Trajectories of Depressive Symptoms and Perceived Stress From Pregnancy to the Postnatal Period Among Canadian Women: Impact of Employment and Immigration

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Objectives. To identify trajectory patterns of maternal depressive symptoms and perceived stress from midpregnancy to 2 years postpartum and determine relationships with selected sociodemographic factors including income, education, immigration, and postpartum employment.

Methods. Pregnant women (n = 3307) recruited from the general population in 4 regions in Canada provided 6 waves of data from pregnancy to 2 years postpartum. The study was conducted from 2009 to 2015.

Results. We determined 5 trajectory groups distinguished by time and magnitude for both depressive symptoms and perceived stress. Immigrants living in Canada for more than 5 up to 10 years, but not more recent arrivals, were at higher risk for persistent stress and depression independent of income status. Being employed at 1 year postpartum was associated with a lower likelihood of postpartum depression and perceived stress, while mothers reporting work exhaustion were substantially more likely to experience persistent depression and stress.

Conclusions. The study highlighted the heterogeneous nature of depressive symptoms and perceived stress. Targeting interventions toward women 5 to 10 years after immigration and those experiencing exhaustion from postpartum work may be particularly beneficial. (*Am J Public Health.* 2019;109:S197–S204. doi:10.2105/AJPH.2018.304624)

Depression, typically characterized by an array of symptoms such as persistent sadness and feelings of guilt, is not uncommon during pregnancy and after giving birth.[1] In developed countries, prevalence rates for depression range from 7% to 20% in the prenatal and 10% to 15% in the postpartum period.[2,3] From 12% to 44% of women report high levels of perceived stress and some 70% experience stressful life events in the year before delivery.[4,5] Antecedents for postpartum depression in developed countries include prenatal depression and anxiety, previous mental illness, poor marital relationships, stressful life events, low socioeconomic status, and lack of social support.[6,7] Maternal depression and stress are risk factors for adverse outcomes to not only mother but also offspring, including offspring's higher risks for inflammation, lower IQ, and externalizing problems such as aggressive behavior.[8–10]

A recent systematic review highlighted the heterogeneous nature of perinatal depression trajectories,[11] finding a substantial variability in the severity (low, medium, or high), stability (stable, increasing, decreasing), and timing (prenatal or postpartum) of these patterns. At the descriptive level, accumulating evidence suggests that depressive symptoms in pregnancy decline until about 6 months postpartum and then increase again.[12] However this pattern varies among studies, and it is unclear if this descriptive pattern is maintained across different severity classes.[8,13,14] Sociodemographic factors such as low education, stressful life events, and ethnic minority status are known to vary across these trajectories. The association with factors such as immigration status and employment is less known,[11] particularly in North America, where large population-based studies have mainly focused on disadvantaged socioeconomic populations.[14,15]

Specifically, in Canada, levels of income vary extensively among immigrant women. For instance, the 2015 median annual salary for immigrant women admitted under the Canadian Experience Class (i.e., skilled worker with Canadian work experience) who landed in 2014 was CAD $41 000 but

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only $8800 for the immigrant women admitted under the Refugee Dependent Class.[16] For the Canadian-born population, the 2015 median salary was CAD $36 000. As compared with their Canadian-born counterparts, immigrant mothers may have less access to social support from family, relatives, and close friends.[17] In addition, the job-protected paid maternal leave policy in Canada only applies to 600 insurable hours of work within 1 year before pregnancy. In other words, pregnant women who move to Canada and are unemployed 1 year before pregnancy would receive no maternal leave benefits.

Research on maternal mental well-being has focused heavily on depressive symptoms while other indicators of mental health, such as perceived stress, have been less frequently studied.[18] It is also not known how trajectories of depressive symptoms and perceived stress, 2 distinct, yet highly related, mental health constructs, interact.[3,7,11] These gaps in the literature pose challenges in identifying the times of greatest vulnerability and the characteristics of mothers most susceptible to perinatal depression and stress.

In this study, we determined multiple longitudinal trajectory patterns of depressive symptoms and perceived stress from mid-pregnancy through to 2 years following delivery. We also examined the association between trajectory patterns of depressive symptoms and trajectory patterns of perceived stress, as well as their relations with multiple sociodemographic factors, including immigration status and postpartum employment within primarily middle-class women in Canada.

METHODS

The study population consisted of 3307 pregnant women participating in the ongoing Canadian Healthy Infant Longitudinal Development (CHILD) Study. Pregnant women were recruited from the general population in Edmonton, Alberta; Toronto, Ontario; Vancouver, British Columbia; and Winnipeg, Morden, and Winkler, Manitoba (see Appendix A and Appendix B, available as supplements to the online version of this article at http://www.ajph.org, for inclusion and exclusion criteria and recruitment methods).

Study participants were surveyed 6 times, at recruitment during the second or third trimester (wave 1; mean gestational age 27 weeks) and at 36 weeks of gestation in the prenatal period (wave 2), and then at 6, 12, 18, and 24 months (waves 3–6) in the postnatal period. Data used in this study were collected from 2009 to 2015 through self-reported questionnaires. Of the 3307 participants, 3011 provided data at wave 2 (91% retained), 2562 at wave 3 (77%), 2580 at wave 4 (78%), 2299 at wave 5 (69%), and 2248 at wave 6 (68%).

Measures

Depression symptoms. Depression symptoms were measured with the 20-item Center for Epidemiologic Studies Depression Scale (CES-D).[19] Women were asked how often they experienced various depressive cognitions, affects, and behaviors during the past week, for example, "felt lonely" and "talked less than usual." Responses were given on a score ranging from 0 (none of the time; < 1 day) to 3 (most or all of the time; 5–7 days). Responses were summed, with higher scores indicating higher depressive symptoms (minimum = 0; maximum = 60). As a depression screening tool, CES-D scores of 16 represent significant risk for clinical depression.[20] Cronbach's α across the 6 waves ranged from 0.89 to 0.91.

Perceived stress. Stress was assessed with the 10-item version of Perceived Stress Scale,[21] which measures how often participants found their lives to be stressful, unmanageable, and overwhelming in the last month. Example items were "How often have you felt nervous and stressed?" and "How often have you felt that you were unable to control the important things in your life?" Items were rated on a scale ranging from 0 (never) to 4 (very often). The responses of the 10 items were summed, with higher scores indicating greater perceived stress (minimum = 0; maximum = 40). In the absence of established criteria for evaluating perceived stress, we used the mean value across all six waves (12.96) as the cut point for a high level of perceived stress, very similar to the mean score (13.02) among women in the general US population.[21] Cronbach's α for perceived stress across the 6 waves ranged from 0.89 to 0.91.

Correlates of trajectory class membership. At baseline, respondents reported their age (range = 18–46 years), marital status (married, other), and total number of pregnancies. They also reported medical history of depression (never, depression in the past, current depression), being employed or not at any point of pregnancy, years lived in Canada (0 to 5 years, from > 5 to 10 years, more than 10 years), annual household income (CAD $0 to $39 999, $40 000 to $59 999, $60 000 to $79 999, $80 000 to $99 999, $100 000 or more), and education level (less than high school, completed high school, completed 2-year college diploma, completed 4-year university degree). At 1 year postpartum, participants were asked whether they were employed (yes, no) and if they felt both physically and mentally tired from work (work exhaustion) based on a 3-point scale (not true to very true).

Statistical Analysis

We first examined if maternal depressive symptoms, on average, followed a linear, or alternatively, a 2-slope development as suggested by some longitudinal studies covering the prenatal and postnatal period.[8,13,14] More specifically, we conducted a χ^2 difference test to compare 2 growth curve models: one with a slope across the 6 waves and another with change from recruitment (mean 27 weeks gestation) to 6 months postpartum as one slope (slope 1) and change from 6 months postpartum to 24 months postpartum as another slope (slope 2). We repeated the same analysis procedures for perceived stress. For both outcomes, the 2-slope model fit the data better than the 1-linear-slope model (Appendix C, available as a supplement to the online version of this article at http://www.ajph.org). This 2-slope specification is consistent with the literature[8,13,14] and thus was employed in subsequent general growth mixture model analyses.

We specified 2 sets of the 2-slope general growth mixture models for each outcome. The growth mixture model is a statistical procedure for identifying distinct longitudinal trajectories for variables of interest (i.e., depressive symptoms and perceived stress in our study).[22] To align with the assumption of homogeneity of individuals within the same trajectory group,[22] we fixed intercepts and slopes within groups to zero. Our key indicator of model fit in the growth mixture models was the Bayesian information criterion.[23] We also considered the bootstrap likelihood ratio test,[23]

as well as entropy indices that summarized the quality of the classification.[22]

Then, we tested the empirical associations between the trajectory patterns of depressive symptoms and perceived stress by using configural frequency analysis. Configural frequency analysis compares observed and expected frequencies in a cross-tabulation and tests whether cell frequencies are larger or smaller than expected based on chance. Lastly, we evaluated how group membership was associated with individual sociodemographics, medical history, and employment characteristics, by using multinomial logistic regression, with the lowest symptom group as the reference.

We conducted all analyses with Mplus version 7.3 (Muthén & Muthén, Los Angeles, CA). We handled missing data through full information maximum likelihood estimation. There were no significant differences in the rate of depressive symptoms and perceived stress between participants who were retained (n = 2248) and who were missing at wave 6 (n = 1059). Intraclass correlations among the 4 centers were small, indicating minimal systematic variation by city.

RESULTS

At baseline, average gestational age during pregnancy was 27 weeks (range = 6–39 weeks; SD = 5.73). Mean age was 32.1 years (range = 18.1–46.2 years; SD = 4.7; Table 1). The sociodemographic characteristics of study participants were comparable to that of the female middle-class population at reproductive age in Canada.[24] Among all women, 8.1% had lived in Canada for 5 years or less and 5.8% for more than 5 up to 10 years. About 38% of these immigrants were White, 6% were Black, 8% were Hispanic, 28% were Asian, and 20% were from other or multiethnic groups. At 1 year postpartum, 76% of all participants responded with "not true" to work exhaustion, while 18% reported "somewhat true" and 6% reported "very true."

Patterns of Depressive Symptoms and Perceived Stress Trajectories

On the basis of the indices of fit, we selected the 5-trajectory model as the optimal solution for both depressive symptoms and perceived stress (Appendix D, available as a supplement to the online version of this article at http://www.ajph.org). The 5 depressive symptom trajectories were

1. persistent (persistently high depressive symptoms; 2.3%),
2. antepartum (depressive symptoms particularly high in the antepartum period; 5.4%),
3. postpartum (high depressive symptoms present only after delivery; 6.7%),
4. never (moderately low; moderately low depressive symptoms, always less than cut-off score; 27.3%), and
5. never (low; lowest levels of depressive symptoms, always less than cut-off score; 58.4%; Figure 1a).

TABLE 1—Baseline Characteristics of the Study Sample: Canada, 2009–2012

Variable	% of Sample
Study sites	
Edmonton	23.6
Manitoba[a]	30.2
Toronto	23.6
Vancouver	22.6
Age at recruitment, y	
18–20	0.9
> 20 to 25	7.0
> 25 to 30	23.9
> 30 to 35	41.7
> 35 to 40	22.2
> 40 to 46.2	4.3
Annual household income, CAD $	
≤ 39 999	8
40 000–79 999	21
80 000–99 999	13
≥ 100 000	46
Education level	
4-year university degree	62.3
2-year college diploma	28.8
≤ high school	8.9
Race/ethnicity	
Non-White	24.3
White	75.7
Years lived in Canada	
≤ 5	8.1
> 5–10	5.8
> 10–20	5.8
> 20	80.4

Note. The sample size was n = 3307.
[a]Includes the sites at Winnipeg, Morden, and Winkler.

The 5 perceived stress trajectories were

1. persistent (persistently high perceived stress; 7.3%),
2. antepartum (perceived stress particularly high in the antepartum period; 4.5%),
3. postpartum (high perceived stress only after delivery; 23.1%),
4. never (moderately low; moderately low perceived stress, always less than cut-off score; 42.4%), and
5. never (low; lowest levels of perceived stress, always less than cut-off score; 22.7%; Figure 1b).

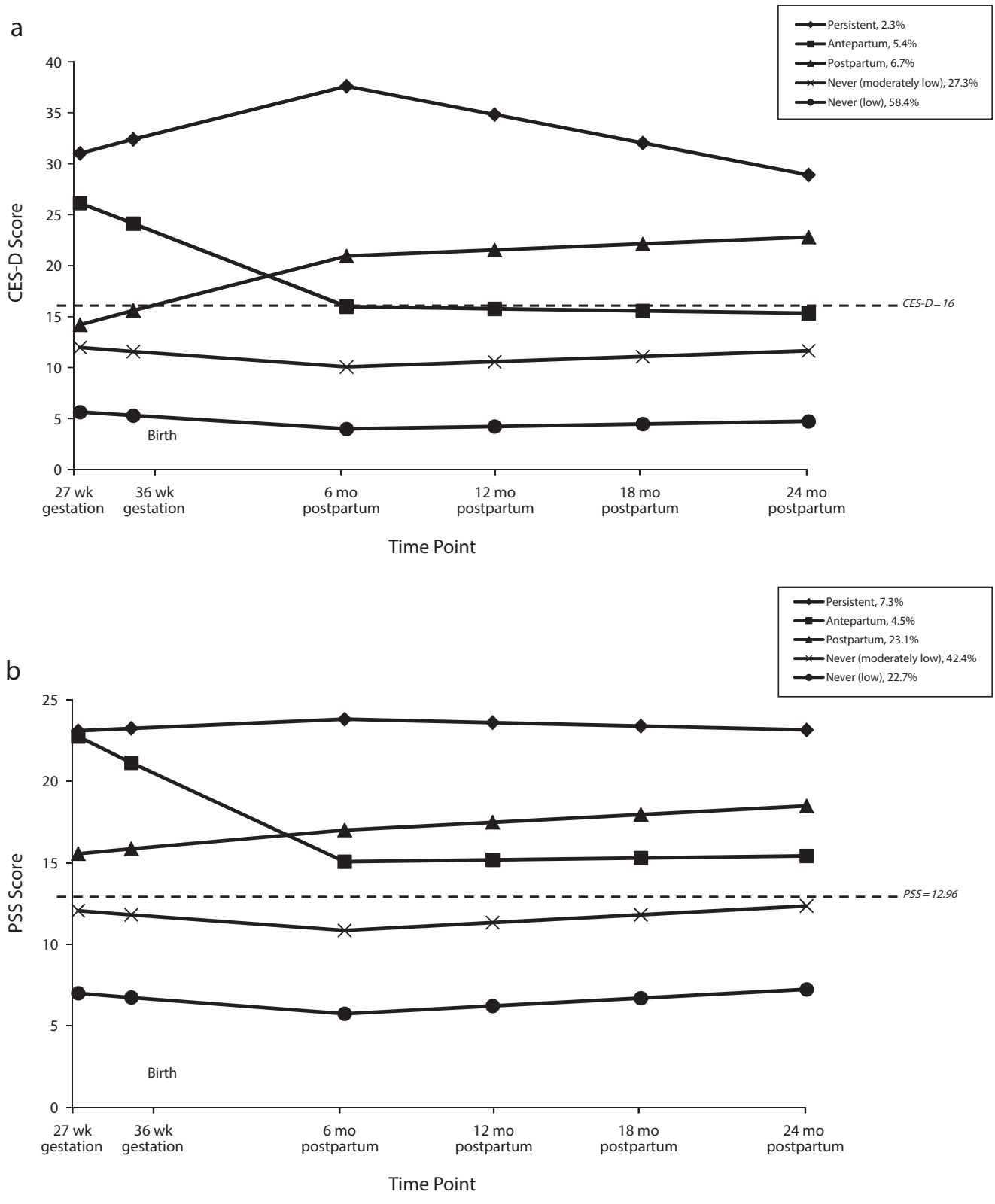
Depressive Symptoms and Stress Group Membership

Configural frequency analysis found that among the 25 possible configurations (5 depressive symptom trajectory groups × 5 perceived stress trajectory groups), 10 combinations were significantly more frequent than expected by chance (χ^2 [16; n = 3307] = 2692.996; $P < .001$). These 10 combinations were

1. persistent depressive symptoms (DEP)—persistent perceived stress (STS),
2. antepartum DEP—persistent STS,
3. antepartum DEP—antepartum STS,
4. antepartum DEP—postpartum STS,
5. postpartum DEP—persistent STS,
6. postpartum DEP—postpartum STS,
7. never (moderately low) DEP—antepartum STS,
8. never (moderately low) DEP—postpartum STS,
9. never (low) DEP—never (moderately low) STS, and
10. never (low) DEP—never (low) STS (summarized in Appendix E, available as a supplement to the online version of this article at http://www.ajph.org).

Factors Associated With the Trajectory Groups

Depressive symptoms. Compared with women with income of CAD $100 000 or greater, those from the lowest household income (CAD $0–$39 999) were at a higher risk of belonging to any of the 4 trajectories compared with the reference group of never (low), as were those with depression during pregnancy or a history of depression (compared



Note. CES-D = Center for Epidemiologic Studies Depression Scale; PSS = Perceived Stress Scale. The dashed line indicates CES-D = 16 and PSS = 12.96 in parts a and b.

FIGURE 1—Trajectory Groups, From 27 Weeks Gestation Through 24 Months Postpartum, of (a) Depressive Symptoms and (b) Perceived Stress: Canada, 2009–2015

with those without such a history) and those who experienced exhaustion from work at 1 year postpartum (Table 2). Compared with university graduates, high-school graduates were more likely to follow the persistent, postpartum, or never (moderately low) trajectory rather than the reference trajectory. Immigrants who had lived in Canada for more than 5 up to 10 years were more likely to fall into the persistent (adjusted odds ratio [AOR] = 3.77; 95% confidence interval [CI] = 1.54, 9.24), postpartum (AOR = 2.20; 95% CI = 1.29, 3.75), and never (moderately low; AOR = 1.50; 95% CI = 1.06, 2.12) trajectories than the never (low) group compared with nonimmigrants. Being employed at 1 year postpartum was associated with a lower likelihood of membership in the antepartum, postpartum, and never (moderately low) groups, but not in the persistent group. Work exhaustion at 1 year postpartum was associated with an elevated risk for persistent (AOR = 4.21; 95% CI = 1.10, 16.20), antepartum (AOR = 2.40; 95% CI = 1.57, 3.68), postpartum (AOR = 2.41; 95% CI = 1.69, 3.44), and never (moderately low; AOR = 1.61; 95% CI = 1.31, 1.97) depression symptom groups (see Appendix F, available as a supplement to the online version of this article at http://www.ajph.org, for distribution of cases by sociodemographics, depression history, and employment variables across the 5 depression symptom groups).

Perceived stress. Compared with women reporting the highest household income (≥ CAD $100 000), women from all other household income groups were consistently more likely to be in the persistent or postpartum group instead of never (low; Table 3). High-school graduates were more likely than university graduates to be in the antepartum group compared with never (low) group. Women with depression during pregnancy or a history of depression tended to fall into the other 4 trajectory groups compared with the never (low) group, as were the immigrants who had lived in Canada more than 5 up to 10 years. However, unlike the previous group, immigrants who had lived in Canada for 5 years or less were more likely to fall into the persistent (AOR = 2.19; 95% CI = 1.19, 4.03) and postpartum (AOR = 2.17; 95% CI = 1.42, 3.32) group compared with the never (low) group, but not the 2 other groups. Finally, women reporting work exhaustion 1 year postpartum were at a higher risk for being in the persistent (AOR = 5.79; 95% CI = 3.49, 9.62), postpartum (AOR = 2.32; 95% CI = 1.75, 3.07), and never (moderately low; AOR = 1.49; 95% CI = 1.17, 1.90) groups compared with the never (low) group (see Appendix F, available as a supplement to the online version of this article at http://www.ajph.org, for distribution of cases by sociodemographics, depression history, and employment variables across the trajectory groups).

DISCUSSION

Drawing on longitudinal data of 3307 Canadian women, this study revealed 5 trajectories of depressive symptoms from pregnancy to 2 years after delivery: persistent,

TABLE 2—Comparing Characteristics Among the 5 Depressive Symptoms Trajectory Groups: Canada, 2009–2015

Variable	Persistent, AOR[a] (95% CI)	Antepartum, AOR[a] (95% CI)	Postpartum, AOR[a] (95% CI)	Never (Moderately Low), AOR[a] (95% CI)
Age	0.95 (0.89, 1.02)	0.98 (0.94, 1.02)	1.00 (0.97, 1.04)	1.02 (1.00, 1.04)
Married	0.47 (0.21, 1.07)	0.51 (0.28, 0.90)	0.66 (0.35, 1.24)	0.68 (0.46, 1.00)
Household income, CAD $ (Ref = ≥ 100 000)				
0–39 999	5.56 (1.97, 15.72)	7.90 (3.82, 16.34)	2.81 (1.45, 5.41)	3.56 (2.45, 5.16)
40 000–59 999	1.47 (0.53, 4.12)	3.23 (1.71, 6.12)	1.49 (0.87, 2.58)	1.73 (1.26, 2.38)
60 000–79 999	2.79 (1.18, 6.64)	2.53 (1.34, 4.80)	1.85 (1.15, 2.98)	2.07 (1.57, 2.73)
80 000–99 999	2.07 (0.80, 5.35)	3.26 (1.87, 5.67)	1.65 (1.03, 2.62)	2.09 (1.62, 2.70)
Educational level (Ref = completed 4-y university)				
< high school	1.99 (0.69, 5.75)	1.37 (0.66, 2.84)	1.36 (0.66, 2.83)	1.27 (0.81, 1.98)
Completed high school	2.14 (0.99, 4.63)	1.14 (0.69, 1.88)	1.78 (1.19, 2.66)	1.35 (1.06, 1.74)
Completed 2-y college	1.61 (0.78, 3.31)	0.79 (0.49, 1.26)	0.85 (0.57, 1.26)	1.05 (0.85, 1.30)
No. of pregnancies	1.11 (0.90, 1.37)	1.00 (0.87, 1.15)	1.08 (0.96, 1.22)	1.04 (0.97, 1.12)
Depression history (Ref = never had depression)				
Past	11.52 (5.82, 22.82)	5.99 (4.08, 8.81)	3.79 (2.70, 5.32)	2.03 (1.63, 2.53)
Depressed at baseline	54.59 (25.44, 117.15)	20.26 (12.01, 34.19)	3.67 (1.90, 7.12)	3.67 (2.47, 5.44)
Years living in Canada (Ref: > 10 y)				
≤ 5	2.28 (0.91, 5.70)	1.41 (0.73, 2.72)	1.47 (0.86, 2.50)	1.16 (0.84, 1.61)
> 5–10	3.77 (1.54, 9.24)	1.47 (0.69, 3.09)	2.20 (1.29, 3.75)	1.50 (1.06, 2.12)
Employment				
Employed during pregnancy	0.84 (0.44, 1.59)	0.96 (0.57, 1.62)	0.92 (0.59, 1.45)	0.95 (0.74, 1.23)
Employed at 1 y postpartum	0.11 (0.01, 1.15)	0.52 (0.29, 0.94)	0.38 (0.24, 0.60)	0.60 (0.47, 0.77)
Work exhaustion at 1 y postpartum	4.21 (1.10, 16.20)	2.40 (1.57, 3.68)	2.41 (1.69, 3.44)	1.61 (1.31, 1.97)

Note. AOR = adjusted odds ratio; CI = confidence interval.
[a]The AOR for each factor is adjusted for the effects of all other factors. Ref = never (low).

TABLE 3—Comparing Characteristics Among the 5 Perceived Stress Trajectory Groups: Canada, 2009–2015

Variable	Persistent, AOR[a] (95% CI)	Antepartum, AOR[a] (95% CI)	Postpartum, AOR[a] (95% CI)	Never (Moderately Low), AOR[a] (95% CI)
Age	1.00 (0.96, 1.04)	1.02 (0.97, 1.07)	1.03 (1.00, 1.06)	1.01 (0.99, 1.03)
Married	0.33 (0.17, 0.65)	0.47 (0.22, 1.02)	0.78 (0.43, 1.41)	0.64 (0.37, 1.10)
Household income, CAD $ (Ref = ≥ 100 000)				
0–39 999	3.78 (1.87, 7.65)	5.06 (2.25, 11.38)	3.03 (1.79, 5.16)	1.47 (0.90, 2.41)
40 000–59 999	2.32 (1.27, 4.23)	4.06 (2.13, 7.75)	2.00 (1.31, 3.03)	1.38 (0.95, 2.01)
60 000–79 999	3.31 (1.93, 5.69)	1.61 (0.75, 3.45)	2.80 (1.93, 4.07)	1.57 (1.12, 2.20)
80 000–99 999	1.94 (1.13, 3.34)	2.54 (1.42, 4.54)	1.81 (1.29, 2.56)	1.44 (1.08, 1.94)
Educational level (Ref = completed 4-y university)				
< high school	1.67 (0.78, 3.59)	2.57 (1.11, 5.93)	1.34 (0.72, 2.50)	0.92 (0.52, 1.64)
Completed high school	1.41 (0.90, 2.21)	1.28 (0.76, 2.18)	1.20 (0.87, 1.66)	0.95 (0.72, 1.27)
Completed 2-y college	0.81 (0.52, 1.25)	0.93 (0.57, 1.50)	0.90 (0.69, 1.18)	0.94 (0.75, 1.17)
No. of pregnancies	1.12 (0.98, 1.27)	1.08 (0.92, 1.25)	1.03 (0.94, 1.13)	1.02 (0.94, 1.11)
Depression history (Ref = never had depression)				
Past	5.85 (3.88, 8.82)	3.68 (2.32, 5.85)	4.02 (2.95, 5.47)	1.86 (1.39, 2.48)
Depressed at baseline	15.21 (7.76, 29.84)	7.46 (3.48, 15.99)	5.21 (2.86, 9.50)	2.54 (1.42, 4.57)
Years living in Canada (Ref = > 10 y)				
≤ 5	2.19 (1.19, 4.03)	1.70 (0.84, 3.45)	2.17 (1.42, 3.32)	1.35 (0.91, 2.00)
> 5–10	2.69 (1.38, 5.21)	2.35 (1.08, 5.10)	2.77 (1.71, 4.50)	1.59 (1.01, 2.52)
Employment				
Employed during pregnancy	0.89 (0.57, 1.40)	1.17 (0.69, 2.00)	0.97 (0.70, 1.36)	1.05 (0.78, 1.42)
Employed at 1 y postpartum	0.14 (0.07, 0.31)	0.76 (0.46, 1.27)	0.49 (0.36, 0.67)	0.80 (0.63, 1.02)
Work exhaustion at 1 y postpartum	5.79 (3.49, 9.62)	1.54 (0.96, 2.47)	2.32 (1.75, 3.07)	1.49 (1.17, 1.90)

Note. AOR = adjusted odds ratio; CI = confidence interval.
[a]The AOR for each factor is adjusted for the effects of all other factors. Ref = never (low).

antepartum, postpartum, never (moderately low), and never (low). We also identified 5 similar pre- and postnatal trajectories for perceived stress. Employment status (being employed and experiencing work exhaustion) and time since immigration had significant effects on depressive symptoms and perceived stress trajectories, even after adjustment for other sociodemographic factors. In line with cross-sectional studies,[3,4] women with a history of depression or lower income were more likely to have high scores for both depressive symptoms and perceived stress across the perinatal period. Moreover, high levels of perceived stress (i.e., persistent) were significantly associated with persistent, antepartum, or postpartum depression, highlighting their concurrent comorbidity. Of note, women with elevated levels of antepartum depressive symptoms were at significant risk of higher stress up to 2 years after delivery. This finding deserves attention, given that substantial research has already established the robust role of stress as a precipitant for recurrent or persistent depressive episodes.[11,14]

Exhaustion from work increased the likelihood of membership in each of the 4 trajectories associated with higher levels of depressive symptoms. In fact, the odds of experiencing persistent stress were 6-fold higher among women who reported work exhaustion at 1 year. Following a US cohort of mothers between 5 weeks and 6 months postpartum, Dagher et al.[25] found that the higher the workload from paid and unpaid work, the higher were women's depressive symptoms. On the other hand, mothers employed 1 year after giving birth in our study were almost half as likely to report heightened stress and depressive symptoms in the postpartum period. Taken together, these findings suggest that having a job that does not entail work exhaustion may be beneficial to postpartum mental health. Accumulating evidence has shown that, when having a job that favors family–work balance, paid work can buffer maternal depression and stress; employment is associated with improved financial resources and positive psychological outcomes such as higher self-esteem and stronger feelings of competence.[26,27] Understanding how employment in the postnatal period impacts maternal mental health in industrialized countries like Canada is important, as many mothers return to the labor force between 6 and 12 months after giving birth.[28] In Canada, although there are slight differences across provinces, in general, women who are employed for 600 insurable hours within 1 year before pregnancy are entitled to a job-protected paid maternal leave for about 1 year, receiving about 55% of their average weekly earnings from the government during the leave.

Immigrant women who had lived in Canada for more than 5 up to 10 years were 2 to 4 times more likely to experience persistent depression, postpartum depression, and heightened perceived stress in the perinatal

period, as compared with Canadian-born women or women who lived in Canada for more than 10 years. Interestingly, we found no significant differences in depressive symptoms between newcomers who moved to Canada within the last 5 years and those in Canada for more than 10 years. This is consistent with previous reports of lower rates of depression in women, in general, among recent immigrants compared with women residing in the United States for longer than 10 years.[29] Likely, recent immigrants exhibit good physical and mental health subsequent to Canada's immigrant selection policy and strict medical screening procedures (the healthy immigrant effect).[30] These advantages may decline over time as women encounter challenges in their new homeland.[31,32] Of note, all immigrant women, regardless of time since immigration, were more likely to fall into the postpartum or persistent stress trajectories. Findings need to be interpreted within a Canadian context, which has different immigration policies from other North American countries (e.g., unlike the United States, Canada uses a point-based system to evaluate immigrant applications, focusing on employability). Future studies need to examine other immigration-related factors such as ethnicity and refugee status; both affect mental health inequities in Canada.[33]

Although there are not many large-scale research studies on perinatal depressive symptoms in North American middle-class women,[11] the trajectories for depressive symptoms identified by this study were similar to those found in another longitudinal study of middle-class French women, where they identified 5 trajectory groups termed never, prenatal, preschool, intermediate, and chronic.[8] The consistency of this finding highlights the heterogeneous nature of depressive symptoms—some women tend to experience more depressive symptoms during pregnancy; others do not develop symptoms until postpartum. Future research to investigate the risk factors associated with these different timings may guide more effective strategies for improving mental health during the perinatal period.

Limitations and Strengths

This study advances our understanding of the longitudinal course of depressive symptoms and perceived stress during pregnancy and postpartum, but has limitations. Typical of longitudinal research, missing data were of concern. Based on our attrition analyses and use of full information maximum likelihood estimation, however, our findings can be generalized to middle-class Canadian women,[24] but not to very-low-income women.[14] Extending these findings to other developed nations such as the United States must be done carefully. It is plausible to assume similar trajectory patterns will be observed; however, differences in health care systems, immigration, and maternity leave policies must to be taken into consideration. Finally, as work exhaustion was measured at 1 year postpartum but trajectory patterns also covered the antepartum period, it is more appropriate to interpret findings as associations of co-occurrence with depressive symptoms and perceived stress trajectory patterns, rather than as a causal framework. Further study with a longer follow-up period is warranted to examine a more robust finding regarding the association among stress, depressive symptoms, work exhaustion, and immigration.

Despite these limitations, our study has several important strengths and contributes to the literature in a number of ways. Our study is among the first to assess the developmental course of depressive symptoms and perceived stress in parallel across motherhood. We identified distinct trajectories in a middle-class population, which complement existing findings in lower-income women[14] and findings in France.[8] Indeed, our study indicates that maternal depression and stress throughout the perinatal period is an issue for many educationally and financially advantaged women, albeit women within the lower-income spectrum of this population are more vulnerable. We also documented the effects of immigration status and employment on maternal mental health.

Public Health Implications

This study has highlighted the extent of concurrent comorbidity of depressive symptoms and perceived stress over the course of pregnancy and early motherhood. Our research on populations other than lower-income women is critical to informing policies for promoting the mental health of women who may not be deemed at risk. It identified several social and employment factors associated with maternal depressive symptoms and perceived stress trajectories over this time period. Importantly, from a public health perspective, because stress is modifiable,[34,35] we found that women with low scores on perceived stress were much less likely to suffer from depression in the pre- and postnatal time period. Hence, provision of stress intervention strategies such as social support, exercise, and meditation, especially in the early stage of pregnancy, may attenuate risk for future maternal depression and stress. Targeting interventions toward women 5 years after immigration, lower-income women, and those experiencing work exhaustion may be particularly beneficial. AJPH

CONTRIBUTORS

A. Chow designed the study, conducted the analyses, interpreted the findings, and wrote the article. A. L. Kozyrskyj obtained funding for and supervised the study, interpreted the findings, and critically revised the article. C. Dharma and M. R. Sears interpreted the findings and critically revised the article. E. Chen and S. J. Elliott contributed to theoretical conceptualization and revision of the article. P. J. Mandhane, S. E. Turvey, A. B. Becker, and P. Subbarao contributed to data collection. All authors provided critical comments on the article and approved the final version of the article.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

This study was approved by the human research ethics boards at the universities of British Columbia, Alberta, Manitoba, and Toronto.

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