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## Risk factors of transient and persistent anxiety during pregnancy

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## ABSTRACT

**Purpose:** chronic poor mental health over the course of pregnancy contributes to greater adverse maternal and child outcomes. Identifying women with chronic depressive or anxiety symptoms can provide opportunities to reduce distress and improve pregnancy outcomes. The objective of this study was to determine risk factors of chronic antenatal depressive and anxiety symptoms using a longitudinal pregnancy cohort in Alberta, Canada.**Methods:** women with singleton pregnancies were included ( $N=3021$ ). Anxiety and depressive symptoms were measured in the second and third trimesters using the Spielberger State-Trait Anxiety Inventory and the Edinburgh Postnatal Depression Scale, respectively. On the basis of the timing and persistence of symptoms, the following three mutually exclusive subgroups for each anxiety and depressive symptoms were created: never symptomatic, symptomatic only in the second trimester, and symptomatic at both time points. Separate logistic regression models were used to derive risk factors for each subgroup.**Findings:** women with chronic anxiety or depressive symptoms were distinguished from those with transient symptoms or no symptoms by their optimism scores, in which less optimistic pregnant women had a four-fold increased risk for developing chronic depressive or anxiety symptoms compared with more optimistic women (AOR varied from 4.30 to 4.93). Additionally, high perceived stress, low social support, history of mental health issues were common predictors of chronic anxiety and depressive symptoms in pregnancy. Partner tension was the exclusive predictor of anxiety symptoms (AOR varied from 1.94 to 2.31) and poor physical health (AOR 2.54; 95% CI 1.32–4.89), unplanned pregnancy (AOR 3.05; 95% CI 1.61–5.79), and infertility treatments (AOR 4.98; 95% CI 1.85–13.39) were unique predictors of chronic depressive symptoms.**Conclusions:** knowledge of the risk factors of chronic poor mental health during pregnancy might inform the development of effective strategies within the limited resources of health-care systems to target populations with greater needs for interventions.

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## Introduction

Anxiety and depressive symptoms are common during pregnancy. Up to one-third of women may experience anxiety symptoms during pregnancy (Lee et al., 2007). The prevalence of depression varies from 7.4% in the first trimester, to 12.8% in the second semester, and 12.0% in the third trimester (Bennett et al.,

2004). The literature suggests that anxiety and depressive symptoms are not static across the perinatal period (Sutter-Dallay et al., 2012; Mora et al., 2009; Kuo et al., 2014) and symptoms for some women may be transitional and resolve over time, whereas these symptoms can persist in other women (Geller, 2004). Significant heterogeneity in the timing and persistence of perinatal depression has been reported and three distinct categories of women in regard to depressive symptoms have been identified: never symptomatic, chronically symptomatic, and only symptomatic at the antenatal or postpartum period (Sutter-Dallay et al., 2012; Mora et al., 2009). Similar evidence on antenatal anxiety is scarce with the exception of a recent study that reported

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trajectories of the severity of anxiety symptoms ranging from very low to very high among women undergoing caesarean childbirth (Kuo et al., 2014). The heterogeneity of anxiety symptoms has been noted in other populations (Nandi et al., 2009).

It is known that depression and anxiety can increase the risk of adverse pregnancy and child outcomes. The timing and duration of depressive and anxiety symptoms may be related to severity of adverse maternal and child health outcomes. For instance, in a longitudinal study, Chung et al. (2004) found that depressive symptomatology that persisted through the perinatal period was related to poor parenting practices (Chung et al., 2004). A link between antenatal anxiety and preterm birth, low birth weight (Littleton et al., 2007; Teixeira et al., 2009; O'Donnell et al., 2011), and postpartum depression (Ahluwalia et al., 2004; Heron et al., 2004; Skouteris et al., 2009) as well as the increased risk of delays in cognitive, behavioural, and psychomotor development and mental health problems in children (Buss et al., 2011; Davis and Sandman, 2012; Kingston et al., 2012; Loomans et al., 2012) has been reported. Alterations in hypothalamo-pituitary-adrenal cortical-axis activity, which is believed to play a role in forming the pathways of these adverse outcomes, have been shown to be related to chronic anxiety symptoms (Greaves-Lord et al., 2007). Roesch et al. (2004) found that pregnancy anxiety experienced at multiple time points over the course of pregnancy was associated with shorter gestation (Roesch et al., 2004).

Demographic and psychosocial characteristics of pregnant women suffering from chronic mental health symptoms might differ from others. In a study by Mora et al. (2009), chronically depressed women were more likely to be multiparous and have moderate or high stress levels compared with other women (Mora et al., 2009). Evidence on risk factors of chronic mental health symptoms during the antenatal period is limited. With a few exceptions, previous studies on risk factors of antenatal depression and anxiety are cross-sectional with a single assessment of symptoms and do not address chronicity of symptoms or variations related to pregnancy stages. Knowledge of the risk factors of chronic antenatal depressive and anxiety symptoms can inform screening strategies to identify the at-risk group of women with a high need for interventions. This information might also aid in the development of more refined models of mechanisms and causal pathways in which poor mental health leads to adverse outcomes. The aim of the current study was to identify the demographic, clinical, cognitive, and psychosocial predictors of transient and chronic depressive and anxiety symptoms in a community sample of pregnant women.

## Materials and methods

Data for this study were obtained from the All Our Babies (AOB) cohort, an established longitudinal pregnancy cohort in Alberta, Canada, that has prospective questionnaire data on maternal mental health, health-care utilisation, birth outcomes, and postpartum experiences. Recruitment began in 2008 and ended in 2010. Information on recruitment, data collection, and questionnaires for the AOB study has been described in detail elsewhere (Gracie et al., 2010; McDonald et al., 2013). Data collection included repeat assessments using validated questionnaires and investigator/stakeholder questions. Participants completed three questionnaires, twice during pregnancy (< 25 weeks and 34–36 weeks gestation) and once during the postpartum period (four months), and provided consent to link to their medical records. The cohort has been followed annually at 12, 24, and 36 months post partum. Cohort retention is greater than 80%. The study was approved by the Conjoint Health Research Ethics Board of the University of Calgary. Participants provided informed consent

at the time of recruitment and were provided copies for their records.

## Study variables

Women with singleton pregnancies were included ( $N=3021$ ). Anxiety was defined as scoring above the established cut-off of 40 on the state anxiety subscale of the Spielberger State Trait Anxiety Inventory (Spielberger and Gorsuch, 1983). The State Anxiety Inventory consists of 20 items rated on a 4-point Likert scale from 1 (not at all) to 4 (very much so). This scale has been validated against clinical interviews during both the pregnancy and postpartum period and has been found to have acceptable sensitivity, specificity, and predictive values to determine cases of anxiety among a perinatal population (Grant et al., 2008; Meades and Ayers, 2011). Three mutually exclusive subgroups of anxiety were created based on the timing and persistence of symptoms: never symptomatic, symptomatic exclusively in the second trimester (< 24 weeks), and symptomatic at both time points. Chronic anxiety was defined as persistently high levels of anxiety symptoms during both the second and third trimesters, whereas transient anxiety was defined as anxiety symptoms exclusively during the second trimester.

Depression was measured by the Edinburgh Postnatal Depression Scale (EPDS), a 10-item self-report questionnaire. The scale has high reliability with an internal consistency of .87 (Cox et al., 1987). The EPDS has been validated for use in the antenatal period (Murray and Cox, 1990). A score greater than or equal to 13 has been recommended to identify women with symptoms of major depression (Gaynes et al., 2005). Similar to anxiety, the following three mutually exclusive subgroups of depression were created: never symptomatic, symptomatic exclusively in the second trimester (transient depression), and symptomatic at both time points (chronic depression).

Variables that were considered potential predictors of antenatal depression and anxiety were selected according to the literature and through discussion with perinatal mental health professionals. Variables were grouped into the following domains: demographics (maternal age, marital status, education level, household income level, ethnicity, and time living in Canada), obstetrical and physical health status (gravidity, parity, pre-pregnancy BMI, reproductive history, timing of pregnancy, mode of conception, pre-existing chronic conditions, and physical health status), psychosocial (history of substance or alcohol abuse, history of abuse/neglect, history of mental health issues, partner tension, and social support in pregnancy), optimism as a cognitive variable, and perceived stress.

Physical health status, social support, and perceived stress variables were measured in the second trimester. Physical health status was measured using the 12-item Short-Form Health Survey (SF-12v2), a shorter version of the SF-36v2 that covers the same eight health domains. This scale evaluates functional health and well-being from the patient's perspective and has two components: physical health (PCS) and mental health (MCS) functioning (Ware et al., 1996). The SF-12v2 has satisfactory validity and reliability, with Cronbach's alphas of .88 for the physical component summary and .82 for the mental component summary (Cheak-Zamora et al., 2009). In the present study, a score below the 20th percentile on the SF-12v2 physical component summary was defined as a poor health status during pregnancy.

The Medical Outcomes Study (MOS) Social Support Scale is a 19-item self-report scale that measures four dimensions of social support: emotional/informational, tangible, affectionate, and positive social interaction (Sherbourne and Stewart, 1991). For each item, participants are asked to indicate how often each type of support was available to them if needed by choosing one of five

options. Scores for each item vary from 1 to 5, and the possible total score ranges from 0 to 100. A higher score indicates a greater perceived social support. The internal consistency of the overall support scale and all subscales is high, ranging from .91 to .97.

The Perceived Stress Scale (PSS) is a ten-item scale that assesses the degree to which individuals perceive situations in their lives to be stressful. Participants are asked to rate how often they have felt or thought a certain way with response choices ranging from never to very often. The total score is determined by summing all items and ranges from 0 to 40 with higher scores indicating more perceived stress. The scale has good internal consistency, with a Cronbach's alpha of .85 (Cohen et al., 1983).

Dispositional optimism was measured by the Life-Orientation Test-Revised, a 10-item self-report scale. Each item is scored from 0 to 4 based on the respondent's level of agreement with the item. Given that 4 of these 10 items are fillers and are therefore not used to derive a score, the total score ranges from 0 to 24. Higher scores indicate greater levels of optimism (Scheier et al., 1994).

A past history of mental health problems was defined as any self-reported depressive episode for greater than two weeks or other mental disorders, such as generalised anxiety disorder, bipolar disorder, schizophrenia, and obsessive compulsive disorder. Information on pre-existing medical conditions was obtained from the medical records. All remaining variables were assessed using single-item questions or combinations of single item survey questions.

### Analysis

Descriptive statistics using frequencies and percentages were used to describe sample characteristics.  $\chi^2$  analysis was used to assess bivariate associations between each category of depression and anxiety and demographic, obstetrical, cognitive, and psychosocial variables. Four separate logistic regression models were performed to derive risk factor profiles for transient anxiety, transient depression, chronic anxiety, and chronic depression. A hierarchical model building strategy was adopted with blocks of variables entered in the following order: demographic, obstetrical, psychosocial, cognitive, and perceived stress. Variables from each domain were considered for inclusion in the multivariable regression models if they had significant bivariate association at  $p = .20$  or if the variables were deemed clinically important regardless of statistical significance. Further model building involved checking the independent effects of those factors previously removed from each block to ensure robustness of the final models. Although our outcome variables included three categories, we did not perform multinomial regression analysis because separate regression analyses allowed for building specific models for each subgroup. Adjusted odds ratios and 95% confidence intervals were presented for all final models, and an alpha level of .05 was used for statistical tests. All analyses were performed using IBM SPSS statistical software program, version 19.0 (IBM Corp, 2010).

### Findings

The majority of participants were between 25 and 34 years of age, married, Caucasian and were born in Canada or had lived in Canada for more than five years. Most participants had more than a high school education and reported an annual household income of at least \$80,000 Canadian dollars (Table 1). These characteristics align with the pregnant and parenting population of an urban centre in Canada (McDonald et al., 2013). In total, 23% of women experienced anxiety on at least one occasion during pregnancy, whereas 11% of women reported depressive symptoms. Similarly,

the occurrence of transient and chronic anxiety symptoms was higher than depression (Table 2).

Bivariate analysis revealed that transient anxiety was associated with younger maternal age ( $< 25$ ) (OR 2.39; 95% CI 1.54–3.71), household income  $< \$40,000$  (OR 2.29; 95% CI 1.60–3.26), household income of \$40,000–\$79,999 (OR 1.45; 95% CI 1.14–1.84), non-Caucasian ethnicity (OR 1.54; 95% CI 1.22–1.95), new immigrants (OR 1.83; 95% CI 1.30–2.56), unplanned pregnancy (OR 1.87; 95% CI 1.50–2.34), poor physical health status (OR 1.99; 95% CI 1.57–2.51), history of abuse/neglect (OR 1.92; 95% CI 1.55–2.36), history of substance abuse (OR 1.76; 95% CI 1.08–2.86), partner tension (OR 2.72; 95% CI 2.21–3.36), history of mental health issues (OR 2.32; 95% CI 1.90–2.84), low social support (OR 3.48; 95% CI 2.64–4.59), being less-optimistic (OR 4.60; 95% CI 3.61–5.87), and high perceived stress (OR 6.65; 95% CI 5.23–8.47). With the exception of being a new immigrant and having a history of substance abuse, similar factors were associated with chronic anxiety symptoms. The final multivariable regression models for transient and chronic anxiety are presented in Tables 3 and 4. High perceived stress, low social support, history of mental health issues, partner tension, and being less optimistic were predictors of chronic anxiety in pregnancy.

Transient depressive symptoms were associated with younger maternal age ( $< 25$ ) (OR 3.19; 95% CI 1.59–6.38), household income  $< \$40,000$  (OR 5.35 95% CI 3.35–8.55), household income of \$40,000–\$79,999 (OR 2.12; 95% CI 1.40–3.21), non-Caucasian ethnicity (OR 2.51; 95% CI 1.74–3.62), new immigrants (OR 2.07; 95% CI 1.30–3.40), unplanned pregnancy (OR 1.77; 95% CI 1.21–2.59), infertility treatments (OR 3.40; 95% CI 4.07–10.79), poor physical health status (OR 2.08; 95% CI 1.42–3.06), history of substance abuse (OR 3.30; 95% CI 1.70–6.40), partner tension (OR 2.39; 95% CI 1.67–3.42), history of mental health issues (OR 3.73; 95% CI 2.60–5.34), low social support in pregnancy (OR 6.44; 95% CI 4.49–9.33), being less optimistic (OR 4.03; 95% CI 2.77–5.86), and high perceived stress (OR 34.43; 95% CI 21.29–55.69) at the bivariate level. In addition to these factors, poor reproductive history and pre-existing chronic conditions were associated with chronic depressive symptoms throughout pregnancy. The final multivariable regression models for transient and chronic depressive symptoms are presented in Tables 5 and 6. Predictors of chronic depressive symptoms in the final model included high perceived stress, low social support, history of mental health issues, poor physical health status, unplanned pregnancy, infertility treatment, and being less optimistic.

On the basis of final models, women with chronic symptoms were distinguished from those with transient symptoms by their optimism scores in which less optimistic pregnant women had a four-fold increased risk for developing chronic depressive or anxiety symptoms compared with more optimistic women (AOR varied from 4.30 to 4.93). Partner tension was the exclusive predictor of anxiety symptoms (AOR varied from 1.94 to 2.31). Poor physical health (AOR 2.54; 95% CI 1.32–4.89), unplanned pregnancy (AOR 3.05; 95% CI 1.61–5.79), and infertility treatments (AOR 4.98; 95% CI 1.85–13.39) were unique predictors of chronic depressive symptoms.

### Discussion

The aim of this study was to examine the risk factors of transient and chronic depressive and anxiety symptomatology in a community sample of over 3000 pregnant women in Alberta, Canada. A range of characteristics was independently associated with membership in each category of symptoms, including demographic, obstetric, cognitive, and psychosocial variables and perceived stress. Some of these factors were widely shared across

**Table 1**  
 Characteristics of the total sample and participants with chronic anxiety and chronic depressive symptoms (N=3021).

Characteristic	Total sample		Chronic anxiety*		Chronic depression†	
	n	%	n	%	n	%
Maternal age at childbirth						
Less than 25 years old	151	5.4	21	9.5	7	10.6
25–34 years old	1985	70.7	138	62.7	38	57.6
35 years old or more	673	24.0	61	27.7	21	31.8
Education						
High school or less	295	9.8	34	14.1	10	13.7
More than high school	2702	90.2	207	85.9	63	86.3
Household income						
Less than \$40,000	223	7.7	32	13.8	14	20.3
\$40,000–\$79,999	619	21.3	70	30.2	25	36.2
\$80,000 or more	2063	71.0	130	56.0	30	43.5
Marital status						
Married/common law	2855	95.3	212	88.0	65	89.0
Other	141	4.7	29	12.0	8	11.0
Ethnicity						
White/Caucasian	2385	79.6	55	22.8	48	65.8
Other	610	20.4	186	77.2	25	34.2
Time lived in Canada						
Born/ ≥ 5 years	2726	91.4	213	89.5	64	88.9
< 5 years	257	8.6	25	10.5	8	11.1
Previously pregnant (gravidity)						
No (primigravida)	1067	35.6	79	32.8	24	32.9
Yes (multigravida)	1931	64.4	162	67.2	49	67.1
Pre-pregnancy BMI						
Underweight	131	4.5	10	4.3	2	2.9
Normal	1812	62.1	126	54.1	43	61.4
Overweight	646	22.1	57	24.5	16	22.9
Obese	331	11.3	40	17.2	9	12.9
Poor reproductive history (miscarriage, preterm births, still births)						
Yes	826	28.7	82	35.2	25	34.7
No/primigravida	2052	71.3	151	64.8	47	65.3
Unplanned pregnancy						
Yes	653	21.9	83	34.6	37	51.4
No	2335	78.1	157	65.4	35	48.6
Assisted conception						
Yes	210	7.0	16	6.6	9	12.3
No	2788	93.0	225	93.4	64	87.7
Pre-existing chronic condition(s)						
Yes	308	10.2	34	14.1	8	11.0
No	2713	89.8	207	85.9	65	89.0
Poor physical health status in 2nd trimester						
Low	566	19.0	80	33.2	30	41.1
Moderate/High	2414	81.0	161	66.8	43	58.9
Optimism						
Low	526	19.3	136	61.3	47	70.1
Moderate/High	2198	80.7	86	38.7	20	29.9
History of alcohol/drug dependency						
Yes	99	3.3	13	5.4	4	5.6
No	2899	96.7	228	94.6	68	93.2
History of abuse/neglect						
Yes	777	25.9	91	37.8	33	45.2
No	2225	74.1	150	62.2	40	54.8
Social support in 2nd trimester						
Inadequate	384	12.9	100	41.8	35	50.0
Adequate	2592	87.1	139	58.2	35	50.0
Tension with partner						
Some/a lot	828	27.9	141	59.5	47	65.3
None	2135	72.1	96	40.5	25	34.7
Perceived stress						
Low	596	20.1	50	21.0	6	8.3
Moderate/high	2371	79.9	188	79.0	66	91.7

Table 1 (continued)

Characteristic	Total sample		Chronic anxiety*		Chronic depression†	
	n	%	n	%	n	%
History of depression/anxiety/other mental disorders						
Yes	1013	33.8	148	61.4	56	77.8
No	1985	66.2	93	38.6	16	22.2

\* n=241.

† n=73.

Table 2  
Rates of antenatal anxiety and depressive symptomatology.

Group	Depression		Anxiety	
	n	%	n	%
Never symptomatic	2600	88.9	2047	73.3
Symptomatic exclusively during the second trimester	133	4.5	190	6.8
Symptomatic exclusively during the third trimester	120	4.1	313	11.2
Symptomatic during both the second and third trimesters	73	2.5	241	8.6

Table 3  
Logistic regression analysis using transient anxiety as the dependent variable.

Predictor	Adjusted Odd ratio	95% CI	p
Maternal age <25	1.84	1.10–3.08	.020
Maternal age 25–34	1.15	.87–1.50	.325
Time lived in Canada <5 years	1.81	1.22–2.70	.004
Partner tension	1.94	1.52–2.48	.000
High perceived stress score	4.84	3.71–6.32	.000
Low social support score	1.86	1.33–2.60	.000
Mental health history	1.73	1.37–2.19	.000

Note: n=2325, p<.001. Variables entered into the model include maternal age, household income level, ethnicity, time living in Canada, timing of pregnancy, physical health status, history of substance abuse, history of abuse/neglect, partner tension, history of mental health issues, social support, optimism, and perceived stress.

Table 4  
Logistic regression analysis using chronic anxiety as the dependent variable.

Predictor	Adjusted Odd ratio	95% CI	p
High perceived stress score	17.16	11.50–25.60	.000
Low social support score	3.37	2.14–5.33	.000
Mental health history	1.74	1.18–2.58	.006
Low optimism score	4.30	2.88–6.42	.000
Partner tension	2.31	1.56–3.44	.000

Note: n=2080, p<.001. Variables entered into the model included maternal age, household income level, ethnicity, timing of pregnancy, mode of conception, physical health status in pregnancy, history of abuse/neglect, history of mental health issues, partner tension, social support in pregnancy, optimism, and perceived stress.

Table 5  
Logistic regression analysis using transient depression as the dependent variable.

Predictor	Adjusted Odd ratio	95% CI	p
Non-Caucasian ethnicity	2.06	1.31–3.25	.002
High perceived stress score	24.95	15.05–41.37	.000
Low social support score	2.37	1.52–3.68	.000
Mental health history	2.20	1.44–3.36	.000

Note: n=2690, p<.001. Variables entered into the model included maternal age, household income level, ethnicity, time living in Canada, pre-pregnancy BMI, timing of pregnancy, physical health status in pregnancy, history of substance abuse, history of abuse/neglect, partner tension, history of mental health issues, social support in pregnancy, optimism, and perceived stress.

Table 6  
Logistic regression analysis using chronic depression as the dependent variable.

Predictor	Adjusted Odd ratio	95% CI	p
High perceived stress score	24.69	10.03–60.81	.000
Low social support score	3.09	1.65–5.78	.000
Mental health history	3.34	1.69–6.63	.001
Poor physical health	2.54	1.32–4.89	.005
Unplanned pregnancy	3.05	1.61–5.79	.001
Low optimism score	4.93	2.57–9.45	.000
Infertility treatments	4.98	1.85–13.39	.001

Note: n=2403, p<.001. Variables entered into the model included maternal age, household income level, ethnicity, time living in Canada, pre-pregnancy BMI, reproductive history, timing of pregnancy, pre-existing chronic conditions, physical health status in pregnancy, history of substance abuse, history of abuse/neglect, partner tension, history of mental health issues, social support, optimism, and perceived stress.

categories regardless of the continuity of symptoms or stage of pregnancy. Three common risk factors of transient or chronic depressive and anxiety symptoms were high perceived stress, low social support, and a past history of mental health problems. The impact of these factors on maternal mental health is well-documented; a past history of mental health problems is a major risk factor for perinatal anxiety and mood disorders (Giardinelli et al., 2012; Goodman and Tyer-Viola, 2010) and the primary reason for referral to mental health services during the perinatal period (Sloan and Kirsh, 2008). Individuals with a history of poor mental health may have a more heightened response to stressful events than those without (Post, 1992). In our study, perceived stress was associated with both transient and chronic anxiety and depression, with the highest risks related to depression and chronic anxiety (AOR varied from 17.16 to 24.95). Some common stressors during pregnancy are low material resources, poor employment conditions, intense family and household responsibilities, tension in intimate relationships, and complications of pregnancy (Dunkel Schetter and Tanner, 2012). Low social support can limit the access and uptake of important resources that enhance resilience to stress, such as social integration, connectedness, and enacted support (Dunkel, 2011). A supportive social network can directly improve overall well-being both by buffering the impact of potentially adverse effects of stressful life events and by increasing the ability to cope with these stressors (Cohen and Wills, 1985).

Nearly 90% of our community-based sample of pregnant women exhibited low depressive symptomatology, and the majority

of elevated depressive symptoms were transient. Less than 3% of women experienced chronic depression. Anxiety rates were higher in all classes, and approximately 9% of women experienced chronic anxiety. These results call for more attention to antenatal anxiety, particularly given its adverse impact on pregnancy outcomes.

The factor that distinguished transient symptoms from chronic conditions for both depressive and anxiety symptoms was dispositional optimism. Pregnant women who were less optimistic had a four-fold increased risk to develop chronic depressive or anxiety symptoms compared with optimistic women. Dispositional optimism may directly reduce stress by influencing internal coping strategies and the cognitive adjustment to diverse stressors. A meta-analysis of 50 studies revealed that dispositional optimism was positively associated with coping strategies used to eliminate, reduce, or manage stressors or emotions and negatively associated with strategies intended to ignore, avoid, or withdraw from stressors or emotions (Nes and Segerstrom, 2006). In addition, a positive vision of the future can affect a person's perception of control and indirectly reduce distress. In a study of distress in a sample of high-risk pregnant women, Lobel et al. (2002) found that optimistic women were more likely than non-optimistic women to perceive their pregnancy as controllable and use non-avoidant coping strategies.

Lancaster et al. (2010) conducted a systematic review of 57 studies to identify an overall trend of evidence of risk factors of depression during pregnancy. Similar to our study, they found that lack of social support and life stress were consistently related to an increased risk of depression during pregnancy. The reviewers also noted that significant bivariate associations between history of depression, unplanned pregnancy, and lower income exist, but further research is needed to confirm multivariate relationships (Lancaster et al., 2010). In our study, unplanned pregnancy and a history of mental health problems were predictors of chronic depressive symptoms, but low household income was not.

Two previous studies have examined the risk factors of chronic depressive symptomatology in the perinatal period. In contrast to our findings, Sutter-Dallay et al. (2012) reported associations between income and parity and chronic depression. One explanation for this contrasting finding is that their analysis did not account for perceived stress or psychosocial and cognitive variables. Mora et al. (2009) examined the risk factors of chronic depression in a prospective cohort study; consistent with our findings, they noted that high or medium stress is related to chronic depression. Similar to our study, they did not find associations between chronic depression and maternal age, marital status, or health behaviours (Mora et al., 2009).

We are not aware of other studies that have examined the risk factors of chronic anxiety symptoms throughout pregnancy. In a longitudinal study, Lee et al. (2007) examined anxiety risk factors at each trimester of pregnancy and noted variations in demographic and obstetric factors, such as age, parity, marital status, and history of smoking and drinking. Buist et al. (2011) conducted a cohort study to determine the association between demographic and psychosocial factors and continuity of generalised anxiety disorder (GAD) from preconception to pregnancy in four groups of women: no history of GAD, pre-pregnancy GAD, GAD only during pregnancy, and GAD during both pre-pregnancy and pregnancy. They found that women with both pre-pregnancy and pregnancy anxiety constituted a unique group and were more likely to have low levels of support and education as well as a history of childhood abuse (Buist et al., 2011). In our study, low social support was a predictor of chronic anxiety. We found associations between chronic anxiety and history of abuse (OR 2.04; 95% CI 1.54–2.70) and education (OR 1.79; 95% CI 1.21–2.66) at a bivariate level; however, these associations did not remain significant in multivariate analysis.

Some variables were more uniquely related to a particular category of symptoms. For example, demographic variables predicted only transient depression or anxiety. Physical health status and obstetrical factors, including unplanned pregnancy, were unique predictors of chronic depression. Generally, the rates of unplanned pregnancy are higher among women with a mental health problem (Takahashi et al., 2012). Women with an unplanned pregnancy also have an increased risk for discontinuing mental health treatment after the confirmation of pregnancy compared with women with a planned pregnancy (Roca et al., 2013). Although not directly examined in our study, it is possible that the combined effects of the discontinuation of treatment, excessive stress about the influence of medications on pregnancy, and a fear of symptoms relapse during pregnancy, labour, or the postpartum period contribute to emotional distress among women with unplanned pregnancies.

Partner tension was a unique predictor for both transient and chronic anxiety. A poor quality marital relationship, particularly in conjunction with other stressors, such as financial difficulties, is a strong predictor for antenatal anxiety (Nasreen et al., 2011). Although there is the possibility of a bidirectional association between anxiety and partnership tension in which elevated anxiety may result in more relationship conflict, preliminary evidence suggests a unidirectional association. In a longitudinal study, Whisman et al. (2011) examined the association between relationship adjustment and symptoms of anxiety and depression among a sample of pregnant women with a past history of depression. They reported a unidirectional association between lower relationship adjustment and higher anxiety levels at the next assessment (Whisman et al., 2011). However, they found a bidirectional, recursive association between depression and low relationship adjustment (Whisman et al., 2011). In our study, bivariate associations between partner tension and depression emerged but were not significant in multivariable analysis. Similarly, Lancaster et al. (2010) found a bivariate trend of association between depression and poor relationship quality in a review of evidence; however, at the multivariable level, they did not observe such a relationship.

Despite the substantial sample size and the length of follow-up, there are a few methodological limitations in this study. Single mothers constituted a small percentage of the sample; therefore, the analysis might not have sufficient power to detect the influence of marital status on mental health. In our sample, approximately 10% of women with a history of mental health problems reported taking prescription medications for their mental health condition during pregnancy. Our data, however, did not include detailed information about the timing, duration, or compliance of the treatment. Although the mean anxiety and depression scores were not significantly different between women taking medications in our sample and those not taking medications, this remains a limitation of the study.

### Implications

Identifying pregnant women who experience chronic anxiety or depressive symptoms can help target resources within health-care systems to serve this high-needs population. The finding with the clearest clinical importance is that women with lower levels of optimism are at greater risk for chronic depressive or anxiety symptoms during pregnancy. If these findings are confirmed with further research, the inclusion of the measure of optimism in routine assessments could distinguish women at risk of chronic symptoms from those with transient symptoms.

Our results also emphasise the importance of understanding relationship dynamics in the preconception and early pregnancy periods to address maternal anxiety. Simple interventions, such as brief cognitive behavioural therapy to improve communications between partners, might reduce anxiety symptoms. The association between poor physical health status, obstetric variables, and

chronic depression suggests that women with pregnancy complications should be monitored closely.

## Conclusions

Our findings confirm that pregnant women represent a heterogeneous group in terms of the chronicity of anxiety and depressive symptoms and that some of the characteristics of women with chronic poor mental health are different from other pregnant women. These results may inform the development of strategies to appropriately target limited resources of health-care systems for populations with chronic poor mental health problems and greater needs for interventions to improve maternal and child outcomes related to poor mental health.

## Conflict of Interest

The authors report no conflicts of interest.

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