response set reflecting frequency.

**Psychological style** was assessed at all waves for baseline grade 7 and 9 students. The styles assessed reflected risk factors for depressive symptoms in adolescents. A self-blaming coping style in response to problems was assessed with 2-item scale ( $\alpha=0.74$ )<sup>27,28</sup>. Self-efficacy was assessed by asking the participants how well they would handle a range of challenging situations such as a peer encouraging them to steal a CD, or not being allowed by parents to go out on the weekend ( $\alpha=0.62$ ).<sup>29</sup> Emotional control is the self-reported ability to regulate or calm oneself when angry, frustrated or distressed and has been previously associated with depression in adolescents.<sup>30</sup> It was assessed with a four-item scale ( $\alpha=0.74$ ) derived from an earlier longitudinal study of temperament<sup>31</sup>. Participants self-rated on the following, with a total score (0-4) obtained as the number of affirmative responses: “I know how to relax when I feel tense”; “I am always able to keep my feelings under control”; “I know how to calm down when I am feeling nervous”; and “I control my temper when people are angry with me”.

## Analysis

Data analysis was undertaken using the Stata program.<sup>32</sup> Prevalence estimates were adjusted for the clustered design using standard sample survey methods (implemented in Stata's “svy” commands), with schools identified as the primary sampling units. Logistic regression models were used to examine associations between the risk of depression and pubertal stage, with adjustment for potential confounding factors. We used robust (information sandwich) standard errors in longitudinal analyses to adjust for correlation of repeated measures within

individual. Analyses were generally undertaken combining both US and Australian samples, with adjustment for State as well as testing for interactions by State.

## Results

The mean age of the US sample at the outset was 12.7 years (95% CI 12.4 to 13.0) in males and 12.6 years (12.3 to 12.8) in females. The mean age of the Australian sample was 12.5 years (12.2 to 12.8) in males and 12.4 years (12.1 to 12.7) in females. Twenty-three percent of the sample came from families with an income less than \$30,000 per year and 75% from intact families with both biological parents. There was no evidence of association between family income or parental marital status and pubertal development at baseline.

Overall rates of high depressive symptoms (cutoff 10/11) were 17% (95% CI 15, 18) among males compared to 26% (24, 28) in females at baseline. Higher rates of female depressive symptoms were found at the subsequent two waves. Prevalence estimates for high depressive symptoms at each wave in males and females stratified by pubertal stage are shown in Table 2. For males there was little discernible trend in prevalence estimates across pubertal stage. For females there was a marked increase in symptoms between mid and late puberty.

### Depressive symptoms and pubertal stage

Table 3 shows the association at each wave between depressive symptoms and pubertal stage, adjusted for age and school year level. For females there was a consistent trend for depressive symptoms to become more common across pubertal stage with the clearest increases in late puberty. For males there was no similar consistent trend across waves of data collection, although elevated risk at stages III and above was evident at the first wave. No independent association with depressive symptoms was apparent for chronological age or school grade level in either males or females. Formal testing for an interaction of sex by pubertal stage for was consistent with the apparent trends (Wave 1  $\chi^2_2= 28$ ,  $p<0.0001$ ; wave 2  $\chi^2_2= 50$ ,  $p<0.0001$ ; wave 3  $\chi^2_2= 466$ ,  $p<0.0001$ ).

Figure 1 shows the mean values for psychosocial risk factors across early, mid and late puberty using data from 14,250 observations over three waves, with adjustment of confidence intervals for clustering at the individual level. Risk factors related to social context changed with progression in pubertal stage for both males and females though the size of these changes tended to be greater for females. Family attachment and conflict were generally more favourable in females in early puberty but less favourable by late puberty. Similarly, reductions in school attachment across puberty were greater in females than males. For males there was little change in the psychological indices of self-blame, emotional control and self-efficacy across pubertal stage. In contrast for females rates of self-blame were substantially higher in late puberty and emotional control poorer. Levels of bullying tended to be lower in males with progression across pubertal stage but in females relatively stable.

### Prospective analysis of change in depressive symptoms across pubertal stage

Prospective analysis focused on the 7,020 paired pubertal observations (see Methods). Table 4 shows the prevalence of depressive symptoms according to the five possible 12-month pubertal transition categories. For females, prevalence of depressive symptoms was higher across pubertal stage whether looking at baseline (T1) or 12-month later (T2) values. The clearest female increase across T1 and T2 values was found from mid- to late-puberty as evidenced by the confidence intervals that do not overlap. Rates of depressive symptoms

changed little in females who remained constant in pubertal stage whether at early, mid or late puberty.

### **Incident depressive symptoms in females**

Logistic regression models were used to consider the extent to which pubertal stage and risk factors associated with social context and psychological style might predict the onset of new depressive symptoms in females (table 5). The initial model (column 1) examined the association with pubertal stage 12 months earlier with adjustment for age, school grade, state and previous total score on the Short Mood and Feelings Questionnaire. In models 2 and 3 psychosocial risk factors were included, in dichotomous form, comparing the high-risk tertile with the two lower-risk tertiles for each risk factor other than bullying. Bullying was modelled as a four-point ordinal variable. Each model included pubertal stage (persistent mid puberty, mid to late puberty transition, persisting late puberty), age, school grade, state of origin and previous level of depressive symptoms.

Pubertal stage predicted incident depressive symptom with late puberty bringing a close to two-fold elevation in odds. High family conflict, bullying and report of poor emotional control predicted the onset of new symptoms with the clearest association with poor emotional control. Adjustment for social context alone did not have a major effect on the association with pubertal stage. Earlier report of poor emotional control also predicted a close to two-fold elevation in odds for later depressive symptoms. Adjusting for poor emotional control in the final model substantially reduced the risks associated with late pubertal stage.

### **Persisting depressive symptoms in females**

Table 6 shows equivalent models for prediction of continuing depressive symptoms. Advancing pubertal stage substantially increased the risks for depressive symptoms to persist twelve months later with both mid and late puberty predicting an over 2-fold increase in risk of persistence. High family conflict and bullying also predicted a greater likelihood of persistence. No psychological attribute increased risks for persistence of depressive symptoms. Adjusting for both social context and psychological style did not diminish the predictive association between advancing pubertal stage and persisting symptoms.

## **Discussion**

This study adds to previous work on the epidemiology of depressive symptoms around puberty in several ways. First, advancing pubertal stage predicted the onset of new depressive symptoms with this effect clearest in females in late puberty. Secondly, advancing pubertal stage influenced the course of depressive symptoms in females with a more than doubling of the risk for continuing depressive symptoms across mid to late puberty. Thirdly, advancing pubertal stage increased the risks for depression rather than depression accelerating pubertal development. Pre-existing depressive symptoms had no effect on the rate of pubertal transitions from either early to mid puberty or from mid to late puberty.

A range of possible psychosocial risk factors for depression in girls changed markedly across pubertal stage.<sup>10;13</sup> These changes included worsening of attachments with family and school contexts and greater report of psychological styles (eg self-blaming) previously linked to depression in young women. Two risk factors linked to the social context, family conflict and bullying, increased risks for new and continuing symptoms of depression in females. Neither, however, explained the predictive effects of advancing pubertal stage. A subjective perception of poor emotional control was the clearest psychological predictor of

becoming a new case 12 months later with an almost two-fold increased risk. Furthermore, adjustment for early poor emotional control diminished greatly the risks for new instances of depressive symptoms linked to advancing pubertal stage. In contrast the effects of pubertal stage on continuing depressive symptoms were unaffected by either earlier context or psychological style.

The finding that the heightened risk for depressive symptoms is most evident from late puberty is consistent with earlier studies<sup>5</sup>. However, in the current study the discrepancy in depression rates between males and females appears to arise not only from differences in new depressive symptoms in females but also a greater persistence of those symptoms in females. The overall effect was a similar level of depressive symptoms across pubertal stage in males and a rising prevalence in females.<sup>5</sup>

This study has notable strengths in its large size, coverage of the age group of most relevance for the early adolescent rise in depressive symptoms and in its high retention. However, study limitations should also be noted. The pubertal measures were based on self-report rather than direct observation to minimise intrusion. We have previously reported good agreement between the Pubertal Development Scale and self-reported Tanner scales<sup>33</sup>. The Pubertal Development Scale has similarly received support in validation studies using physician assessment, though this evidence is clearer in girls than boys.<sup>34</sup> Some level of measurement error was evident in this study in that some subjects reported lower pubertal stage twelve months later and were thus excluded from prospective analysis.

Poor emotional control was the clearest predictor of new cases of depression in females. The decline in emotional control also appeared to mediate pubertal risks for new depressive symptoms raising a possibility that a diminished capacity to deal with difficult emotions is a central factor in the female rise in depression at puberty. The present study is unable to disentangle whether this may be a pre-existing temperamental characteristic that marks a vulnerability for depression that becomes evident with advancing pubertal stage, or whether an increasing difficulty in dealing with emotions is a result of the pubertal process. If the latter were true, poor emotional control may be an early sign of emotional difficulties that eventually become manifest as high levels of depressive symptoms. The emergence of difficulties in dealing with emotions might then be a useful focus for preventive interventions in girls passing through puberty.

Rates of depressive symptoms in girls passing through late puberty were high with around a half of all girls reporting depressive symptoms at some point. A majority of these were not evident twelve months later suggesting that much depressive symptomatology is transient. Given this, predictors of persistence also have relevance as targets for intervention and the prevention of later depressive and anxiety disorders that have been linked to early puberty.<sup>35</sup> Both family conflict and report of being bullied predicted ongoing depressive symptoms twelve months later in females. Success in dealing with such interpersonal stresses seems likely to be relevant in determining whether high levels of symptoms in early adolescence develop into depressive episodes. A focus on reducing interpersonal conflicts in family and peer relationships seems a promising starting point for interventions to reduce the likelihood that depressive symptoms persist and progress to fully-fledged disorder.

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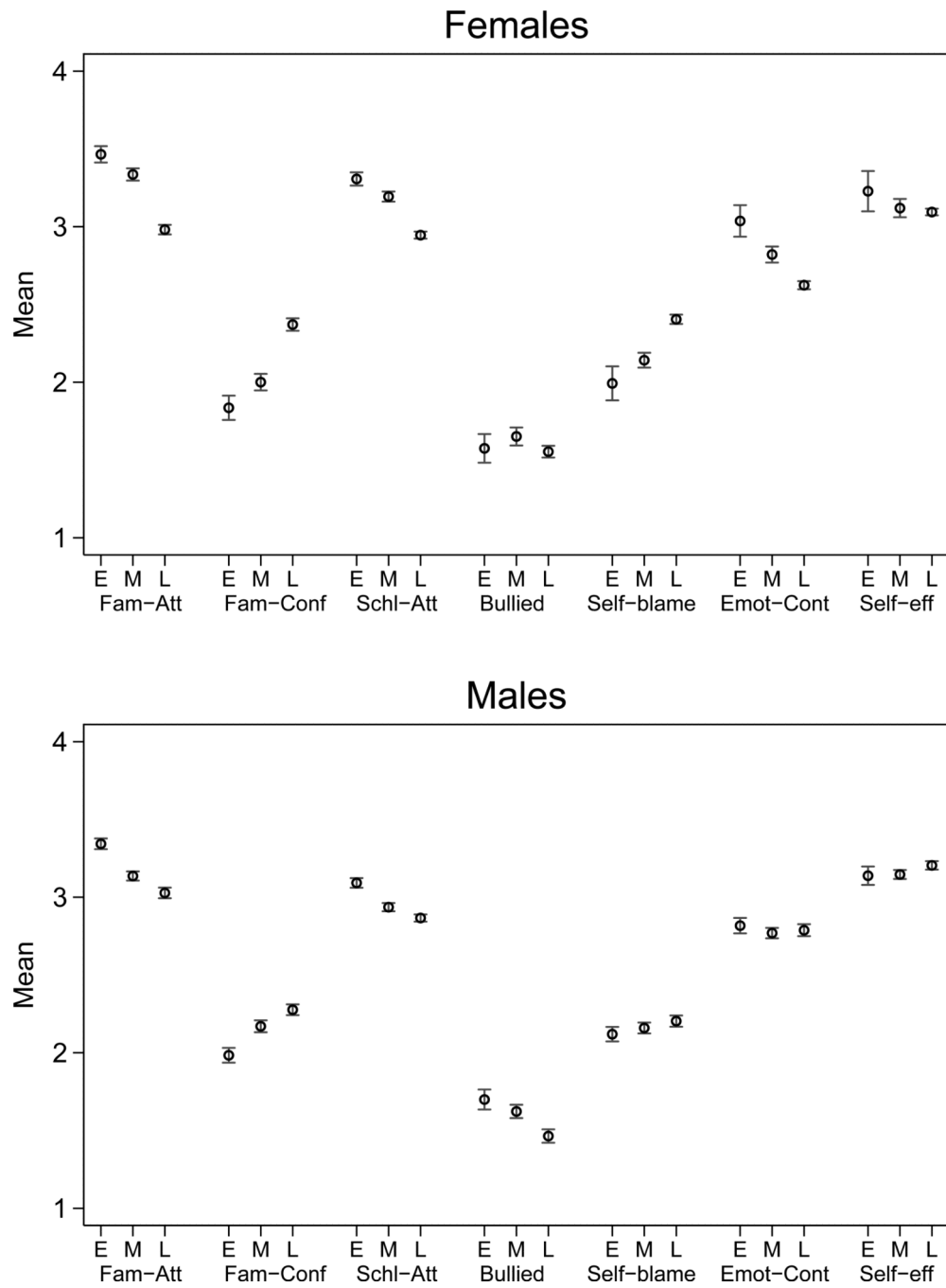
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**Figure 1.** Levels of psychosocial risk factors\* for depressive symptoms across puberty in 5,769 participants studied across 3 annual waves of data collection  
 Footnote:  
 \* E = Early puberty; M = Mid-puberty; L = Late puberty Fam-Att = Family attachment; Fam-Conf = Family conflict; Schl-Att = School attachment; Emot-Cont = Emotional control; Self-eff = Self-efficacy

**Table 1**

Participants with complete depression data over the three annual waves of data collection in Washington State and Victoria for the grade 5 (bold), grade 7 (italics) and grade 9 (underlined) cohorts

Survey Year	WASHINGTON USA									VICTORIA AUSTRALIA					
	AGE									AGE					
	10	11	12	13	14	15	16	10	11	12	13	14	15	16	
<b>2003</b>	<b>943</b>	<b>961</b>	<b>981</b>	<b>927</b>	<b>975</b>	<b>936</b>	<b>946</b>	<b>936</b>	<b>936</b>	<b>927</b>	<b>984</b>	<b>973</b>	<b>959</b>	<b>941</b>	
<b>2004</b>	<b>936</b>	<b>946</b>	<b>975</b>	<b>916</b>	<b>907</b>	<b>941</b>	<b>959</b>	<b>941</b>	<b>941</b>	<b>907</b>	<b>970</b>	<b>959</b>	<b>959</b>	<b>941</b>	
<b>2005</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>907</b>	<b>941</b>	<b>941</b>	<b>941</b>	<b>n/a</b>	

**Table 2**

Prevalence (95% CI) of depressive symptoms in survey participants in Washington, USA and Victoria, Australia, stratified by pubertal stage according to the Pubertal Development Scale.

	Wave 1		Wave 2		Wave 3*	
Mean age (95% CI)	Male % N=2806*	Female % N=2927*	Male % N=2603*	Female % N=2586*	Male % N=858*	Female % N=887*
	13.1 (12.9, 13.3)	13.0 (12.8, 13.2)	14.1 (13.9, 14.3)	14.0 (13.8, 14.2)	15.1(14.8, 15.4)	15.0 (14.7, 15.4)
Pubertal stage						
• I/II	13 (11, 16)	14 (11, 18)	18 (14, 21)	11 (5, 16)	21 (3, 38)	0
• III	20 (17, 22)	20 (17, 23)	17 (15, 19)	18 (16, 21)	18 (16, 21)	16 (12, 21)
• IV/V	18 (15, 21)	33 (30, 36)	16 (13, 18)	34 (32, 36)	34 (32, 36)	28 (23, 31)
Total depressive symptoms	17 (15, 18)	26 (24, 28)	16 (15, 18)	28 (26, 30)	22 (19, 25)	31 (28, 34)

\* numbers based on complete Short Mood and Feelings Questionnaires

• see figure 1 for explanation of numbers at Wave 3

**Table 3**

Association between depressive symptoms and pubertal stage in 5,733 US and Australian participants stratified by sex and controlling for age, school year level and country at each of the three waves of data collection. Odds ratios (with 95% confidence intervals) derived from logistic regression analysis.

	Wave 1		Wave 2		Wave 3	
	Male N=2806	Female N=2927	Male N= 2603	Female N=2586	Male N=858	Female N=887
<b>Pubertal stage</b>						
• I/II	1.0	1.0	1.0	1.0	1.0	.*
• III	1.8 (1.4, 2.3)	1.4 (1.0, 1.9)	1.0 (0.7, 1.3)	1.7 (0.9, 3.2)	0.8 (0.3, 2.1)	1.0 *
• IV/V	1.7 (1.2, 2.5)	2.5 (1.7, 3.6)	0.8 (0.6, 1.3)	3.6 (1.9, 6.7)	1.3 (0.5, 3.3)	1.7 (1.1, 2.8) *
<b>Age (per year)</b>	1.0 (0.8, 1.2)	1.0 (0.8, 1.2)	1.1 (0.9, 1.4)	1.1 (0.9, 1.2)	1.1 (0.8, 1.5)	1.0 (0.8, 1.4)
<b>Grade level</b>	1.0 (0.8, 1.2)	1.1 (0.9, 1.3)	0.9 (0.7, 1.1)	1.0 (0.9, 1.2)	1.0 (0.7, 1.3)	0.8 (0.6, 1.0)

\* Too few females remained at early puberty in the third wave of data collection and so mid-puberty was set as the comparison category

**Table 4**

Prevalence of high depressive symptoms (95% confidence intervals) in 7,020 paired observations classified by pubertal transition and stratified by sex.

	Early puberty constant		Early to mid-puberty transition		Mid-puberty constant		Mid to late puberty transition		Late puberty constant	
	Male N= 548*	Female N=125*	Male N=617*	Female % N=242*	Male N=1,028*	Female % N=508*	Male % N=603*	Female % N=513*	Male % N=756*	Female % N=2,078*
Depressive symptoms T1	14 (11, 18)	14 (7, 20)	14 (11, 17)	13 (9, 17)	20 (17, 22)	19 (15, 22)	20 (16, 23)	21 (17, 24)	16 (13, 18)	35 (32, 37)
Depressive symptoms T2	16 (12, 19)	12 (5, 19)	18 (14, 21)	17 (11, 22)	18 (16, 21)	17 (13, 22)	20 (16, 23)	29 (24, 33)	20 (17, 22)	35 (32, 37)

\*\* Models adjusted for depression symptom score at the previous wave, age, school grade level and country of origin.

\* Number of transitions observed over the three study waves

**Table 5**

Predictors (Odds Ratios, 95% CI) of incident high depressive symptoms 12 months later<sup>†</sup> in younger adolescent females in the US and Australia using 2,452 paired observations in which the participant did not report depressive symptoms at the first time point.

Predictive variables twelve months earlier.	Partially adjusted*	Additional adjustment for social context	Fully adjusted**
<b>Pubertal stage</b>			
• Early	1.0	1.0	1.0
• Mid	1.5 (0.95, 2.3)	1.5 (0.94, 2.2)	1.1 (0.5, 2.6)
• Late	<b>1.8 (1.1, 2.9)</b>	<b>1.7 (1.0, 2.8)</b>	1.3 (0.5, 3.1)
<b>Low family attachment</b>		1.1 (0.9, 1.5)	1.1 (0.8, 1.5)
<b>High family conflict</b>		<b>1.3 (1.0, 1.7)</b>	1.2 (0.9, 1.6)
<b>Low school connection</b>		0.9 (0.7, 1.2)	0.8 (0.6, 1.2)
<b>Bullying</b>		<b>1.1 (1.0, 1.3)</b>	1.1 (0.97, 1.3)
<b>Self-blaming coping style</b>		n/a	1.2 (0.9, 1.6)
<b>Poor emotional control</b>		n/a	<b>1.8 (1.4, 2.4)</b>
<b>Low self-efficacy</b>		n/a	1.0 (0.7, 1.2)

<sup>†</sup> Psychosocial predictors are dichotomous variables comparing upper tertile with lower two tertiles, with the exception of bullying that was measured on a 4-point ordinal scale.

\* Adjusted for pubertal stage change (mid-mid, mid-late, late-late), age, school grade level, state of origin, and previous level of depressive symptoms.

\*\* Adjusted for all other variables in the model. N of 1701 was lower as the data on individual characteristics was only available for the older two cohorts

**Table 6**

Predictors (Odds Ratios, 95% CI) of continuing high depressive symptoms 12 months later<sup>†</sup> in younger adolescent females using 1,002 paired observations in which the participant reported depressive symptoms on the first time point.

Predictive variables twelve months earlier	Partially adjusted*	Additional Adjustment for social context	Fully adjusted**
<b>Pubertal stage</b>			
• early	1.0	1.0	1.0
• mid	2.2 (1.1, 4.3)	2.0 (1.0, 3.8)	3.3 (0.8, 13)
• late	2.4 (1.2, 4.7)	2.2 (1.1, 4.6)	2.6 (0.6, 10)
<b>Low family attachment</b>		1.1	1.1 (0.8, 1.5)
<b>High family conflict</b>		1.5 (1.2, 1.9)	1.6 (1.2, 2.1)
<b>Low school connection</b>		0.9 (0.6, 1.2)	0.9 (0.7, 1.5)
<b>Bullying</b>		1.2 (1.1, 1.4)	1.2 (1.0, 1.3)
<b>Self-blaming coping style</b>		n/a	1.1 (0.7, 1.4)
<b>Poor emotional control</b>		n/a	0.9 (0.7, 1.3)
<b>Low self-efficacy</b>		n/a	1.0 (0.8, 1.4)

<sup>†</sup> Psychosocial predictors are dichotomous variables comparing upper tertile with lower two tertiles, with the exception of bullying that was measured on a 4-point ordinal scale.

\* Adjusted for pubertal stage change (mid-mid, mid-late, late-late), age, school grade level, state of origin, and previous level of depressive symptoms.

\*\* Adjusted for all other variables in the model. N of 824 was lower as the data on individual characteristics was only available for the older two cohorts