Postpartum depression prevalence and risk factors among Indigenous, non-Indigenous and immigrant women in Canada

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Abstract

Objectives The social position of different minority groups in contemporary societies suggests different risk factors for postpartum depression (PPD). In this study, we used two cut-offs of the Edinburgh Postpartum Depression Scale (EPDS) to examine prevalence and risk factors for PPD among mothers participating in the Canadian Maternity Experiences Survey (MES), and to compare Indigenous, Canadian-born non-Indigenous and immigrant mothers.

Methods We used cross-sectional nationwide data from the 2006 MES (unweighted $N = 6237$, weighted $N = 74,231$) and conducted multivariate logistic regression models for $EPDS \geq 10$ and $EPDS \geq 13$ to explore risk factors for the total sample of mothers and in each study group.

Results Prevalence (%; 95 % CI) of $EPDS \geq 10$ and $EPDS \geq 13$ was significantly higher among immigrant (12.2 %, 10.2–14.2 and 24.1 %, 21.5–26.7) and Indigenous (11.1 %, 7.5–14.7 and 21.2 %, 16.5–25.9) compared to Canadian-born non-Indigenous mothers (5.6 %, 4.9–6.3 and 12.9 %, 11.9–13.9). Multivariate analysis of the total sample showed similar risk factors for $EPDS \geq 10$ and $EPDS \geq 13$ (ethnicity, low education, $\geq$ low income cut-off, taking antidepressants, experiencing abuse, low social support). Stratification by study group revealed differing risk factors in each group for $EPDS \geq 10$ and $EPDS \geq 13$. Indigenous mothers had the most distinct risk factors, followed by immigrant mothers. Non-indigenous Canadian-born mothers had risk factors most similar to the total sample.

Conclusion Differing prevalence and risk factors for PPD within and across study groups suggest that instead of a universal approach, tailored programs and services to prevent PPD in Indigenous, immigrant and non-Indigenous Canadian-born groups could better protect the mental health of Canadian mothers.

Résumé

Objectifs La position sociale de divers groupes minoritaires dans les sociétés contemporaines suggère des facteurs de risque différents pour la dépression postpartum. Notre étude emploie deux seuils de coupure dérivés de l'Échelle de dépression postnatale d'Edimbourg (EPDS) pour explorer la prévalence de la dépression postpartum et identifier facteurs de risque chez des mères participants à l'Enquête canadienne sur l'expérience de la maternité, et pour effectuer une comparaison entre trois groupes de mères : autochtones, non autochtones nées au Canada, et immigrantes.

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Méthodes Analyse de données de l'Enquête canadienne sur l'expérience de la maternité 2006 ($N = 6237$ non pondérées, $N = 74,231$ pondérées) et utilisation de modèles de régression logistique multivariés pour deux seuils de coupure ($EPDS \geq 10$ et $EPDS \geq 13$) pour explorer les facteurs de risque pour l'échantillon globale de mères, et pour chacun des trois groupes.

Résultats La prévalence (95 % IC) d' $EPDS \geq 10$ et d' $EPDS \geq 13$ était sensiblement plus haute chez les mères immigrantes (12,2 %, 10,2–14,2 et 24,1 %, 21,5–26,7) et autochtones (11,1 %, 7,5–14,7 et 21,2 %, 16,5–25,9) comparativement aux mères non autochtones nées au Canada (5,6 %, 4,9–6,3 et 12,9 %, 11,9–13,9). L'analyse multivariée de l'échantillon globale a démontré des facteurs de risque semblables pour $EPDS \geq 10$ et $EPDS \geq 13$ (ethnicité, faible niveau d'éducation, $\geq$ SFR, utilisation d'antidépresseurs, maltraitance, faible soutien). La stratification par groupe a révélé des facteurs de risques différents pour chaque groupe pour $EPDS \geq 10$ et $EPDS \geq 13$. Les mères autochtones avaient les facteurs de risque les plus distinctifs, suivi par les mères immigrantes. Les mères non autochtones nées au Canada avaient les facteurs de risque les plus semblables à ceux de l'échantillon globale.

Conclusion Le taux de prévalence et les facteurs de risques variables entre les groupes sous étude indiquent qu'au lieu d'une politique universelle pour prévenir la dépression postpartum chez les mères autochtones, immigrantes, et non autochtones nées au Canada, des programmes et services sur mesure pourraient mieux protéger la santé mentale des mères canadiennes.

Keywords Postpartum depression · Edinburgh Postnatal Depression Scale (EPDS) · Risk factors · Canada · Indigenous, immigrant, and non-Indigenous Canadian-born mothers

Mots-clés Dépression postpartum · L'Échelle de dépression postnatale d'Edimbourg · Facteurs de risque · Canada · Mères autochtones, immigrantes, et non autochtones nées au Canada

Introduction

Postpartum depression (PPD), a common health disorder occurring after birth among women of childbearing age (O'Hara & McCabe, 2013), brings detrimental health effects for mothers (Beck, 2003), newborns (Gress-Smith et al., 2012), and partners (Falah-Hassani et al., 2015). PPD affects approximately 13 % of new mothers (O'Hara & Swain, 1996) and 7–19 % of mothers during the first 12 weeks postpartum (Cohen et al., 2010). However, PPD is not experienced evenly across population groups, with higher prevalence among mothers belonging to minority (Wei et al., 2008) and marginalized groups (Clare & John, 2012; Jesse et al., 2005)(Da-Silva et al., 1998; Hobfall et al., 1995; Sit & Wisner, 2009), including immigrant and Indigenous mothers (Falah-Hassani et al., 2015; Wei et al., 2008). Despite this, few studies in Canada have compared PPD risk factors among mothers of different minority groups. Previous research suggests that these groups occupy different social positions in society that might differentially affect the determinants of mental health and PPD. For Indigenous mothers in Canada, the social determinants of health that might impact PPD include experiences of historical trauma (Brave Heart, 2003), inequalities (Noël & Larocque, 2009; Smylie & Andersons, 2006; Smylie, 2008; Statistics Canada, 2011) and discrimination (CIHI, Canadian Institute for Health Information, 2009). Among immigrant mothers in Canada, risk factors for PPD include low income, language

barriers, lack of social support (Dennis et al., 2017), being in Canada less than 2 years and living in neighbourhoods with high concentrations of immigrants (Dennis et al., 2017). However, there has not been a comparison in Canada of risk factors across immigrant, Indigenous, and Canadian-born non-Indigenous population groups. Most research into PPD, prevalence and risk factors in Canada have compared either Indigenous with non-Indigenous mothers or immigrant with non-immigrant mothers.

In general, research on PPD among Indigenous mothers has lagged behind that conducted among immigrant mothers (Bowen et al., 2014). For example, while a recent hospital-based study found higher PPD prevalence among refugees and recent immigrant mothers (Dennis et al., 2017), and another study identified PPD risk factors among immigrant mothers (Falah-Hassani et al., 2015), two studies that did examine PPD among Indigenous mothers were based only on small sample sizes, did not consider risk factors and reached contradictory results—one found significant differences in PPD among antenatal Indigenous and non-Indigenous mothers (Bowen & Muhajarine, 2006), while the other found none (Bowen et al., 2009).

The 2006 Canadian Maternity Experiences Survey (MES), which forms the basis of the current analysis, found a prevalence of 8.5 % minor risk for PPD in the general population of Canadian mothers (measured by the Edinburgh Postpartum Depression Scale (EPDS) with the cut-off of ≥ 10 to ≤ 12) and 8.7 % major risk of PPD (EPDS cut-off of ≥ 13) (Lanes et al., 2011). Risk factors

for PPD identified in the study included young maternal age, immigrant status, antidepressant use, low household income, low availability of support after pregnancy, and high stress during pregnancy (Lanes et al., 2011). Rates of minor and major risk for PPD were also higher in geographical areas with a higher concentration of Indigenous and rural women (Lanes et al., 2011). A recent analysis of the MES data found that the prevalence of PPD is higher among each of three groups of Indigenous mothers (First Nations off-reserve, Inuit, and Métis) compared to non-Indigenous Canadian-born mothers (12.9 %, 10.6 %, and 9.1 %, respectively, compared to 5.6 %). These differences became non-significant after adjustment for different risk factors (Nelson et al., 2018). However, neither the MES data nor other data have been used to compare prevalence and risk factors across immigrant, Indigenous and Canadian-born non-Indigenous population groups. Conducting such a comparison is important for yielding evidence that would guide better programming to prevent PPD among mothers in different minority groups in Canada.

Our paper addresses this gap in the literature by analyzing the MES data to:

1. Compare prevalence of and risk factors for EPDS ≥ 10 and EPDS ≥ 13 in three groups: Indigenous, Canadian-born non-Indigenous, and immigrant mothers in Canada; and
2. Compare risk factors for each group with those of the total sample. Using two EPDS cut-offs can reveal different risk factors among these three groups of mothers based on the severity of PPD, which might be important for maternity clinicians.

Methods

Data and participants

We obtained data from the 2006/7 Maternity Experiences Survey (MES) (detailed elsewhere) (Dzakpasu et al., 2008; Chalmers et al., 2008). The MES, conducted by Statistics Canada, is the first nationwide survey on pregnancy, birth and early postpartum in Canada. Eligible mothers (age 15 and older, with a live singleton birth) were randomly selected from the 2006 Census using a stratified sampling procedure. Women were proportionally sampled according to their geographic distribution in the general Canadian population. Information about the study was mailed to mothers in the sample, after which trained female interviewers contacted

them by phone. Interviews lasted about 45 min and were conducted in English, French and 13 other languages. The final sample included 6421 pairs of babies and their mothers who were 5 to 14 months after birth. After removing missing information on the main outcome and key predictor variables and applying weights, we arrived at 74,231 participants: $N = 3152$ Indigenous, $N = 53,803$ Canadian born non-Indigenous and $N = 17,276$ immigrant mothers. Indigenous mothers included First Nations, Inuit, and Métis mothers from all provinces and territories. For operational reasons, however, this group excluded First Nations mothers living on reserve (Dzakpasu et al., 2008). Indigenous mothers were sampled according to the proportion of the population they made up in geographic areas across Canadian provinces. However, they were not oversampled. Therefore, we were cautious in interpreting results related to these mothers and generalizing from these to all Indigenous mothers in Canada (Dzakpasu et al., 2008). The overall response rate for the MES was 77.9 % (Chalmers et al., 2008). The response rate by our study subgroups was not presented in the MES study report. However, the response rate varied by province, ranging from highest (86 %) in Nova Scotia to lowest (64 %) in Nunavut, where many Indigenous mothers live. Overall, the MES is considered a representative sample of mothers in Canada (Dzakpasu et al., 2008).

Ethics approval

The MES was approved by Statistics Canada (CIHR, 2007). Our secondary analysis was approved by St. Michael's Hospital's Research Ethics Board. In keeping with standards for secondary data analysis of Indigenous peoples, our analysis was conducted in collaboration with the Native Women's Association of Canada and the National Aboriginal Council of Midwives (CIHR, 2007; Royal Commission on Aboriginal Peoples, 1993).

Main outcome measures

We measured PPD using the Edinburgh Postnatal Depression Scale (EPDS), which includes 10 questions evaluating a woman's feelings over the past week (Cox et al., 1987). Answers range from 0 to 3, and the total questionnaire score ranges from 0 to 30. A cut-off point of 10 or less represents a minor risk for PPD; a cut-off of 13 and above represents medium to high risk. The EPDS is sensitive to PPD (Cox et al., 1987; Murray & Carothers, 1990) and has been shown to be a reliable tool among Indigenous women in Australia (Campbell et al., 2008) and Canada (Clarke, 2008). In this study, we used two cut-offs for the EPDS: EPDS ≥ 10 for total scores ≥ 10 and EPDS ≥ 13 for total scores ≥ 13 . Internal consistency of the EPDS was high for the three study groups

(see Cronbach's alpha in Table 2a). Among Indigenous mothers, Cronbach's alpha for EPDS ≥ 13 was also high (Table 2b).

Independent variables

Women's study groups by ethnicity and immigrant status were determined by first asking participants 'Were you born in Canada?' We categorized mothers responding negatively as immigrants (living in Canada for less than 5 years). Next, women born in Canada were asked 'Are you an Aboriginal person, that is, First Nations, Métis or Inuit?' (Statistics Canada, 2006a).

Mother's age at childbirth: we categorized age into '15–24 years' and '25–50 years'.

Marital status: we dichotomized this status into 'lone' (not married, single, divorced, separated or widowed) or 'cohabitating' (married or common-law).

Education included three levels of achievement: 'less than high school diploma', 'high school diploma or vocational training' and 'greater than high school diploma or vocational certificate.'

Low income cut-off after tax (LICO-AT): women could be 'above LICO', 'at or below LICO', or this information could be 'missing'. The LICO-AT reflects whether respondents lived in a household spending 20 percentage points more of their after-tax income than the average family on food, shelter and clothing, thus leaving less income for other expenses (Statistics Canada, 2006b).

Experience of abuse: either a woman reported experiencing at least one of ten acts of physical or sexual violence during the past 2 years at the hands of a spouse, partner or anyone else, or a woman reported no exposure to abuse during the past 2 years (Statistics Canada, 2006a; Statistics Canada, 1993).

Parity: number of times a respondent gave birth to a live baby, including the birth of the last baby. Answers were dichotomized into 'one child' and 'two or more children'.

Taking antidepressants before pregnancy: determined by whether the mother reported being prescribed antidepressants or diagnosed with depression before pregnancy or reported not having been prescribed antidepressants or diagnosed with depression in that period.

Social support was measured based on the following question: "People sometimes look to others for companionship, assistance or other types of support. During your pregnancy, how often was support available to you when you needed it?" Answers were dichotomized into 'no support' (none of the time, a little of the time, or some of the time) or 'some support' (most of the time or all of the time).

Stressful life events in the past 12 months: measured based on how respondents characterized the stress of most days

during the 12 months before the most recent childbirth. Responses were categorized into 'not stressful', 'somewhat stressful', or 'very stressful'.

Statistical analysis

After applying weights, we calculated two cut-off points for EPDS ≥ 10 and ≥ 13 and examined the internal consistency of each outcome for each study group. For prevalence, we estimated the percentage (and 95 % confidence intervals, CIs) of EPDS ≥ 10 and EPDS ≥ 13 scores above the cut-offs for the weighted subsamples and compared estimates between the study groups (Canadian-born Indigenous and non-Indigenous and immigrant), and among the three groups of Indigenous mothers (First Nations, Inuit and Métis) using a chi-square test. To determine risk factors for EPDS ≥ 10 and EPDS ≥ 13 for the total sample, we fit various multivariate logistic regression models while adjusting for independent variables that showed significant differences in PPD ($p < 0.05$) between study groups in the univariate associations. The first model was unadjusted and examined the association between ethnicity and PPD. Subsequent models sequentially adjusted for different independent variables are as follows: model 2 adjusted for age, model 3 added socio-economic status (SES—education and LICO-AT), model 4 added marital status, model 5 added antidepressant use before pregnancy, model 6 added experiences of abuse, and the final model considered social support in addition to all previous variables. Finally, to explore the specific risk factors for depression as measured by EPDS ≥ 10 and EPDS ≥ 13 in each study group (Indigenous and non-Indigenous Canadian-born and immigrant), we conducted multivariate logistic regression analysis while considering all independent variables (except ethnicity and immigrant status). We used SAS version 9.4 (SAS Institute Inc., Cary, NC, USA) for all analyses. We followed the MES Users' Guide and did not report estimates based on cell counts < 5 (Statistics Canada, 2006c). We report adjusted odds ratios and 95 % CI that we calculated while applying bootstraps to adjust for the complex study design.

Results

We found significant differences between the three study groups with respect to the independent variables (Table 1). Indigenous mothers were younger, less likely to report cohabitation, more likely to be living at or below LICO-AT, more likely to have taken antidepressants before pregnancy and to have experienced abuse in the past 2 years, and had lower levels of education compared to immigrant and non-Indigenous Canadian-born mothers.

Table 1 Distribution of study variables (weighted $N = 74,231$)

	Total weighted $N = 74,231$		Indigenous Canadian-born weighted $N = 3152$		Non-Indigenous Canadian-born weighted $N = 53,803$		Immigrant weighted $N = 17,276$		p value
	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	
Age									
15–24 years	11,728	15.8 (14.8, 16.8)	1227	38.9 (33.2, 44.7)	8759	16.3 (15.2, 17.4)	1742	10.1 (8.3, 11.9)	< 0.001
25–50 years	62,503	84.2 (83.2, 85.2)	1925	61.1 (55.3, 66.8)	45,045	83.7 (84.8, 82.1)	15,534	89.9 (88.1, 91.7)	
Marital status									
Lone	6154	8.3 (7.6, 9.0)	799	25.3 (20.2, 30.5)	4523	8.4 (7.6, 9.2)	832	4.8 (3.5, 6.1)	< 0.001
Cohabiting	68,077	91.7 (91.0, 92.4)	2353	74.7 (69.5, 79.8)	49,280	91.6 (90.8, 92.4)	16,444	95.2 (93.9, 96.5)	
Parity									
1 child	33,794	45.6 (44.2, 46.9)	1410	44.7 (38.8, 50.7)	24,965	46.4 (44.9, 48.0)	7419	43.0 (40.0, 46.0)	0.09
2 children or more	40,370	54.4 (53.1, 55.8)	1742	55.3 (49.3, 61.2)	28,785	53.6 (52.0, 55.1)	9842	57.0 (54.0, 60.0)	
Education									
Less than HS	5552	7.5 (6.8, 8.2)	749	23.7 (18.8, 28.7)	3588	6.7 (5.9, 7.4)	1216	7.0 (5.5, 8.6)	< 0.001
HS diploma/vocational	19,658	26.5 (25.3, 27.7)	1380	43.8 (37.8, 49.7)	14,937	27.8 (26.4, 29.1)	3341	19.3 (17.0, 21.7)	
Greater than HS diploma/vocational	49,020	66.0 (64.8, 67.3)	1023	32.5 (26.8, 38.1)	35,279	65.6 (64.1, 67.0)	12,718	73.6 (71.0, 76.3)	< 0.001
Household income									
\$0–\$29,999	11,763	15.8 (14.9, 16.8)	1136	36.0 (30.4, 41.7)	6964	12.9 (11.9, 14.0)	3663	21.2 (18.7, 23.7)	
\$30,000–\$59,999	21,550	29.0 (27.8, 30.3)	822	26.1 (20.8, 31.3)	15,407	28.6 (27.2, 30.0)	5321	30.8 (28.0, 33.6)	
≥ \$60,000	37,029	49.9 (48.5, 51.2)	869	27.6 (22.1, 33.0)	29,387	54.6 (53.1, 56.2)	6774	39.2 (36.3, 42.2)	
Missing	3889	5.2 (4.6, 5.8)	326	10.3 (6.8, 13.9)	2045	3.8 (3.2, 4.4)	1518	8.8 (7.1, 10.5)	
LICO-AT									
At/below LICO	13,512	18.2 (17.2, 19.2)	1193	37.9 (32.1, 43.6)	7436	13.8 (12.8, 14.9)	4882	28.3 (25.5, 31.0)	< 0.001
Above LICO	54,667	73.6 (72.4, 74.8)	1534	48.7 (42.7, 54.6)	42,866	79.7 (78.4, 80.9)	10,266	59.4 (56.5, 62.4)	
Missing	6053	8.2 (7.4, 8.9)	425	13.5 (9.4, 17.5)	3501	6.5 (5.7, 7.3)	2128	12.3 (10.3, 14.3)	
Antidepressant use before pregnancy									
No	62,708	84.5 (83.5, 85.4)	2399	76.1 (70.9, 81.3)	44,304	82.3 (81.2, 83.5)	16,005	92.6 (91.1, 94.2)	< 0.001
Yes	11,523	15.5 (14.6, 16.5)	753	23.9 (18.7, 29.1)	9499	17.7 (16.5, 18.8)	1271	7.4 (5.8, 8.9)	
Experiencing any abuse									
No	66,026	89.0 (88.2, 89.9)	2172	69.3 (63.8, 74.7)	47,557	88.5 (87.5, 89.4)	16,297	94.5 (93.1, 95.8)	< 0.001
Yes	8124	11.0 (10.1, 11.8)	964	30.7 (25.3, 36.2)	6210	11.5 (10.5, 12.5)	950	5.5 (4.2, 6.9)	
Stressful life events									
Not stressful	32,016	43.3 (41.9, 44.6)	1232	39.1 (33.2, 44.9)	22,881	42.7 (41.2, 44.2)	7903	45.9 (42.9, 48.9)	0.08
Somewhat stressful	33,102	44.7 (43.4, 46.1)	1418	45.0 (39.1, 50.9)	24,347	45.4 (43.8, 46.9)	7338	42.6 (39.6, 45.5)	
Very stressful	8900	12.0 (11.1, 12.9)	502	15.9 (11.6, 20.3)	6418	12.0 (10.9, 13.0)	1980	11.5 (9.6, 13.4)	
Social support during pregnancy									
No support or some	31,356	42.3 (41.0, 43.7)	1264	40.3 (34.4, 46.2)	20,749	38.6 (37.1, 40.2)	9342	54.3 (51.3, 57.3)	< 0.001
All times	42,699	57.7 (56.3, 59.0)	1873	59.7 (53.8, 65.6)	32,963	61.4 (59.8, 62.9)	7863	45.7 (42.7, 48.7)	

Total unweighted $N = 6237$

Table 2 Distribution of EPDS ≥ 13 and EPDS ≥ 10 and Cronbach's alpha for subgroups of women in the study

a. Distribution of EPDS ≥ 13 and EPDS ≥ 10 among Indigenous, non-Indigenous Canadian-born and immigrant women (total weighted N = 74,231)**							
	Indigenous Canadian-born Weighted N = 3152		Non-Indigenous Canadian-born Weighted N = 53,803		Immigrant Weighted N = 17,276		p value
Cronbach's alpha (EPDS-13)	0.832		0.836		0.793		
EPDS ≥ 13	N	%	N	%	N	%	< 0.001
< 13	2802	88.9	50,797	94.4	15,173	87.8	
≥ 13	350	11.1	3006	5.6	2103	12.2	
EPDS ≥ 10	N	%	N	%	N	%	< 0.001
< 10	2484	78.8	46,863	87.1	13,110	75.9	
≥ 10	668	21.2	6940	12.9	4166	24.1	
b. Distribution of EPDS ≥ 13 and EPDS ≥ 10 among Indigenous women subgroups (weighted N = 3059)							
	First Nations Total weighted N = 1423		Métis Total weighted N = 1428		Inuit Total weighted N = 208		p value
Cronbach's alpha* (EPDS-13)	0.835		0.830		0.807		
EPDS ≥ 13	N	%	N	%	N	%	0.2424
< 13	1237	86.9	1309	91.6	187	90.1	
≥ 13	186	13.1	120	8.4	20	9.9	
EPDS ≥ 10	N	%	N	%	N	%	0.1997
< 10	1082	76.0	1182	82.8	167	80.2	
≥ 10	342	24.0	246	17.2	41	19.8	

*Cronbach's alpha was calculated based on weighted data

**Total unweighted $N = 6237$

Immigrant mothers reported lower social support than the two Canadian-born groups of mothers. Parity and stressful life events were not significantly different across study groups, although, compared to others, more Indigenous mothers responded that most days in the past 12 months were 'very stressful'.

Prevalence of EPDS ≥ 13 for the total sample was 7.4 % (95 % CI = 6.6, 8.1), and prevalence of EPDS ≥ 10 was 15.9 % (95 % CI = 14.9, 16.8). Across study groups, prevalence of both EPDS ≥ 13 and EPDS ≥ 10 was significantly higher among immigrant (12.2 % and 24.1 %, respectively) and Indigenous mothers (11.1 % and 21.2 %, respectively) compared to non-Indigenous Canadian-born mothers (5.6 % and 12.9 %, respectively) (Table 2a).

We found no significant differences when comparing prevalence of EPDS ≥ 10 and EPDS ≥ 13 across First Nations, Inuit and Métis groups, although a trend existed towards higher PPD among First Nations mothers compared to Inuit and Métis mothers (Table 2b).

Results of the multivariate analysis for the total sample (Table 3) show that the unadjusted odds ratios (ORs) for EPDS ≥ 13 were a little more than twice as high among Indigenous and immigrant mothers compared to non-Indigenous Canadian-born mothers (model 1). In addition to immigrant and Indigenous identity, risk factors for EPDS ≥ 13 included low education, living at or below LICO-AT, taking antidepressants before pregnancy, experiencing abuse, and

some or no social support. We found similar trends and risk factors in the multivariate results for EPDS ≥ 10 (Table 4). However, the associations (ORs) were stronger for EPDS ≥ 13 than for EPDS ≥ 10 .

Looking at the risk factors for EPDS ≥ 10 and EPDS ≥ 13 , we found differences within and between each of the three study groups (Table 5). Indigenous mothers had distinct risk factors compared to the total population and the other two study groups. Risk factors for Indigenous mothers also differed for EPDS ≥ 13 and EPDS ≥ 10 : for EPDS ≥ 13 , risk factors included antidepressant use prior to pregnancy and experiencing abuse, while for EPDS ≥ 10 , risk factors were low education and stressful life events in addition to antidepressant use.

Immigrant mothers also had different risk factors for EPDS ≥ 13 and EPDS ≥ 10 compared to the total sample and other groups. Risk factors for EPDS ≥ 13 among immigrant women included living at or below LICO-AT, stressful life events, and low social support. For EPDS ≥ 10 , we found the same risk factors, as well as that of experiencing abuse.

Risk factors for PPD among non-Indigenous Canadian-born mothers were most similar to those of the total sample. For EPDS ≥ 13 , risk factors included low education, antidepressant use before pregnancy, experiencing abuse, stressful life events, and low social support. We found the same risk factors for EPDS ≥ 10 , with the addition of

Table 3 Multivariable models for EPDS ≥ 13 among participants in the Canadian MES (weighted $N = 74,231$)

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)	Model 6 OR (95% CI)	Model 7 OR (95% CI)
Ethnicity							
Indigenous	2.11 (1.44, 3.09)	1.87 (1.28, 2.74)	1.47 (1.00, 2.17)	1.45 (0.99, 2.12)	1.40 (0.95, 2.05)	1.24 (0.84, 1.85)	1.27 (0.85, 1.90)
Immigrant	2.34 (1.87, 2.93)	2.43 (1.94, 3.05)	2.19 (1.74, 2.77)	2.24 (1.77, 2.83)	2.65 (2.09, 3.37)	2.85 (2.24, 3.64)	2.53 (1.97, 3.24)
Non-Indigenous Canadian-born	1	1	1	1	1	1	1
Age							
15–24 years		1.63 (1.29, 2.07)	1.15 (0.88, 1.52)	1.12 (0.84, 1.49)	1.11 (0.83, 1.48)	0.99 (0.73, 1.34)	1.07 (0.79, 1.45)
25–50 years		1	1	1	1	1	1
Education							
Less than HS			1.70 (1.18, 2.45)	1.68 (1.16, 2.41)	1.63 (1.13, 2.36)	1.55 (1.07, 2.26)	1.59 (1.09, 2.30)
HS diploma/vocational			1.38 (1.08, 1.76)	1.38 (1.08, 1.76)	1.34 (1.05, 1.72)	1.32 (1.02, 1.69)	1.30 (1.01, 1.68)
Greater than HS diploma/vocational			1	1	1	1	1
LICO-AT							
At/below LICO			1.89 (1.47, 2.44)	1.82 (1.41, 2.35)	1.81 (1.40, 2.34)	1.73 (1.33, 2.25)	1.67 (1.28, 2.18)
Above LICO			1	1	1	1	1
Missing			1.29 (0.90, 1.86)	1.25 (0.86, 1.80)	1.24 (0.85, 1.81)	1.28 (0.88, 1.86)	1.27 (0.86, 1.86)
Marital status							
Lone				1.25 (0.91, 1.72)	1.19 (0.86, 1.64)	0.99 (0.70, 1.39)	1.00 (0.72, 1.41)
Cohabiting				1	1	1	1
Antidepressant use before pregnancy							
Yes					2.86 (2.26, 3.63)	2.69 (2.12, 3.42)	2.58 (2.02, 3.29)
No					1	1	1
Experiencing any abuse							
Yes							
No						2.42 (1.85, 3.15)	2.17 (1.65, 2.84)
Social support						1	1
No support or some							2.42 (1.95, 3.02)
All times							1

Unweighted $N = 6237$

Table 4 Multivariable models for EPDS ≥ 10 among participants in the Canadian MES (weighted $N = 74,231$)

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)	Model 6 OR (95% CI)	Model 7 OR (95% CI)
Ethnicity							
Indigenous	1.82 (1.36, 2.42)	1.69 (1.26, 2.25)	1.36 (1.02, 1.83)	1.34 (1.00, 1.80)	1.30 (0.97, 1.74)	1.17 (0.86, 1.59)	1.18 (0.86, 1.63)
Immigrant	2.15 (1.82, 2.53)	2.20 (1.86, 2.59)	1.99 (1.68, 2.36)	2.03 (1.72, 2.41)	2.34 (1.97, 2.79)	2.50 (2.10, 2.98)	2.23 (1.87, 2.67)
Non-Indigenous Canadian-born	1	1	1	1	1	1	1
Age							
15–24 years		1.38 (1.16, 1.66)	1.00 (0.82, 1.23)	0.97 (0.79, 1.20)	0.96 (0.78, 1.19)	0.86 (0.69, 1.08)	0.92 (0.73, 1.14)
25–50 years		1	1	1	1	1	1
Education							
Less than HS			1.53 (1.16, 2.03)	1.50 (1.13, 1.99)	1.47 (1.11, 1.96)	1.41 (1.06, 1.88)	1.42 (1.06, 1.89)
HS diploma/vocational			1.34 (1.13, 1.59)	1.34 (1.13, 1.59)	1.31 (1.10, 1.56)	1.29 (1.08, 1.53)	1.28 (1.08, 1.53)
Greater than HS diploma/vocational			1	1	1	1	1
LICO-AT							
At/below LICO			1.76 (1.46, 2.12)	1.68 (1.39, 2.04)	1.67 (1.38, 2.03)	1.59 (1.30, 1.94)	1.55 (1.27, 1.90)
Above LICO			1	1	1	1	1
Missing			1.47 (1.14, 1.90)	1.42 (1.09, 1.84)	1.43 (1.10, 1.86)	1.48 (1.13, 1.92)	1.47 (1.12, 1.93)
Marital status							
Lone				1.28 (1.00, 1.63)	1.22 (0.95, 1.56)	1.02 (0.78, 1.33)	1.04 (0.80, 1.35)
Cohabiting				1	1	1	1
Antidepressant use before pregnancy							
Yes					2.66 (2.23, 3.17)	2.53 (2.12, 3.03)	2.46 (2.05, 2.95)
No					1	1	1
Experiencing any abuse							
Yes						2.48 (2.01, 3.05)	2.27 (1.84, 2.81)
No						1	1
Social support during pregnancy							
No support or some							2.18 (1.87, 2.54)
All times							1

Unweighted $N = 6237$

Table 5 Multivariable models for EPDS ≥ 13 and EPDS ≥ 10 among Indigenous, immigrant and non-Indigenous Canadian-born mothers in the Canadian MES (total weighted $N = 74,231$)

	EPDS ≥ 13			EPDS ≥ 10		
	Indigenous weighted $N = 3152$	Non-Indigenous Canadian-born weighted $N = 53,803$	Immigrant weighted $N = 17,276$	Indigenous weighted $N = 3152$	Non-Indigenous Canadian-born weighted $N = 53,803$	Immigrant weighted $N = 17,276$
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age						
15–24 years	1.64 (0.69, 3.92)	1.24 (0.83, 1.86)	1.18 (0.60, 2.35)	1.08 (0.47, 2.47)	1.11 (0.84, 1.48)	0.69 (0.39, 1.23)
25–50 years	1	1	1	1	1	1
Education						
Less than HS	3.18 (0.78, 12.90)	1.85 (1.09, 3.11)	1.07 (0.49, 2.34)	5.45 (1.94, 15.36)	1.70 (1.17, 2.48)	0.95 (0.50, 1.79)
HS diploma/vocational	0.76 (0.25, 2.28)	1.71 (1.24, 2.34)	1.01 (0.62, 1.65)	1.91 (0.81, 4.49)	1.40 (1.12, 1.75)	1.21 (0.84, 1.74)
Greater than HS diploma	1	1	1	1	1	1
LICO-AT						
At/below LICO	0.72 (0.25, 2.12)	1.41 (0.95, 2.08)	2.35 (1.50, 3.69)	0.53 (0.24, 1.17)	1.41 (1.06, 1.87)	2.15 (1.50, 3.07)
Above LICO	1	1	1	1	1	1
Missing	0.38 (0.08, 1.87)	0.77 (0.40, 1.48)	2.30 (1.28, 4.13)	0.47 (0.16, 1.33)	1.17 (0.76, 1.79)	2.44 (1.53, 3.89)
Marital status						
Lone	2.46 (0.99, 6.14)	0.72 (0.45, 1.17)	0.89 (0.42, 1.92)	1.82 (0.84, 3.95)	0.80 (0.56, 1.14)	1.04 (0.54, 2.00)
Cohabiting	1	1	1	1	1	1
Parity						
1 child	0.92 (0.34, 2.49)	0.85 (0.64, 1.13)	1.02 (0.67, 1.55)	1.14 (0.48, 2.71)	0.94 (0.77, 1.14)	1.13 (0.82, 1.55)
2 children or more	1	1	1	1	1	1
Antidepressant use before pregnancy						
Yes	2.74 (1.12, 6.70)	2.33 (1.73, 3.15)	1.51 (0.78, 2.90)	3.25 (1.56, 6.77)	2.17 (1.76, 2.68)	1.52 (0.90, 2.55)
No	1	1	1	1	1	1
Experiencing any abuse						
Yes	2.39 (1.02, 5.57)	1.79 (1.26, 2.55)	1.54 (0.71, 3.34)	1.43 (0.72, 2.85)	2.04 (1.57, 2.64)	1.81 (1.02, 3.23)
No	1	1	1	1	1	1
Stressful events						
Not stressful	1	1	1	1	1	1
Somewhat stressful	1.96 (0.64, 5.99)	2.62 (1.77, 3.88)	1.65 (1.04, 2.61)	2.73 (1.23, 6.04)	2.58 (2.04, 3.27)	2.00 (1.43, 2.80)
Very stressful	2.88 (0.74, 11.27)	7.26 (4.66, 11.31)	4.38 (2.47, 7.74)	4.99 (1.83, 13.63)	4.93 (3.66, 6.64)	4.34 (2.66, 7.06)
Social support during pregnancy						
No support or some	1.61 (0.60, 4.28)	2.31 (1.74, 3.08)	2.09 (1.37, 3.10)	1.58 (0.79, 3.16)	1.94 (1.60, 2.36)	2.20 (1.63, 2.98)
All times	1	1	1	1	1	1

Unweighted $N = 6237$

living at or below LICO-AT. Notably, age and parity were not significant risk factors in any of the study populations. A summary of the multivariable associations can be found in Appendix 1.

Discussion

Our study revealed that Indigenous and immigrant mothers in Canada are at higher risk for PPD compared to non-Indigenous Canadian-born mothers (almost twofold EPDS ≥ 10 and EPDS ≥ 13), with immigrant women experiencing slightly higher risk for PPD than Indigenous mothers. In the total sample of mothers, we found similar risk factors for EPDS ≥ 13 and EPDS ≥ 10 , including (in addition to ethnicity) low education, $\geq$ LICO-AT, antidepressant use before pregnancy, experiencing abuse, and low social support. This might suggest that both EPDS ≥ 13 and EPDS ≥ 10 capture similar PPD concepts, given that the risk factors were also the same for the total sample of mothers.

Although the EPDS has been validated for use as a screening tool among young mothers (Friesen et al., 2017) and Indigenous mothers in Canada (Clarke, 2008), it is important to consider issues of sensitivity and specificity of the two EPDS cut-offs among different groups of mothers in Canada, as the multivariate associations for EPDS ≥ 10 and EPDS ≥ 13 revealed different risk factors within and between study groups. While risk factors for non-Indigenous Canadian-born mothers were most similar with those of the total sample—a reasonable result, considering that these mothers compose a high percentage of the sample—risk factors for Indigenous mothers were most distinct, and their risk factors were different for the two EPDS cut-offs. In the Indigenous group, while antidepressant use before pregnancy was a common risk factor for both EPDS cut-offs, any abuse was a significant risk factor for EPDS ≥ 13 only, while low education and stressful life events were important only for EPDS ≥ 10 . Further, some PPD risk factors we identified in the total population (low social support and at or below LICO-AT) were not found among Indigenous mothers. Last, among immigrant mothers, risk factors for EPDS ≥ 13 included $\geq$ LICO-AT, stressful life events, and low social support. For EPDS ≥ 10 , the risk factors for this subgroup included any abuse in addition to the previous risk factors identified for EPDS ≥ 13 .

While our results found prevalence rates similar to those arrived at in other Canadian studies, they are novel because research on PPD in Canada has compared either Indigenous or immigrant mothers with Canadian-born mothers but not these two minority groups with the majority group. Meanwhile, the higher PPD prevalence found among immigrant mothers aligns with results that

compared immigrant with non-immigrant mothers in Canada (Dennis et al., 2017; Lanes et al., 2011). Since we applied different EPDS cut-offs for PPD, we found slightly different risk factors from those identified in previous research based on MES data (Lanes et al., 2011). Our results regarding risk factors support previous evidence showing that low SES, psychological distress (Davey et al., 2011), low social support during pregnancy and after birth (Lanes et al., 2011), and intimate partner violence (Dennis & Vigod, 2013) are risk factors for PPD among Canadian mothers. Also, our results with regard to the risk factors for PPD among immigrant women are consistent with results of a prospective study in Ontario that found that low social support, low income, living in Canada for less than 2 years, and living in communities with a high concentration of immigrants are risk factors for PPD among immigrant women (Ganann et al., 2016). As for Indigenous mothers, few studies in Canada have examined prevalence and risk factors for PPD for this group. Drawing on the same MES data that we used in this study, Lanes et al. (2011) (Lanes et al., 2011) found that the highest rates of PPD were among mothers living in the territories, where there is a high concentration of Indigenous Canadians, compared to other provinces (Lanes et al., 2011). However, these researchers did not examine risk factors within this group of mothers. Our results regarding the unique risks among Indigenous mothers for each EPDS cut-off suggest that using only one such cut-off might miss groups of Indigenous mothers, a consideration when screening for PPD. This result is supported by Nelson et al.'s 2018 study (Nelson et al., 2018), which used the MES data to compare the prevalence and risk factors for PPD within three groups of Indigenous mothers with non-Indigenous mothers in Canada (Nelson et al., 2018). The distinct risk factors for PPD that we identified for Indigenous mothers might relate to higher prevalence of mental health problems in the general Indigenous population in Canada and elsewhere (Bowen et al., 2014; King et al., 2009; Kirmayer et al., 2000). The fact that low social support was not a risk factor for PPD among Indigenous mothers might suggest a different perception of this concept in this population. This needs to be studied in future research.

Limitations

We used cross-sectional data from the MES. These data were collected retrospectively, 6 to 9 months after birth, and up to 14 months for Indigenous mothers, and were based on mothers' reports of PPD symptoms and risk factors. Given that the risk for PPD can differ for different periods after birth, this data collection method might have

affected reports by mothers on both PPD symptoms and risk factors. As well, PPD risk factors among immigrant mothers could differ by country of origin and length of stay in Canada (Ganann et al., 2016), but we did not analyze these variables, as they were not relevant to and could not be compared with the other two groups. Next, the sample of Indigenous mothers was relatively small compared to the other two groups and did not include women living on reserve, who have generally lower SES. Indigenous mothers living on reserve were excluded from the MES for practical reasons (Chalmers et al., 2008). Future research on PPD should include a larger and more representative sample of Indigenous mothers. This would enable the research to yield more generalizable results for this population group. Previous research on Indigenous mothers suggests several contextual factors influencing PPD that were not included in the MES data, including historical trauma, colonialism, discrimination, and the legacy of multi-sectoral, impoverishing, discriminatory policies (King et al., 2009). Research on PPD among Indigenous mothers must consider these variables. Last, because the MES did not collect data about use of health care services for PPD, we could not consider service usage in our analysis. Previous research has shown a gap in access to maternal health care services for Indigenous mothers (Beking, 2013). Further, although the MES includes a representative sample of mothers in Canada, it included only singleton mothers with live babies. Other mothers (with twins or multiples, not live baby, etc.) were

excluded, which might have led to a selection bias. The MES collected data via phone calls, and mothers who do not have a telephone at home (e.g., with low socioeconomic status) might be less represented in the survey.

Conclusion

This is the first study we know of to compare the prevalence and risk factors of PPD within and between three groups of mothers in Canada: Indigenous, immigrant and non-immigrant Canadian-born. Our findings show that mothers belonging to these different population groups experience different prevalence and risk factors for PPD. This highlights the importance of tailoring prevention and treatment programs to meet the unique needs of groups of mothers in order to protect them from developing PPD and to prevent PPD consequences for both mothers and infants. Our work also shows the need for more adequately powered research into PPD prevalence and risk with large sample sizes of these population groups.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Appendix 1- Summary of multivariate associations of risk factors for EPDS $\geq$ 13 and EPDS $\geq$ 10

	EPDS $\geq$ 13				EPDS $\geq$ 10			
	Indigenous	Non-Indigenous Canadian-born	Immigrant	Total	Indigenous	Non-Indigenous Canadian-born	Immigrant	Total
Ethnicity and immigrant status				+				+
Age	-	-	-	-	-	-	-	-
Education	-	+	-	+	+	+	-	+
$\leq$ LICO	-	-	+	+	-	+	+	+
Marital status	-	-	-	-	-	-	-	-
Parity	-	-	-	NR	-	-	-	NR
Anti-depressants	+	+	-	+	+	+	-	+
Experiencing any abuse	+	+	-	+	-	+	+	+
Stressful life events	-	+	+	NR	+	+	+	NR
Social support	-	+	+	+	-	+	+	+

NR – not included in the model

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