

## Research paper

# Preconception personality disorder and antenatal maternal mental health: A population-based cohort study



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## ARTICLE INFO

## Keywords:

Maternal health

Mental disorders

Personality disorders

Epidemiology

## ABSTRACT

**Background:** Prior anxiety and depression have been identified as risk factors for maternal perinatal mental health problems, but other preconception mental disorders have not been prospectively examined. This study investigated prospectively whether women with preconception personality disorder have increased rates of antenatal anxiety and/or depressive symptoms.

**Methods:** 244 women in a population cohort were assessed for personality disorder at age 24 using the Standardised Assessment of Personality. Five to twelve years later, women were screened with the Clinical Interview Schedule, Revised Anxiety Subscale and the Edinburgh Postnatal Depression Scale during the third trimester of 328 pregnancies.

**Results:** Preconception personality disorder was associated with a three-fold increase in the odds of antenatal anxiety symptoms, which remained with adjustment for preconception background factors and preconception common mental disorder (adjusted OR 2.84, 95% CI 1.31–6.15). Preconception personality disorder was associated with doubled odds of antenatal depressive symptoms, however this was attenuated with adjustment for preconception background factors and preconception common mental disorder (adjusted OR 1.98, 95% CI 0.81–4.81).

**Limitations:** Our findings are restricted to pregnant women aged 29–35 years. Anxiety and depression may have been under-identified because they were assessed at a single antenatal time point. Residual confounding of the associations by preconception common mental disorder at other time points may have occurred.

**Conclusions:** Women with personality disorder are at heightened risk of anxiety symptoms in pregnancy, over and above risks associated with prior common mental disorder. This raises a possibility that pregnancy brings particular emotional challenges for women with personality disorders.

## 1. Introduction

Perinatal mental disorders are the commonest complication of childbearing and associated with a wide range of adverse offspring outcomes (Howard et al., 2014). The most frequent mental health problems seen antenatally are anxiety and depression – approximately one in six pregnant women have anxiety symptoms (Fairbrother et al.,

2016; Grant et al., 2008) and one in ten have depressive symptoms (Milgrom et al., 2008). These symptoms affect maternal quality of life (Bauer et al., 2016; Highet et al., 2014), and have the potential to compromise maternal caregiving and maternal-infant bonding (Stewart, 2011), with developmental consequences for offspring (Goodman et al., 2011; Kingston et al., 2012). These may include cognitive delays by middle childhood (Buss et al., 2010; Laplante et al.,

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2008), and behavioural and emotional difficulties through to adolescence (Betts et al., 2014; O'Donnell et al., 2014; Van den Bergh et al., 2008). Yet despite widespread acknowledgement of the significance of antenatal maternal depression and anxiety, many episodes are under-identified and under-treated (Andersson et al., 2003; Woolhouse et al., 2009). There is strong case for early recognition and prevention. Ideally this would occur *before* pregnancy. However, knowledge about pre-conception risk factors for maternal anxiety and depression is scant and largely based on retrospective data (Hardt and Rutter, 2004; Moffitt et al., 2010).

Of the psychiatric preconception risk factors explored to date (Biaggi et al., 2016; Martini et al., 2015; Micali et al., 2011), prior history of anxiety and depression are the only factors that have been rigorously investigated prospectively (Dietz et al., 2007; Patton et al., 2015). One potential vulnerability factor for future anxiety and depressive symptoms is a preconception personality disorder. Personality disorders are pervasive and problematic patterns of relating to the self and others that cause marked distress and impairment (American Psychiatric Association, 2000). They are associated with functional impairments that can persist even when diagnostic thresholds are no longer met (Skodol et al., 2005) and are linked to premature mortality (Fok et al., 2012). Rates of comorbid anxiety (Friborg et al., 2013) and depression (Friborg et al., 2014) are high in personality disorder, and comorbid personality disorder predicts poorer outcomes for these disorders (Ansell et al., 2011; Newton-Howes et al., 2014). Furthermore, our group has recently shown that the presence of personality disorder in young adulthood independently predicts future anxiety and depression over a decade later (Moran et al., 2016). Rates of personality disorder are highest among younger adults (Balsis et al., 2007; Samuels et al., 2002) rendering personality disorder a particularly important preconception risk factor to explore for future mental health problems in mothers.

1.1. Aims of the study

Using prospective data from an Australian intergenerational cohort study of community-dwelling women, we investigated whether (1) preconception personality disorder assessed in young adulthood was associated with increased rates of anxiety and depressive symptoms during subsequent pregnancies, and (2) whether associations observed between preconception personality disorder and antenatal anxiety/depressive symptoms might be explained by the presence of preconception anxiety and depression.

2. Materials and method

2.1. Sample

We recruited eligible female participants from the Victorian Adolescent Health Cohort Study (VAHCS), a prospective cohort study of 1943 male and female participants assessed 10 times from adolescence to adulthood, which commenced in 1992. Data collection protocols were approved by the Royal Children's Hospital Human Research Ethics Committee. A representative sample of adolescents

was selected with a two-stage cluster sampling procedure. In the first stage, 45 secondary schools were randomly selected from a stratified frame of government, private, and Catholic schools, with the probability of each school being selected proportional to the number of year nine students in each school type. In the second stage, two intact classes were randomly selected from each school, the first in the latter half of the ninth school year (wave 1) and the second six months later in the tenth school year (wave 2). School retention rates to year nine in the year of initial sampling were 98%. One school did not continue past the first wave, leaving 44 schools in the sample. Participants were followed up four more times during adolescence at six-monthly intervals (wave 3–6), three times in young adulthood at age 20–21 (wave 7), 24–25 years (wave 8), and 28–29 years (wave 9). From the original sample of 2032 participants, 1943 (95.6%) participated in at least one of the adolescent waves. Of these, 1000 (51.5%) were female and are the focus for this particular study. Fig. 1 shows the flow of female participants through the study. At each wave participants completed a range of assessments of health and wellbeing (Moran et al., 2015).

During the ninth wave of VAHCS, when women were aged 28–29 years, we commenced identification, recruitment, and assessment of participants and their offspring for the Victorian Intergenerational Health Cohort Study (VIHCS). Between November 2006 and July 2013 (i.e. when the women were between the ages of approximately 29–36 years) we contacted active VAHCS participants every six months to identify new pregnancies. Women who were pregnant or had an infant under one-year of age were invited to participate in computer assisted telephone interviews in the third trimester of pregnancy, eight weeks post-birth, and one-year post-birth. Women were invited to participate for every eligible pregnancy during the study period, thus some women completed assessments relating to more than one of their offspring. Assessments included a range of measures of maternal and child health, wellbeing, and development.

From the range of assessments in both studies, the present study utilised the following VAHCS preconception and VIHCS antenatal measures.

2.2. Preconception measures (VAHCS)

2.2.1. Personality disorder

When women were aged 24–25 years (VAHCS wave 8) the Standardised Assessment of Personality Disorder (SAP) was used to assess for the presence of personality disorder (Mann et al., 1997). The SAP is a semi-structured informant interview that can be conducted in-person or via telephone to assess for the presence of ten DSM-IV-TR (American Psychiatric Association, 2000) defined categories of personality disorder. It has high inter-rater (kappa 0.76) and good temporal (kappa 0.65) reliability (Pilgrim et al., 1993). Women nominated a friend, partner, or family member to complete the SAP via computer assisted telephone interview with a trained research assistant. If the nominated contact was unavailable or declined involvement, women were asked to nominate a second contact. We selected informant-reports of personality rather than self-report as, in principle, this enhances the validity of a diagnostic assessment for personality

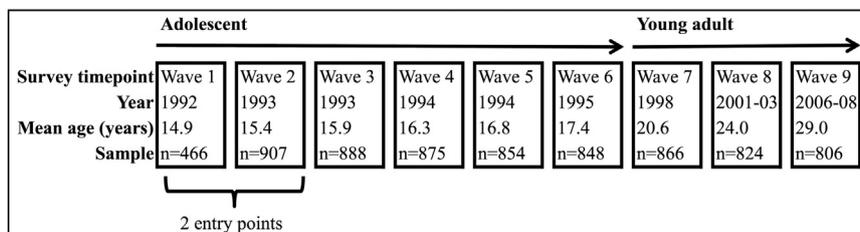
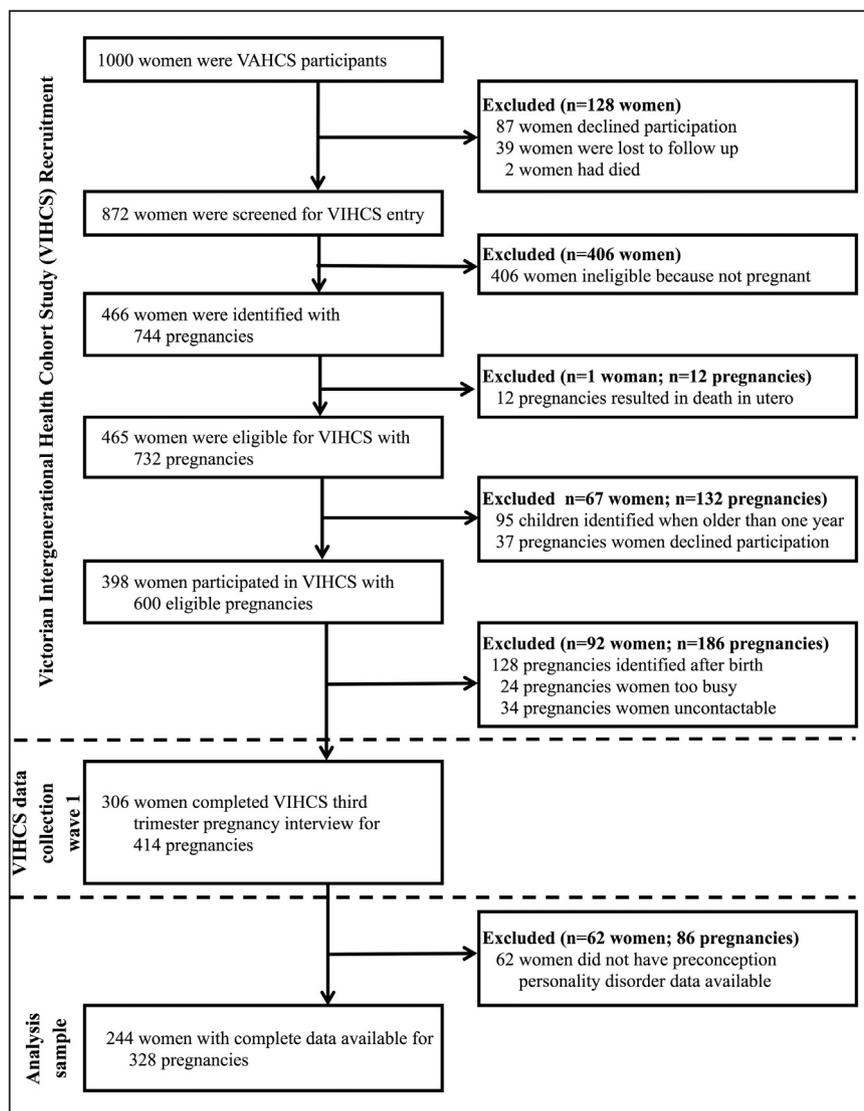


Fig. 1. Sampling and retention of female participants in the Victorian Adolescent Health Cohort Study (VAHCS), 1992–2003. Participant entry into the study was staggered across wave 1 and 2. A total of 1000 females participated at least once during adolescence.



**Fig. 2.** Sampling and pregnancies for the Victorian Intergenerational Health Cohort Study (VIHCS) during the study period November, 2006–July, 2013 and analysis sample of the present study.

disorder (Klonsky et al., 2002) by removing the impact of current mental state on the description of personality (Zimmerman, 1994).

2.2.2. Common mental disorder

Also while aged 24–25 years (VAHCS wave 8), women were assessed for common mental disorder using the General Health Questionnaire 12-item version (GHQ-12), which screened for mixed anxiety/depression symptoms present in the past week (Goldberg and Williams, 1988). Responses were made using a four-point scale with binary scoring. Item scores were summed to give a total score ranging from 0 to 12, with higher scores representing more severe mental health concerns. A cut-off of three or more was used, which has been demonstrated to identify psychiatric illness in the general population with sensitivity 76.3% and specificity 83.4% (Goldberg et al., 1997).

2.2.3. Parental divorce/separation

Women were asked if her own parents had divorced or separated by the time she was aged 17 years during wave 6 of VAHCS.

2.2.4. Demographics

Women's country of birth, relationship, education and employment

status were assessed at wave 8. Women's parents' educational attainment was also assessed at wave 8.

2.3. Antenatal measures (VIHCS)

2.3.1. Anxiety symptoms

When women (mean age 33 years), were in their third trimester of pregnancy the Clinical Interview Schedule Revised (CIS-R) anxiety subscale assessed cognitive and physiological symptoms of anxiety present during the past week (Lewis and Pelosi, 1992; Lewis et al., 1992). The 10-item scale commenced with two screening items that determined whether the remaining eight-items were administered. Summed scores ranged from 0 to 8, with higher scores denoting higher levels of anxiety. A cut-off score of two or more identified 14% of the sample as anxious, a level comparable to existing community data (Fairbrother et al., 2016; Grant et al., 2008).

2.3.2. Depressive symptoms

The Edinburgh Postnatal Depression Scale (EPDS) was used to assess depressive symptoms in pregnancy (Cox et al., 1987). This 10-item screening measure was designed for use in the postnatal period

**Table 1**  
Preconception demographic and mental health characteristics of the sample (N=244).

	Participants	
	n	(%)
<b>Participant characteristics</b>		
Maternal mental health		
Any personality disorder <sup>a</sup>	42	(17.2)
Cluster A	24	(9.84)
Cluster B	16	(6.56)
Cluster C	24	(9.84)
Common mental disorder <sup>b</sup>	56	(23.1)
Demographic factors		
Relationship status		
Married/de-facto	111	(45.5)
Boyfriend/girlfriend	83	(34.0)
Single	50	(20.5)
Education / Employment		
Did not complete secondary school <sup>c</sup>	14	(5.8)
Post secondary school <sup>c</sup>		
None or vocational training	115	(47.1)
Degree	128	(52.5)
Undertaking higher education or training	25	(10.2)
In paid employment	221	(90.6)
Born outside of Australia	24	(9.8)
<b>Participant's parents' characteristics</b>		
Parents divorced/separated <sup>d</sup>	48	(19.7)
Parents' educational attainment <sup>e</sup>		
Secondary school not completed	87	(35.7)
Secondary school completed/vocational training	80	(32.8)
Degree	77	(31.6)

<sup>a</sup> Personality disorder measured using the Standardised Assessment of Personality (SAP) to derive DSM-IV diagnoses.

<sup>b</sup> Common mental disorder (anxiety/depression) measured using the General Health Questionnaire 10 item version (GHQ-10) with scores > 2 defined as presence of common mental disorder.

<sup>c</sup> Data unavailable for 1 participant on measure, n=243.

<sup>d</sup> Participant's own parents were before she was 18 years of age.

<sup>e</sup> Highest education obtained by either parent of participant.

and has been validated for use in pregnancy (Murray and Cox, 1990). Responses on a four-point scale were summed. A cut-off score of 10 or more was used to identify depressive symptoms due to its appropriateness for use during pregnancy in community samples (Gibson et al., 2009) and method of administration via telephone (Figueiredo et al., 2012). This cut-off has demonstrated sensitivity of 76 and specificity of 94 (Bergink et al., 2011).

### 2.3.3. Parity

Women were asked whether or not it was their first pregnancy.

### 2.4. Analysis

We summarised the demographic and preconception mental health characteristics of the women. For the pregnancies, we estimated the prevalence of anxiety and depressive symptoms in the third trimester, overall and stratified by preconception personality disorder. We estimated the associations between preconception personality disorder with anxiety and depressive symptoms during pregnancy. We used logistic generalised estimating equations to account for possible correlations between the repeated outcome measures within women who participated in more than one pregnancy. For each outcome we first estimated the effect of each preconception factor separately. We then estimated the effect of preconception personality disorder after (i) adjusting for parity and parental divorce/separation; and (ii) also adjusting for preconception common mental disorder. In a sensitivity analysis, we repeated the analyses using continuous measures of

anxiety and depressive symptoms and modelled the associations with linear generalised estimating equations. All analyses were conducted using Stata version 14 (Statacorp, 2015).

### 3. Results

At the commencement of VIHCS in 2006, there were 872 women actively participating in VAHCS and eligible for our study. The 128 women who had previously participated but were no longer active participants comprised 87 women who had declined participation, 39 who were lost to follow up, and two who had died. Within the VIHCS study period (when the women were aged between 29 and 36 years), 465 women gave birth to a total of 732 children (see Fig. 2). This figure was consistent with expected birth rates for women of the same age, living in the state of Victoria, during this same period (724 expected births) (Australian Bureau of Statistics, 2013). Sixty-seven (14.4%) VAHCS women with 132 pregnancies in the study period did not participate (95 children were identified retrospectively, and women declined participation for 37 pregnancies). Compared to women who participated in VIHCS, the 67 women who did not participate were significantly more likely to have been born overseas, attend a metropolitan rather than rural school, have different patterns of cannabis use, and higher rates of preconception common mental disorder (Patton et al., 2015). Of the 465 women eligible for VIHCS, 306 (65.8%) completed the antenatal interview covering 414 pregnancies. Sixty-two (20.3%) of these women with 86 pregnancies were then excluded from analyses due to missing preconception personality disorder data. Our analyses are based on complete case data for 244 women (52% of the eligible sample) with 328 pregnancies.

At the antenatal assessment the mean age of women was 33 years (standard deviation [SD]=1.73 years, range 29–36 years). Antenatal interviews were completed in the third trimester of pregnancy (mean=34 weeks gestation, SD=2.1 weeks, range 30–40 weeks). Half of the pregnancies in the sample (n=163; 49.7%) were the women's first live (i.e. primiparous) birth. Approximately two-thirds of women in the sample participated for one pregnancy (n=160, 65.6%) and the remaining third of women participated more than once, for two (n=80, 32.8%) or three (n=4, 1.6%) pregnancies.

Table 1 shows preconception demographic and mental health characteristics for the total sample of women at age 24. Three quarters

**Table 2**

Estimated prevalence of anxiety and depression in pregnancy among women overall and by preconception personality disorder<sup>a</sup>.

	N	Anxiety <sup>b</sup>		Depression <sup>c</sup>	
		% <sup>d</sup>	(95% CI) <sup>e</sup>	% <sup>d</sup>	(95% CI) <sup>e</sup>
<b>All pregnancies</b>	328	14.0	(10.7, 18.2)	12.2	(09.1, 16.2)
<b>Preconception personality disorder<sup>f</sup></b>					
Yes	55	29.1	(18.8, 42.1)	21.8	(13.0, 34.4)
No	273	11.0	(07.8, 15.3)	10.3	(07.2, 14.4)

<sup>a</sup> N=328 pregnancies to 244 women.

<sup>b</sup> Participants were classified as anxious in pregnancy if cut-off score of  $\geq 2$  on Clinical Interview Schedule, Revised (CIS-R) anxiety subscale score was reached.

<sup>c</sup> Participants were classified as depressed in pregnancy if cut-off score of  $\geq 10$  on Edinburgh Postnatal Depression Scale (EPDS) was met.

<sup>d</sup> Percentage of pregnancies for which participants met defined cut-off.

<sup>e</sup> Corresponding binomial Wilson 95% confidence interval.

<sup>f</sup> Personality disorder defined as DSM-IV diagnosis using the Standardised Assessment of Personality (SAP) administered at age 24 and prior to conception.

of women had undertaken higher education or training after secondary school. Four of five women were in relationships (either married, de-facto, or boyfriend/girlfriend) and nearly all were in paid employment. 19.7% of women had parents who had divorced or separated before she was aged 18 years. 17.2% of women were categorised as having a preconception personality disorder and 23.1% as having a preconception common mental disorder at age 24.

Table 2 displays the prevalence of antenatal anxiety and depressive symptoms among women with and without preconception personality disorder. Overall, maternal anxiety symptoms were present in 14.0% of pregnancies. Anxiety symptoms were more frequent in pregnancies of women who had a preconception personality disorder than those who did not (29.1% vs. 11.0%). Maternal depressive symptoms were present in 12.2% of pregnancies in the sample. Depressive symptoms were more common in pregnancies to women with prior personality disorder (21.8%) than those without prior personality disorder (10.3%).

Table 3 shows estimated associations between preconception factors and anxiety and depressive symptoms in pregnancy. In the unadjusted model, we observed a three-fold increase in the odds of self-reported anxiety in pregnancy for women with a preconception personality disorder (unadjusted odds ratio (OR) 3.36, 95% confidence interval (95%CI) 1.59–7.13) compared to those without a preconception personality disorder. This association remained with adjustment for preconception parental divorce/separation and pregnancy parity (adjusted OR 3.05, 95%CI 1.41–6.57). In the final model, after also adjusting for preconception common mental disorder, the association between preconception personality disorder and anxiety during pregnancy remained (adjusted OR 2.84, 95% CI 1.31–6.15). Of the other background factors explored in the final model, preconception common mental disorder was also associated with increased odds of anxiety

(adjusted OR 2.28, 95% CI 1.10–4.74).

We further observed a doubling of the odds of depression in pregnancy in those with a preconception personality disorder (unadjusted OR 2.43, 95% CI 1.06–5.59; Table 3) compared to those without preconception personality disorder. However, this association was reduced when adjusted for preconception parental divorce/separation and pregnancy parity (adjusted OR 2.21, 95% CI 0.92–5.28). In the final model, the association between preconception personality disorder and depressive symptoms in pregnancy was further reduced when preconception common mental disorder was also adjusted for (adjusted OR 1.98, 95% CI 0.81–4.81). In the final model, two background factors were associated with increased odds of depression during pregnancy: preconception common mental disorder (adjusted OR 2.82, 95% CI 1.27–6.26) and preconception parental divorce/separation (adjusted OR 2.51, 95% CI 1.09–5.79).

Sensitivity analyses using continuous anxiety and depression scores in pregnancy as outcomes showed a pattern of results consistent with these findings (see Table A1 in Appendix A and Table B1 in Appendix B).

#### 4. Discussion

In this community sample, preconception personality disorder was associated with increased odds for anxiety and depressive symptoms during pregnancy. Antenatal anxiety symptoms were approximately three times more likely in women with a prior diagnosis of personality disorder compared to women without prior personality disorder. Adjustment for the presence of preconception background factors including common mental disorders had little effect on the association. The odds of antenatal depressive symptoms in women with preconcep-

**Table 3**  
Estimated associations between preconception factors with anxiety and depressive disorders during pregnancy<sup>a</sup>.

	Anxiety <sup>b</sup>									
	Unadjusted <sup>c</sup>			Partially adjusted <sup>d</sup>			Fully adjusted <sup>e</sup>			
	OR	(95% CI)	<i>p</i>	OR	(95% CI)	<i>p</i>	OR	(95% CI)	<i>p</i>	
<b>Preconception mental health</b>										
Any personality disorder <sup>f</sup>	3.36	(1.59, 7.13)	0.002	3.05	(1.41, 6.57)	0.004	2.84	(1.31, 6.15)	0.008	
Common mental disorder <sup>g</sup>	2.43	(1.19, 4.95)	0.015				2.28	(1.10, 4.74)	0.028	
<b>Pregnancy factors</b>										
Woman's first child (parity)	1.29	(0.71, 2.36)	0.406	1.37	(0.74, 2.56)	0.316	1.33	(0.70, 2.52)	0.379	
<b>Participant's parents' factors</b>										
Parental divorce/separation <sup>h</sup>	1.69	(0.78, 3.62)	0.181	1.63	0.73, 3.65	0.24	1.65	(0.73, 3.71)	0.226	
	Depression <sup>i</sup>									
	Unadjusted <sup>c</sup>			Partially adjusted <sup>d</sup>			Fully adjusted <sup>e</sup>			
	OR	(95% CI)	<i>p</i>	OR	(95% CI)	<i>p</i>	OR	(95% CI)	<i>p</i>	
<b>Preconception mental health</b>										
Any personality disorder <sup>f</sup>	2.43	(1.06, 5.59)	0.037	2.21	(0.92, 5.28)	0.075	1.98	(0.81, 4.81)	0.133	
Common mental disorder <sup>g</sup>	2.63	(1.22, 5.67)	0.014				2.82	(1.27, 6.26)	0.011	
<b>Pregnancy factors</b>										
Woman's first child (parity)	1.10	(0.63, 1.93)	0.738	1.18	(0.64, 2.18)	0.597	1.13	(0.59, 2.15)	0.715	
<b>Participant's parents' factors</b>										
Parental divorce/separation <sup>h</sup>	2.34	(1.06, 5.21)	0.036	2.39	(1.03, 5.53)	0.042	2.51	(1.09, 5.79)	0.031	

<sup>a</sup> N=328 pregnancies for 244 participants.

<sup>b</sup> Anxiety in pregnancy defined as Clinical Interview Schedule-Revised (CIS-R) anxiety subscale score ≥2.

<sup>c</sup> Univariate logistic regression analyses unadjusted for potential confounders.

<sup>d</sup> Multivariate logistic regression analyses using GEE estimation, adjusted for parity and parental divorce.

<sup>e</sup> Multivariate logistic regression analyses using GEE estimation, adjusted for parity, parental divorce and preconception common mental disorder.

<sup>f</sup> Personality disorder measured using the Standardised Assessment of Personality (SAP) to derive DSM-IV diagnoses at age 24 years.

<sup>g</sup> Common mental disorder defined as score of > 2 on General Health Questionnaire 12-item version (GHQ-12) at age 24 years.

<sup>h</sup> Participant's own parents were divorced/separated before she was 18 years of age.

<sup>i</sup> Depression in pregnancy defined as Edinburgh Postnatal Depression Scale (EPDS) score ≥10.

tion personality disorder were twice that of those without a prior history. Although this trend persisted after adjustment for preconception background factors including common mental disorders, the evidence for an independent association was weaker.

The prevalence for personality disorder in our sample is within the range of estimates reported elsewhere. 17% of our participants were classified as having a preconception personality disorder at age 24, a figure that is a little higher than the 11–12% estimated in a review of American epidemiological data (Torgersen, 2014), but lower than the 26% reported for an Australian population sample of 25–34 year-old women (Quirk et al., 2016). We identified anxiety and depressive symptoms in 14 and 12% of pregnancies in our sample, respectively, consistent with estimates for antenatal anxiety (Buist et al., 2008; Grant et al., 2008) and depression (Banti et al., 2011; Milgrom et al., 2008) in other community samples.

Our present findings support and expand previous research demonstrating continuities between preconception mental health and that of the perinatal period (Biaggi et al., 2016; Dietz et al., 2007; Patton et al., 2015). To our knowledge, our finding that women with preconception personality disorder are at increased risk for anxiety and possible depressive symptoms during pregnancy has not been reported previously. The association may be understood in part with reference to broader literature concerning personality disorder, anxiety and depression, as well as other work showing that personality disorder is a risk factor for poor future mental health (Moran et al., 2016). High comorbidities between personality disorder and anxiety (Friborg et al., 2013) and depression (Friborg et al., 2014) are well documented, and coexisting personality disorder has been linked to poorer outcomes in anxiety (Ansell et al., 2011) and depression (Grilo et al., 2010). Our finding of an attenuated association between personality disorder and antenatal depressive symptoms with the adjustment for preconception background factors including common mental disorder does not negate the possibility of an independent association between personality disorder and antenatal depression. The adjusted point estimate was consistent with nearly doubled odds of depression and the comparatively wide confidence intervals around the estimate may indicate that our analyses are underpowered.

The inherent difficulties that people with personality disorder experience in forming and maintaining relationships means that they may lack social buffering in responding to major life events. Pregnancy, childbirth and becoming a parent are therefore particularly challenging experiences for women with symptoms of personality disorder. Furthermore, women with personality disorder may be more likely to be parenting in a context of social isolation, financial problems and exposure to substance misuse (Coid et al., 2006; Moran et al., 2006). In addition these women experience difficulties engaging with maternity and mental health services as well as social services (Green et al., 2008).

Some possible alternative explanations also need to be considered. The association between preconception personality disorder and antenatal anxiety and depression symptoms might be explained by residual confounding. It is possible that we have not accounted for all previous common mental disorder. However, adjusting for concurrent symptoms of disorder did not bring a major change in the strength of association, suggesting that is an unlikely explanation. Of greater relevance might be the role of persisting social and economic disadvantage (e.g., intimate partner violence, lack of social support), comorbid substance use or physical health problems that were not

controlled for in these analyses. Finally, it is possible that our findings reflect the presence of a causal link, whereby women with personality disorder are more vulnerable to biological and psycho-social changes associated with pregnancy, resulting in greater likelihood of anxiety and depression symptoms.

Our study had strengths and limitations. The longitudinal design was a strength with the prospective identification of mental health problems (Moffitt et al., 2010). However, we may have missed some anxiety and depressive symptoms as we assessed maternal mental health at a single antenatal time point. Second, selective attrition may have had some effect on the estimates of association as women who did not participate in the perinatal phase of the study tended to have a greater history of previous common mental disorder. Thirdly, the VIHCS study period restricted the inclusion of pregnancies to those occurring when participants were aged 29–36 years, missing pregnancies that occurred at other times. While we captured the peak fertility rate for Australian women (Australian Bureau of Statistics, 2013), it is possible that different patterns of maternal anxiety and depressive symptoms occur in pregnancies at younger or older maternal ages (Hudson et al., 2000; Quinlivan et al., 2004).

We found personality disorder in young adulthood to be independently associated with antenatal anxiety symptoms. This highlights personality and personality disorder specifically in understanding risks for mental health problems in pregnancy. The possibility of personality disorder, together with prior mental health problems and social adversity, deserve exploration when clinicians assess women's well-being in pregnancy (National Institute for Health and Care Excellence NICE, 2014). For women with personality disorder, actions to promote social engagement and emotional regulation may have benefits for her own mental health and well as promoting healthy maternal-infant bonding after birth.

Women identified as having a history of personality disorder may benefit from greater support and monitoring during the perinatal period. In recent years small trials have assessed psychosocial interventions for anxiety and depression delivered during pregnancy but with mixed results (Austin et al., 2008; Bittner et al., 2014; Goodman et al., 2014; Milgrom et al., 2011). There is, however, some evidence for prevention of children's mental health problems via interventions directed to parents (Siegenthaler et al., 2012). The prospect of identifying and treating women at increased risk of antenatal anxiety and depression in the preconception years through to pregnancy holds the potential to improve the quality of life and mental health of mothers and their children.

## Acknowledgements

Thank you to the project team involved in data collection and management, and to the participants who contributed their time to the study. This work was supported by the National Health and Medical Research Council [APP1008273, APP1063091, APP437015, APP1019887 to G.P., and APP1104644 to R.B.]; Australian Rotary Health; Colonial Foundation; Perpetual Trustees; Financial Markets Foundation for Children (Australia); Royal Children's Hospital Foundation; Murdoch Childrens Research Institute; Australian Postgraduate Association to E.S.; and the Australian Research Council [DP1311459 to C.O.]. Research at the Murdoch Childrens Research Institute is supported by the Victorian Government's Operational Infrastructure Program.

## Appendix A

Table A1

**Table A1**  
Anxiety and depression symptoms in pregnancy among women with versus without preconception personality disorder<sup>a</sup>: mean raw scores and confidence intervals.

	Anxiety <sup>b</sup>				Depression <sup>c</sup>		
	N	Mean	SE <sup>d</sup>	(95% CI) <sup>e</sup>	Mean	SE <sup>d</sup>	(95% CI) <sup>e</sup>
<b>All pregnancies</b>	328	0.6	0.1	(0.5, 0.8)	4.9	0.2	(4.5, 5.3)
<b>Preconception personality disorder<sup>f</sup></b>							
Yes	55	1.1	0.2	(0.7, 1.5)	5.6	0.6	(4.4, 6.9)
No	273	0.5	0.1	(0.4, 0.7)	4.7	0.2	(4.3, 5.2)

<sup>a</sup> N=328 pregnancies to 244 participants.

<sup>b</sup> Anxiety symptom raw score measured using the Clinical Interview Schedule-Revised (CIS-R) anxiety subscale (score range 0–8) during pregnancy at age 29–32 years.

<sup>c</sup> Depressive symptom raw score measured using the Edinburgh Postnatal Depression Scale (EPDS) (score range 0–30) during pregnancy at age 29–32 years.

<sup>d</sup> Standard Error.

<sup>e</sup> Mean raw score and 95% confidence interval.

<sup>f</sup> Personality disorder defined as DSM-IV diagnosis using Standardised Assessment of Personality (SAP) administered at age 24.

**Appendix B**

Table B1

**Table B1**  
Prediction of anxious and depressive symptom scores during pregnancy from preconception factors<sup>a</sup>.

	Anxiety symptom scores <sup>b</sup>								
	Unadjusted <sup>c</sup>			Partially adjusted <sup>d</sup>			Fully adjusted <sup>e</sup>		
	β	(95% CI)	p	β	(95% CI)	p	β	(95% CI)	p
<b>Preconception mental health</b>									
Any personality disorder <sup>f</sup>	0.56	(0.06, 1.05)	0.027	0.52	(0.01, 1.03)	0.046	0.46	(-0.03, 0.96)	0.066
Common mental disorder <sup>g</sup>	0.54	(0.08, 1.00)	0.022				0.49	(0.03, 0.95)	0.038
<b>Pregnancy factors</b>									
Woman's first child (parity)	0.18	(-0.09, 0.44)	0.193	0.19	(-0.07, 0.46)	0.154	0.17	(-0.10, 0.44)	0.224
<b>Woman's parents' factors</b>									
Parental divorce/separation <sup>h</sup>	0.22	(-0.17, 0.60)	0.276	0.21	(-0.19, 0.62)	0.305	0.21	(-0.18, 0.61)	0.294
	Depressive symptom scores <sup>i</sup>								
	Unadjusted <sup>c</sup>			Partially adjusted <sup>d</sup>			Fully adjusted <sup>e</sup>		
	β	(95% CI)	p	β	(95% CI)	p	β	(95% CI)	p
<b>Preconception mental health</b>									
Any personality disorder <sup>f</sup>	0.96	(-0.48, 2.39)	0.191	0.77	(-0.63, 2.16)	0.281	0.54	(-0.79, 1.88)	0.425
Common mental disorder <sup>g</sup>	2.05	(0.82, 3.29)	0.001				2.03	(0.82, 3.24)	0.001
<b>Pregnancy factors</b>									
Woman's first child (parity)	0.04	(-0.59, 0.67)	0.901	0.10	(-0.53, 0.74)	0.747	0.02	(-0.62, 0.66)	0.941
<b>Woman's parents' factors</b>									
Parental divorce/separation <sup>h</sup>	1.46	(0.20, 2.73)	0.023	1.46	(0.18, 2.75)	0.026	1.46	(0.27, 2.65)	0.016

<sup>a</sup> N=328 pregnancies for 244 participants.

<sup>b</sup> Pregnancy anxiety scores measured using Clinical Interview Schedule Revised (CIS-R), anxiety subscale (CIS-R, score range 0–8).

<sup>c</sup> Univariate linear regression analyses unadjusted for potential confounders.

<sup>d</sup> Multivariate linear regression analyses using Generalised Estimating Equations (GEE), adjusted for parity and parental divorce/separation.

<sup>e</sup> Multivariate linear regression analyses using GEE adjusted for parity, parental divorce/separation, and preconception common mental disorder.

<sup>f</sup> Personality disorder measured using the Standardised Assessment of Personality (SAP) to derive DSM-IV diagnoses at age 24 years.

<sup>g</sup> Common mental disorder defined as score of > 2 on General Health Questionnaire 10 item version (GHQ-10) at age 24 years.

<sup>h</sup> Participant's own parents' divorce/separation before she was 18 years old.

<sup>i</sup> Pregnancy depression symptoms measured using the Edinburgh Postnatal Depression Scale (EPDS; score range 0–30).

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