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Research paper

Prevalence of postpartum depressive symptoms in a multiethnic population and the role of ethnicity and integration

Nilam Shakeel[a,*], Line Sletner[b], Ragnhild Sørum Falk[c], Kari Slinning[d], Egil W. Martinsen[e], Anne Karen Jenum[f], Malin Eberhard-Gran[g,h,i]

[a] General Practice Research Unit (AFE), Department of General Practice, Institute of Health and Society, University of Oslo, Norway
[b] Department of Pediatrics and Adolescents Medicine, Akershus University Hospital, Lørenskog, Norway
[c] Oslo Centre for Biostatistics and Epidemiology, Oslo University Hospital, Norway
[d] Center for Child and Adolescent Mental Health Eastern and Southern Norway (R.BUP Oslo), Norway
[e] Division of Mental Health and Addiction, Oslo University Hospital, Institute of Clinical Medicine, University of Oslo, Norway
[f] General Practice Research Unit (AFE), Department of General Practice, Institute of Health and Society, University of Oslo, Norway
[g] Domain for Mental and Physical Health, Norwegian Institute of Public Health, Oslo, Norway
[h] Health Services Research Centre, Akershus University Hospital, Lørenskog
[i] Institute of Clinical Medicine, Campus Ahus, University of Oslo, Norway

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ABSTRACT

Background: Postpartum depression (PPD) may have adverse effects on both mother and child. The aims were to determine the prevalence of postpartum depressive symptoms, PPDS, identify associations with ethnicity and with the level of social integration.

Method: Population-based, prospective cohort study of 643 pregnant women (58% ethnic minorities) attending primary antenatal care in Oslo. Questionnaires regarding demographics and health issues were collected through interviews. PPDS was defined as a sum score ≥ 10 by the Edinburgh Postnatal Depression Scale, used as the main outcome in logistic regression analyses, first with ethnicity, second with level of integration as main explanatory factors.

Results: The prevalence of PPDS was higher in ethnic minorities 12.7% (95% CI: 9.31–16.09) than in Western Europeans 4.8% (2.26–7.34). Adverse life events, lack of social support and depressive symptoms during the index pregnancy were other significant risk factors. Western European with PPDS were more likely to have had depressive symptoms also during pregnancy than women from ethnic minorities (72.2% versus 33.3%, $p = 0.041$). When replacing ethnicity with integration, a low level of integration was independently associated with PPDS (2.1 (1.11–3.95)).

Limitations: Cases with PPDS were limited. Heterogeneity in the ethnic groups is a concern.

Conclusion: Both point prevalence and new onset of PPDS was higher among ethnic minorities than among Western Europeans. Low level of integration was associated with PPDS. Our findings suggest that clinicians should be aware of the increased risk of new cases of PPDS among ethnic minorities compared to Western European women and offer evidence-based care accordingly.

1. Introduction

Postpartum depression (PPD) is prevalent, as most studies report rates of 10–15%, but estimates differ considerably, from 3% to more than 25% depending on the population, context, instruments and strategies used to identify cases (Dennis and Dowswell, 2013; Dennis and Hodnett, 2007; Melo et al., 2012). PPD may be a continuation of symptoms experienced during pregnancy or a new onset of depression. Not only the mother's health but also the relationship with her partner and any other children may be affected. In addition, PPD can lead to

Abbreviations: PPD, Postpartum depression; PPDS, Postpartum depressive symptoms; GW, Gestational week; SD, Standard deviation; EPDS, Edinburgh Postnatal Depression Scale; IQR, Interquartile range; SEP, Socioeconomic position; PCA, Principal component analysis; OR, Odds ratio

* Corresponding author.
E-mail addresses: nilam.shakeel@medisin.uio.no (N. Shakeel), line.sletner@medisin.uio.no (L. Sletner), rs@ous-hf.no (R.S. Falk), kari.slinning@icloud.com (K. Slinning), e.w.martinsen@medisin.uio.no (E.W. Martinsen), a.k.jenum@medisin.uio.no (A.K. Jenum), malin.eberhard-gran@fhi.no (M. Eberhard-Gran).

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poor attachment between the newborn and the mother, which may interrupt breastfeeding (Silva et al., 2017) and negatively affect the cognitive and emotional development of the infant (Grace et al., 2003). Further, maternal PPD has been associated with the development of intellectual problems, social dysregulation, violent behavior and psychiatric problems in the child (Hay et al., 2003, 2001; Murray et al., 2011; Pawlby et al., 2008).

Known risk factors for PPD are previous depression, adverse life events and lack of social support (Norhayati et al., 2015). In addition, many studies have also found that low socioeconomic position (SEP) may increase the risk (Norhayati et al., 2015). Of note is that in some patriarchal societies, it may be considered more preferable to give birth to a boy (Husain et al., 2012; Wittkowski et al., 2017), posing a potential risk of higher PPD rates for mothers with daughters, but findings are contradictory (Husain et al., 2012; Norhayati et al., 2015; Wittkowski et al., 2017). In studies from Western countries, immigrant women may experience higher rates of PPD or postpartum depressive symptoms, PPDS, compared with native Western Europeans, partly due to language problems and poor social integration (Falah-Hassani et al., 2015; Norhayati et al., 2015). More specifically, the harmful effects of perceived prejudice and discrimination experienced by immigrants, referred to as “minority stress”, are observed across a range of mental health outcomes including depression (Pascoe and Smart Richman, 2009). Importantly, we have little empirical knowledge about the impact of cultural differences and the level of integration on PPD or PPDS (Fung and Dennis, 2010). Migration and acculturation may be stressful and can induce mental health problems, and some studies found that a low level of integration was associated with depression or depressive symptoms, although in a complex manner (Bhugra and Becker, 2005; Gonidakis et al., 2011; Unlu Ince et al., 2014). Moreover, there may be synergistic effects of migration, integration and other social factors, such as SEP and family social support, which could make ethnic minority women even more vulnerable to PPDS.

The potentially long-lasting adverse effects on the offspring make PPDS an important public health issue. The immigrant population in Norway is growing, as in rest of Europe. In order to optimize the health care we need more knowledge about specific health challenges among immigrants. Migrant women are more likely to experience postpartum depressive symptoms compared to native-born women, with a prevalence of about 20% among ethnic minority women (Falah-Hassani et al., 2015). However, there is a lack of population-based studies (Falah-Hassani et al., 2015), and little is known about prevalence rates among a population with limited commands of the majority language and those newly arrived, as these groups often are excluded from research.

We have earlier reported a double risk of depression in pregnancy among ethnic minority women (Shakeel et al., 2015). To the best of our knowledge, only one previous study from Norway have reported prevalence of PPD among immigrants (Bjerke et al., 2008). Hence, the primary aim of this study was to assess the prevalence of postpartum depressive symptoms (PPDS), and explore its associations with ethnicity. Secondarily, we wanted to investigate whether low level of social integration was associated with PPDS.

2. Methods

2.1. Design, study population and setting

This study is part of the STORK Groruddalen Research Program, which is a population-based, prospective cohort of 823 healthy pregnant women attending the Child Health Clinics for antenatal care in Groruddalen, Oslo, Norway, between 2008 and 2010. Antenatal care for normal pregnancies in Norway is carried out in primary health care by either the general practitioner, midwife or both. The STORK Groruddalen project has previously been described in detail (Jenum et al., 2012, 2010). Briefly, information material and questionnaires were translated into eight different languages and quality checked by bilingual health professionals. Questionnaire data regarding demographics and health related issues were collected through interviews by midwives at three visits: at inclusion (mean gestational week (GW) 15), at a follow-up in GW 28, and 14 weeks postpartum Professional translators were used when needed. Women were eligible for participation if they: (1) lived in the districts; (2) planned to give birth at one of two study hospitals; (3) were < 20 week's GW at inclusion; (4) could communicate in Norwegian, Arabic, English, Sorani, Somali, Tamil, Turkish, Urdu or Vietnamese; and (5) were able to give informed written consent. Women with known diabetes and/or other diseases necessitating intensive hospital follow-up during pregnancy were excluded, according to protocol. The inclusion rate was 74% (range 64–83% among ethnic groups), and the participating women were found to be representative of all pregnant women attending the Child Health Clinics. Informed consent was obtained from all individual participants included in the study. The study was approved by The Regional Committee for Medical and Health Research Ethics for South Eastern Norway (reference number: 2007.894) and The Norwegian Data Inspectorate.

2.2. Primary outcome variable – postpartum depressive symptoms

The Edinburgh Postnatal Depression scale (EPDS), developed to measure depressive symptoms after delivery (Cox, 2003; Harris et al., 1989), is a ten-item self-rating scale with a sum score range of 0–30, with higher scores indicating more symptoms (Cox et al., 1987). We used a cut-off value of ≥10 as indicative of depressive symptoms, as this cut-off level has been used previously in several epidemiological studies (Dorheim et al., 2012, 2014; Eberhard-Gran et al., 2001b; Hewitt et al., 2009). The EPDS was administered through interviews performed by midwives, who were trained to ensure standardized data collection procedures at the postpartum visit. We used eight official translations of the EPDS (Norwegian, Arabic, English, Somali, Tamil, Turkish, Urdu and Vietnamese). In addition, we used a version in Sorani, translated by the City Services Department's Interpreting Service in Oslo for this study. All except the Somalian and Sorani versions have been validated (Marshall and Bethell, 2006).

2.3. Exposure variables

2.3.1. Ethnicity

Ethnicity was our primary variable of interest. Ethnic origin was defined by the country of birth of the pregnant participant. If the participant's mother was born outside of Europe or North America, the country of origin was defined by the participant's mother's country of birth. This was further categorized as Western European and ethnic minority women, the latter further subdivided into Middle Easterners (mainly from Iraq, Iran and Turkey), South Asians (mainly from Pakistan and Sri Lanka), and others (from Eastern Europe, Africa South of Sahara, East Asia and South and Central America) (Jenum et al., 2010). These categories were chosen as these groups considered to have some shared cultural practices that differ from groups originating from Europe, where for instance more individual-oriented values dominate, versus the more collectivistic and family-oriented values of the traditional Asian and African culture (Eberhard-Gran et al., 2010). In general, few among ethnic minorities were second-generation immigrants (7%), and of these 75.6% were of Pakistani origin.

2.3.2. Level of integration

As an alternative to ethnicity, we also explored factors related to the level of social integration into the Norwegian mainstream society. In accordance with our secondary aim, we used the level of integration as the main exposure factor. Our integration variable holds information from questionnaires about: (1) language skills (need of interpreter – during study interviews, need of interpreter at a doctor's appointment,

self-reported abilities in the Norwegian language), (2) time of residence, (3) how often one reads a Norwegian newspaper or watches Norwegian TV, and (4) how often one is visited (in any context) by an ethnic Norwegian. Ethnic Norwegian participants were not asked these questions but were automatically given the highest value for these variables. A component score was extracted using principal components analysis, explained in more details under statistics (Shakeel et al., 2015; Sletner et al., 2014).

2.4. Other variables

2.4.1. Adverse life events

Seven questions assessed stressful life events: (1) serious illness or injury (self); (2) serious illness or injury of a close family member; (3) death of a close family member; (4) divorce or separation following a long-term relationship; (5) unemployment or serious difficulty finding a job; (6) major concerns about children; and (7) any other major events not already covered, such as serious financial problems, difficulties at work, and serious conflicts. Response options were "yes" or "no". Women reported adverse life events in GW 28, including events that occurred following their inclusion in the study, and then again in the postpartum visit, including any new events occurring after GW 28. First, the number of events for each time was calculated and then combined in a single variable, to reflect the total number of events from inclusion in the study through the postpartum visit. This variable was recoded as 0–1 (reference), 2 or ≥3 events.

2.4.2. Social support

At the postpartum visit, the women were asked if practical and emotional support and care from those closest to them around the time of their labor and delivery were adequate according to their needs, with three possible response categories: "to a large extent", "to some extent", and "to a small extent". This variable was dichotomized (the first two merged), driven by the distribution of data.

2.4.3. Previous history of depression and depressive symptoms in the index pregnancy

Information on history of depression was obtained by Kendler's lifetime major depression scale, which assesses lifetime history of major depression based on the DSM-IV criteria (Kendler et al., 1993; Kjeldgaard et al., 2017). This scale consists of five questions concerning sadness, appetite changes, lack of energy, self-blame and concentration problems with the response categories "yes" or "no". Prior depression was defined as having had at least two simultaneously concurrent symptoms with duration of at least two weeks in addition to sad mood (Kendler et al., 1993; Kjeldgaard et al., 2017). As depressive symptoms in pregnancy are associated with PPDS (Norhayati et al., 2015), we also used the EPDS score from gestational week 28 and categorized women with a score ≥ 10 during pregnancy as "depressive symptoms in index pregnancy".

2.4.4. Socioeconomic position

We used the following socioeconomic variables: educational level, occupational class, employment status, renting tenure and rooms per person in the household collected at inclusion. A component score (Crohnbach's $\alpha > 0.7$) was extracted using principal components analysis, explained in more details under statistics.

2.4.5. Gestational diabetes

We used information about gestational diabetes according to the WHO criteria (fasting plasma glucose ≥ 7.0 mmol/l and/or 2-h plasma glucose ≥ 7.8 mmol/l) (Alberti and Zimmet, 1998), after having offered all participants an oral glucose tolerance test at GW 28.

2.4.6. Other variables used for descriptive purposes

Information about marital status/single parenthood, use of interpreter at the first visit, weeks postpartum, parity, education, offspring gender, gestational diabetes and the use of antidepressants were explored and used to describe the sample.

2.4.7. Study sample

From the total cohort of 823 women included in the STORK Groruddalen study, 662 women attended the postpartum visit and 632 had valid EPDS scores with answers to all 10 questions. For 11 women with 1–3 missing answers (1 missing: $n = 7$; 2 missing: $n = 2$; and 3 missing: $n = 2$), the mean scores of the completed items were imputed in the missing items, leaving a study sample of 643 women (78% of those included in early pregnancy).

2.4.8. Statistical methods

Descriptive statistics are provided as mean with standard deviation (SD) or median with interquartile range (IQR). To compare groups chi-square tests or Fisher`s exact test were used for categorical data and *T*-tests or the Mann–Whitney *U* test for continuous variables as appropriate, depending on their distribution.

Most variables reflecting socioeconomic position (SEP) and level of integration were strongly correlated, although they represent different dimensions of societal and contextual factors. All individual and household markers of maternal SEP and variables related to the level of integration were entered into a principal components analysis (PCA) (Sletner et al., 2014). Two separate, uncorrelated components were extracted. The first component was strongly correlated with the predefined markers of the level of integration such as language skills (three different questions), time of residency, social interaction with ethnic Norwegians and use of Norwegian media, and, was skewed to the right, reflecting that ethnic Norwegians all had high scores. The second component had strong correlations with the predefined individual and household markers of SEP (educational level, occupational class, employment status, renting tenure and rooms per person in the household) and was normally distributed. Both components had Cronbach's $\alpha > 0.7$, indicating good internal reliability. As we were mainly interested in the potential effect of low SEP and integration, the PCA scores were further dichotomized as the 40% with the lowest scores versus the 60% with highest scores for SEP and level of integration. The score values may also be difficult to interpret directly from the tables. These categories were chosen to obtain consistency with our previous article related to depression during pregnancy (Shakeel et al., 2015). There, we examined different cut-off values (20/80 as well as three categories with different cut-off values) but found that the pragmatic 40/60 cut-point had a sufficient number in the lowest category and still carried important information.

An etiological approach was chosen, and a directed acyclic graph (DAG), was drawn prior to the analyses (Fig. 1), to guide our selection of confounders in the analysis and thereby reduce the magnitude of bias in the estimates produced (Hernan et al., 2002; Shrier and Platt, 2008). In a timeline, ethnic origin was considered as the explanatory variable of greatest interest. Age at inclusion, adverse life events, lack of social support about the time of delivery, history of depression, depressive symptoms in index pregnancy, SEP and gestational diabetes were regarded as potential confounding variables for the association between ethnicity and PPDS.

We first did univariate logistic regression analyses of all possible confounders. The first model included ethnicity, age at inclusion, adverse life events, SEP, self-reported health and depressive symptoms in index pregnancy (model not shown). Based on significance level and clinical importance, variables were included in the further analysis as confounders for the association between ethnicity and PPDS.

We also hypothesized that there could be synergistic effects between having an ethnic minority background and other risk factors, i.e. that different risk factors may operate differently in ethnic minorities and Norwegians.

Interactions between our main explanatory variable ethnicity and

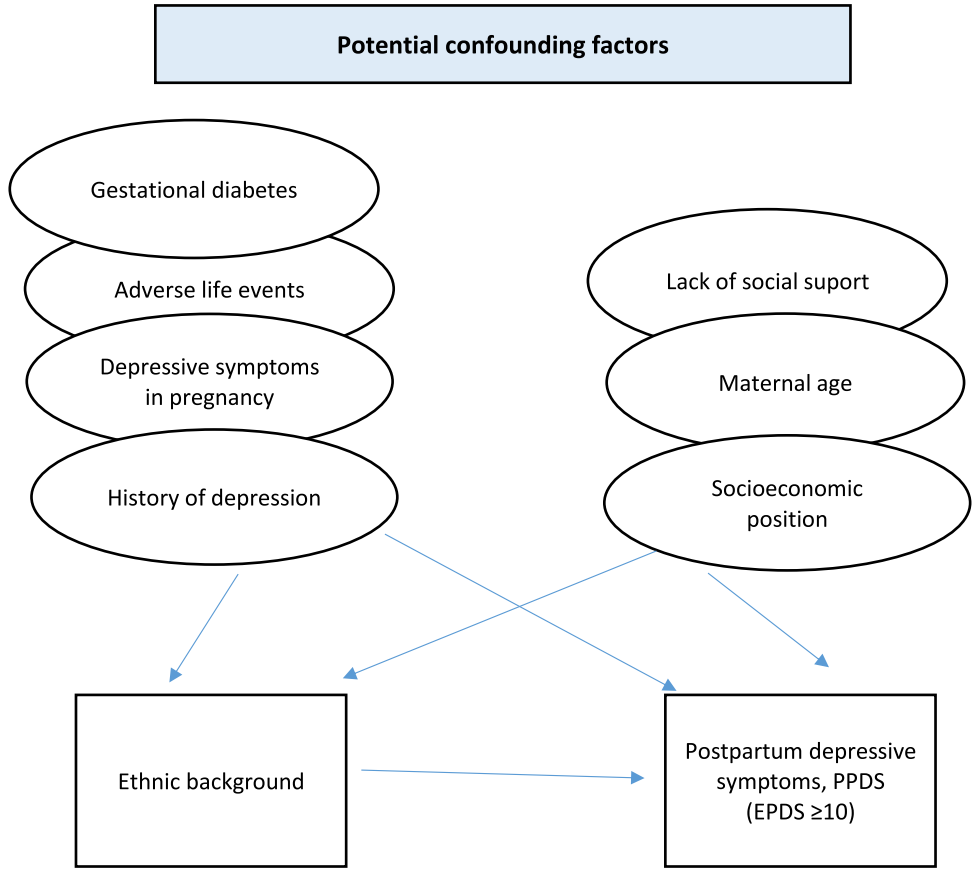


Fig. 1. Directed acyclic graph, DAG, for the association between ethnicity and postpartum depressive symptoms, PPDS.

other variables were therefore checked by including product terms, one at a time. The significance level of the interaction effects was set to 0.01 to reduce the problem of false positives. In total, we ran seven tests. The only significant interaction was between ethnicity and depressive symptoms in index pregnancy ($p = 0.01$).

Thereafter, to explore this interaction effect, a new combined variable with four categories ("Western European, no depressive symptoms in pregnancy"; "Western European, with depressive symptoms in pregnancy"; "ethnic minority, no depressive symptoms in pregnancy"; and "ethnic minority, with depressive symptoms in pregnancy") was constructed. Furthermore, we also used the level of social integration as an alternative explanatory variable instead of ethnicity with the same confounders as for ethnicity. As ethnicity and social integration are strongly interrelated, we did not use level of integration and ethnicity in the same model, as this could lead to over-adjustment.

Model 1 included ethnicity and was designed to answer the primary research question, while model 2 included the level of social integration to address our secondary aim (Table 3). As a sensitivity analysis, we also repeated the last analysis in ethnic minority women only. Nagelkerke R2 provided the goodness of fit of the model. The statistical significance level was set to $p < 0.05$. SPSS version 19 (IBM SPSS statistics, NY, USA) was used for all analyses.

3. Results

3.1. Characteristics of study sample

Western European women constituted 42.3% of the sample (17.6% from Norway, 1.7% from Sweden, 0.3% from Denmark and 0.5% from other Western European countries and North America).

In total, 57.7% of the 643 women in our sample were ethnic minorities: Pakistan (19.6%), Sri Lanka (9.5%), Middle East (11.2%), East European countries (6.7%), Africa South of Sahara (3.4%), East Asia (6.9%), and South and Central America (1.9%). These women were younger, less educated, more likely to be unemployed, had higher parity and lower SEP compared to Western European women (Table 1). Further, 21.8% of the minority women were in need of an interpreter during the first visit. Those who did not re-attend after the first visit (non-attendants) had slightly low SEP (49.4 % vs 37.2%, $p < 0.01$), low education (20.8 % vs 15%, $p < 0.01$), more unemployment (39.3 % vs 28%, $p < 0.01$), and more were living without a partner (8.9 % vs 4.8, $p = 0.04$)

3.2. Prevalence of PPDS, median EPDS score and depressive symptoms in pregnancy

Sixty women had EPDS score ≥ 10 at the postpartum visit, yielding a crude prevalence rate of 9.3% (95% CI: 7.1–11.6) for the whole study sample (Fig. 2) and further, 4.8% (2.3–7.4) for Western European women and 12.7% (9.3–16.1) for the ethnic minorities ($p = 0.001$). Using Western European women as the reference, women with Middle Eastern and South Asians ethnic origin had higher prevalence rates; 18.1% (10.3–25.9) and 11.9% (6.9–16.9) ($p < 0.001$ for both) while the prevalence was 9.4% (4.1–14.7) in the merged group of other ethnic minorities . Compared with Western Europeans (1; (IQR) (0–3)), Middle Eastern (median; (4; (1–7)) and South Asian (3; (1–6)), women had higher EPDS scores while other ethnic minorities had (2; (0–5) – not significantly different from the reference group).

Among women who had depressive symptoms in pregnancy, 28.0% still had depressive symptoms at the postpartum visit; 33.3% among the Western Europeans and 25.9% among the merged ethnic minority group, (Fig. 3(a)). Among women with PPDS, 72.7% in the Western European group and 33.3% in the merged ethnic minority group also had depressive symptoms in the index pregnancy (Fig. 3(b)).

Table 1
Sample characteristics for Western European and ethnic minority women. Values are n (%) if not stated otherwise.

	Total $N = 643$	[g]Western European $n = 272$ (42.3%)	[h]Ethnic minority $n = 371$ (57.7%)
Age at inclusion, mean (SD)	29.9 (4.81)	31.0 (4.40)	29.0 (4.88)
Weeks postpartum, mean (SD)	14.2 (2.68)	14.1 (2.60)	14.3 (2.74)
Nulliparous	298 (46.3)	140(51.5)	158 (42.6)
[a]Single parenthood	22 (3.4)	5 (1.8)	17 (4.6)
Educational			
<10 years schooling	96 (15.0)	5 (1.9)	91 (24.7)
Secondary level, (10–12 y)	249 (39.0)	82 (30.4)	167 (45.3)
Up to 4 years of further education	196 (30.7)	111 (41.1)	85 (23)
University/college	98 (15.3)	72 (26.7)	26 (7)
[b]Adverse life events			
0 or 1 event	470 (77.6)	206 (81.1)	264 (75.0)
2 events	85 (14.0)	27 (10.6)	58 (16.5)
3 ≥ events	51 (8.4)	21 (8.3)	30 (8.5)
[c]Proportion with low score for socioeconomic position	239 (37.2)	50 (18.4)	189 (50.9)
[d]Proportion with low score for social integration	247 (38.4)	16 (5.9)	231 (62.3)
Previous history of depression	137 (21.0)	73 (26.2)	64 (17.2)
[e]Depressive symptoms in index pregnancy	82 (13.1)	24 (9.2)	58 (16)
Lack of social support around the birth period	79 (12)	28 (10)	51 (13.5)
Offspring gender			
Male	309 (50.2)	135 (51.7)	174 (49)
Female	307 (49.8)	126 (48.3)	181 (51)
Use of intepreter during the first visit	81 (12.6)	0	81 (21.8)
[f]Gestational diabetes	86 (13.7)	31 (11.6)	55 (15.3)

[a] Living without a partner.
[b] From gestational week 28 to postpartum.
[c] Reflects low socioeconomic position.
[d] Reflects low level of integration into the mainstream Norwegian society.
[e] EPDS ≥ 10 in gestational week 28.
[f] According to WHO definition (fasting plasma glucose ≥ 7.0 mmol/l and/or 2-hour plasma glucose ≥ 7.8 mmol/l).
[g] Norway ($n = 113$), Sweden ($n = 11$), Denmark ($n = 2$), other Western European countries and North America ($n = 3$).
[h] Pakistan ($n = 126$), Sri Lanka ($n = 61$), Middle East ($n = 72$), East European countries ($n = 43$), Africa South of Sahara ($n = 22$), East Asia ($n = 44$), and South and Central America ($n = 12$).

3.3. Variables associated with PPDS

In addition to ethnicity, depressive symptoms in the index pregnancy, adverse life events, lack of social support, low SEP and integration were associated with PPDS in univariate analyses, while gestational diabetes was not (Tables 2 and 3).

In multiple regression analyses, depressive symptoms in the index pregnancy was associated with a more than double risk of PPDS both in Western European and ethnic minority women, although the OR did not reach statistical significance for ethnic minority women ($p = 0.08$). Due to the interactional effect between ethnicity and depressive symptoms in pregnancy, "Western European women with no depressive symptoms in pregnancy" had a substantially lower risk of PPDS (Table 3, Model 1) than ethnic minority women with no depressive symptoms in pregnancy (OR 0.2 (0.05–0.59), $p = 0.005$). Adverse life events and lack of social support were also independently associated with PPDS (Model 1).

To investigate our second aim, we replaced ethnicity by level of social integration (Table 3, Model 2). A low level of social integration was associated with an OR of 2.1 (95% CI: 1.1–3.95) for PPDS, adjusted for age, SEP, adverse life events, lack of social support and a history of depression. All these factors except age were independently associated with PPDS in the adjusted models. "History of depression" was chosen instead of "depressive symptoms in the index pregnancy" in Model 2, as the model with "history of depression" had higher R^2 ($R^2 = 27.6$) than the model with "depressive symptoms in the index pregnancy", (latter model not shown). No interaction between "mother`s level of social integration" and "history of depression" ($p = 0.80$), nor with "depressive symptoms in the index pregnancy" ($p = 0.11$) was found.

In the sensitivity analysis exploring the level of integration among ethnic minorities only, we found a similar, but non-significant, trend for the PCA variable for integration as in the main analysis (results not shown).

4. Discussion

In our population-based cohort study from an urban, multiethnic setting, also including women who had recently immigrated and women with poor skills in the majority language, we found a prevalence rate of PPDS of 9.3% for the whole study sample, 4.8% for Western European women and 12.7% for the ethnic minorities. The prevalence was higher in Middle Eastern and South Asian women than in Western European women, as was the median EPDS score. In contrast to minority women, the majority of the Western European women with PPDS also had depressive symptoms during pregnancy. Recent adverse life events, lack of social support, depressive symptoms in the index pregnancy and ethnic minority background were independently associated with PPDS. Importantly, low social integration was also significantly associated with PPDS when replacing ethnicity in our models.

5. Comparison with other studies

Prevalence rates for PPD vary considerably across studies (O'Hara and McCabe, 2013). Different contexts, populations and methodology (study design, measures and criteria for PPD, and timing of the assessment) make direct comparison across studies difficult (Dennis and Dowswell, 2013; Dennis and Hodnett, 2007; Eberhard-Gran et al., 2001a). As EPDS in our study was measured about 14 weeks postpartum, our cases might represent more persistent symptoms than studies reporting rates from earlier in the postpartum period. Rates are generally higher in low-income compared with high-income countries (Norhayati et al., 2015). Studies from Turkey, Pakistan, and India (the Tamil population) generally report high prevalence rates (14–40%) of PPD (Ali et al., 2009; Husain et al., 2006; Savarimuthu et al., 2010; Turkcapar et al., 2015). Furthermore, a systematic review of PPD in migrant South Asian women found prevalence rates ranging from 5% to 20%, with ORs 1.8–2.5 in those who were born overseas compared to later generations (Nilaweera et al., 2014).

Relatively few studies have reported results from diverse ethnic communities (Dennis and Dowswell, 2013; Rich-Edwards et al., 2006). However, a systematic review from 2015 of PPD in various immigrant groups included eleven studies from Canada (mostly Asian Indians), three from Australia, and six from Europe. Overall, the OR for PPD was 1.8–2.2 for immigrant versus native women in adjusted analyses (Falah-Hassani et al., 2015), in accordance with our findings.

In line with several other studies, we found that regardless of ethnicity, adverse life events, depressive symptoms during pregnancy and depression earlier in life are strongly related to the development of PPDS (Eberhard-Gran et al., 2002; Rich-Edwards et al., 2006; Robertson et al., 2004; Rubertsson et al., 2005).

Our finding that "lack of social support" was strongly associated with PPDS is well supported by other studies (Beck, 2001; Husain et al., 2012; O'Hara and Swain, 1996). Immigrant women may be particularly vulnerable when it comes to childrearing in a new country, as they carry with them their own traditions regarding childbirth and the postpartum period (Evagorou et al., 2016; Gulamani et al., 2013). For instance, in Pakistan and Turkey traditional rituals include 40 days of mandatory rest for the new mother, with practical and emotional support offered by family members (Eberhard-Gran et al., 2010). Usually

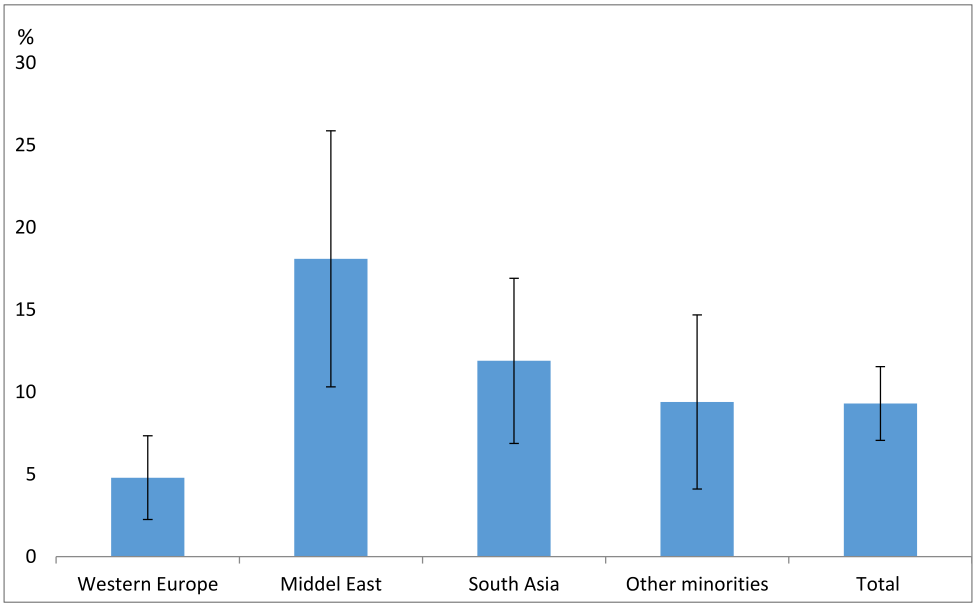


Fig. 2. Proportion with postpartum depression (%, 95% confidence intervals) by main ethnic groups.

the mother-in-law and other family members take care of the newborn. However, in cases where emotional support offered by family members or the mother-in-law does not meet the new mother's needs, this may increase the risk of PPDS (Evagorou et al., 2016). Another aspect of cultural differences is the level of physical activity in the postpartum period. In another study from our cohort, we found that South Asian and Middle Eastern women did not increase their level of physical activity from mid-gestation to the postpartum visit, in contrast to what we observed in Western European women (Richardsen et al., 2016). As in another study from a high-income country, we did not find a relationship with the gender of the newborn (Husain et al., 2012). SEP is associated with PPDS across different cultures and countries (Robertson et al., 2004; Rubertsson et al., 2005) and can further influence adjustments to motherhood and overall emotional health (Eberhard-Gran et al., 2010). In another study from our cohort, we found that low SEP was independently associated with depression during pregnancy (Shakeel et al., 2015). In the present study, however, low SEP was independently associated with PPDS only in the model where we used social integration instead of ethnicity, probably in part due to the strong association between ethnicity and SEP and the relatively small sample size and number of cases.

Gestational diabetes is a common complication of pregnancy, is more frequent in ethnic minorities (Jenum et al., 2010), and the diagnosis is considered stressful at least in the short term (Crowther et al., 2005). There are contradictory findings in the literature about gestational diabetes and its association with PPDS (Barakat et al., 2014), and we did not find any significant associations between gestational diabetes in the index pregnancy and PPDS.

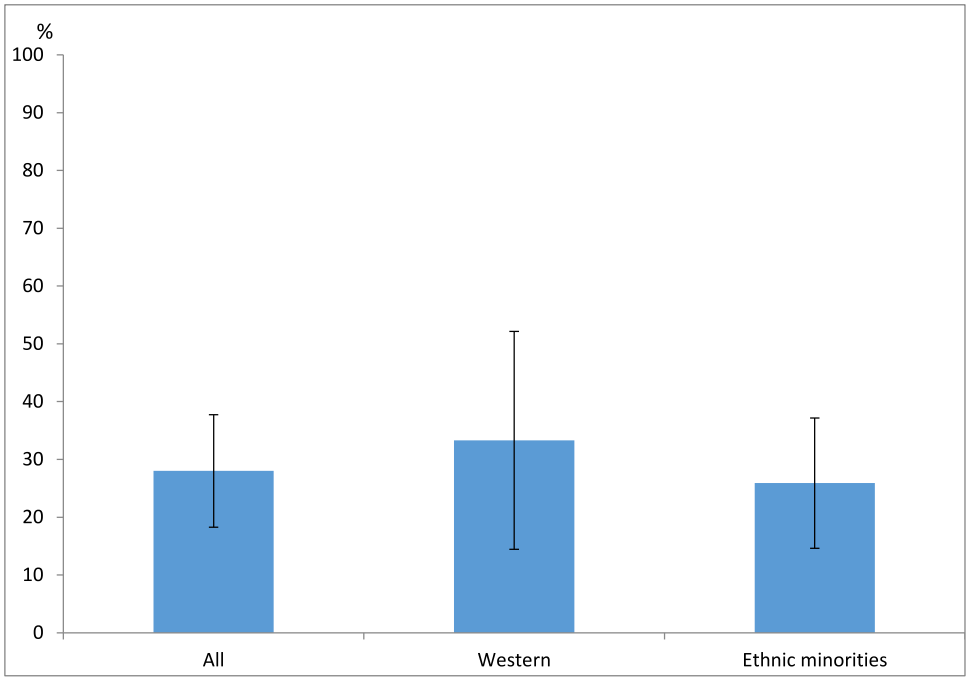
Interestingly, we found that a higher proportion of Western European women with PPDS also had depressive symptoms in pregnancy, indicating that the majority of these PPDS cases probably could be identified if screened during pregnancy. By contrast, although ethnic minorities in our study had at least a double risk for depressive symptoms both in pregnancy and postpartum, the proportion of new cases was higher compared with Western Europeans at the postpartum visit. Hence, the majority of ethnic minority women with PPDS might be more difficult to identify during pregnancy.

To better understand the increased risk of PPDS in ethnic minorities, we explored the level of social integration in the mainstream Norwegian society and found a strong independent association with PPDS. Our social integration variable covers several aspects and our study is one of the few that addresses this important issue in more detail. Differences in PPDS risk related to level of integration and time of residence may reflect different stages of acculturation. The observed heterogeneity in prevalence of PPDS among the ethnic minority groups might be a reflection of different levels of integration. The lack of interaction between the integration variable and depressive symptoms in pregnancy, despite a strong interaction between ethnicity and depressive symptoms in pregnancy, could also suggest that social integration might play an important part in the increased rate of new cases with depressive symptoms at the postpartum visit in ethnic minority women.

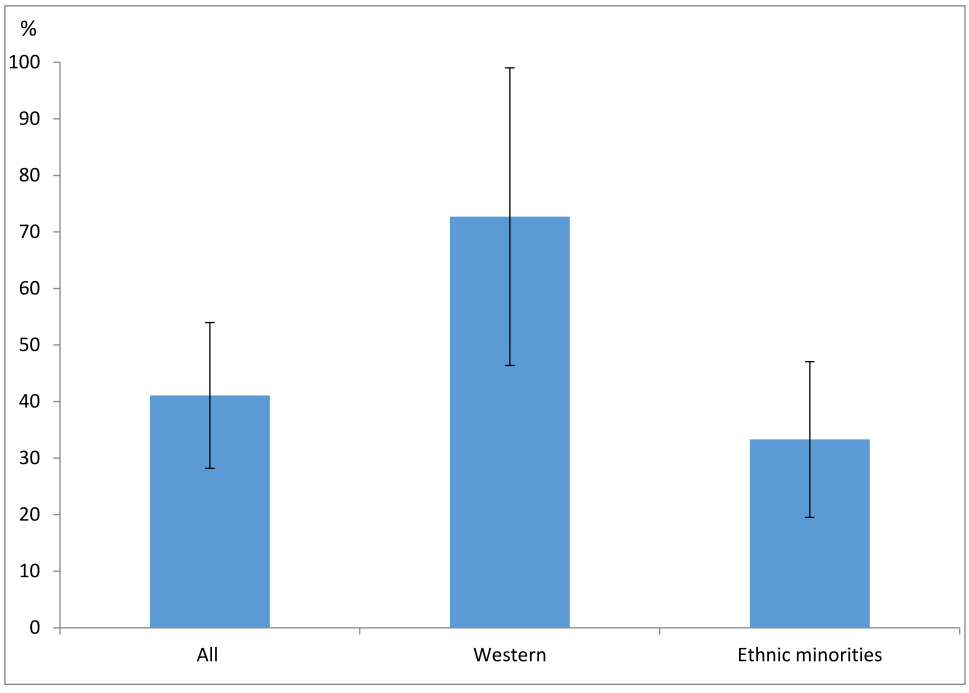
6. Strength and limitations

Our study has several strengths, including the prospective cohort design, the population-based multiethnic sample with inclusion of women in need of an interpreter, high inclusion rates in all ethnic groups, and the broad range of variables, including factors related to SEP, social integration and use of the DAG approach to capture true confounders. We also recorded use of any medication, including antidepressants.

Furthermore, we used the EPDS measure. This is developed for the identification of PPDS, and has good sensitivity and specificity when tested against other assessment methods (Murray and Carothers, 1990). When tested against the gold standard (the DSM IV criteria for major depression), in an earlier Norwegian study of postpartum women, a cut-off point of $\geq$ 10 had 100% sensitivity and 87% specificity (Eberhard-Gran et al., 2001b). The EPDS and its validated translated versions have demonstrated good psychometric properties across different contexts and cultures (Aydin et al., 2004; Benjamin, 2005; Berle et al., 2003; Marshall and Bethell, 2006; Husain et al., 2011). In accordance with other epidemiological studies, we used score $\geq$ 10 to define PPDS, indicative of increased risk of depression (Harris et al., 1989). EPDS is primarily a screening instrument, and in clinical practice, a diagnostic interview should be carried out to identify cases of depression in need of treatment. Only one of the women with PPDS used antidepressant medication, while five women on such medication had an EPDS score $<$ 10, indicating clinical effect. By measuring EPDS symptoms at postpartum week 14, which is somewhat later than the recommended time period in clinical practice (six to eight weeks postpartum), we have probably included cases with more persistent symptoms, but less persistent cases were probably missed.



a



b

Fig. 3. (a) Proportion of those who were depressed in gestational week 28 and still depressed in postpartum (%, 95% confidence interval). (b) Proportion of those with postpartum depression who were also depressed in gestational week 28 (%, 95% confidence interval).

However, our study has several limitations. Most importantly, the number of PPDS cases was limited. We have PPDS data for 78% of included women, implying a loss to follow-up of 22%, which is lower than in other studies (Ganann et al., 2016). Nevertheless, we found indications of some selection bias, which is often the case in cohort studies with longer follow-up-times. Women in the current study sample had slightly higher SEP, were more educated and less unemployed, and were more often living with a partner compared to the non-respondents.

Further, information about history of depression was collected postpartum, which may have led to some memory or recall bias, and some of those who reported a history of depression, may have been referring to an episode in the index pregnancy. The cross-cultural validity of the EPDS is an important issue (Shakeel et al., 2015). As our primary aim was to compare the symptom load in different ethnic groups with mainly Asian and African backgrounds in Europe living in

Table 2
Characteristic of women with and without postpartum depressive symptoms. Values are n (%) if not stated otherwise.

	Depressive symptoms $n = 60$ (9.3%)	No depressive symptoms $n = 583$	*P*-value
Ethnic minority women	47 (12.7)	324 (87.3)	<0.01
Western European women	13 (4.8)	259 (95.2)	
Age at inclusion, mean (SD)	28.8 (4.47)	30.0 (4.81)	0.07
Weeks postpartum	14.1 (3.50)	14.2(2.59)	0.80
Nulliparous	27 (45)	271 (46.5)	0.83
[a]Single parenthood	3 (5.1)	19 (3.3)	0.45
Educational level			
<10 years schooling	12 (20)	84 (14.5)	0.44
Secondary level,10–12 years	26 (43.3)	223 (38.5)	
Up to 4 years of further education	15 (25)	181 (31.3)	
University/college	7 (11.7)	91 (15.7)	
[b]Adverse life events			
0 or 1 event	24 (44.4)	446 (80.8)	<0.001
2 events	13 (24.1)	72 (13.0)	
≥3 events	17 (31.5)	34 (6.2)	
Proportion with low score for socioeconomic position score	35 (58.3)	204 (35.0)	<0.001
Proportion with low score for social integration	31 (51.7)	216 (37.0)	0.03
Previous history of depression	29 (49.2)	108 (18.6)	<0.001
[c]Depressive symptoms in index pregnancy	23 (41.1)	59 (10.4)	<0.001
Lack of social support around the birth period	17 (28.3)	61(10.5)	<0.001
Offspring gender			
Male	25 (43.9)	284 (50.8)	0.32
Female	32 (56.1)	275 (49.2)	
Use of antidepressive at the postpartum visit	1 (1.7)	5 (0.9)	
Gestational diabetes with WHO criteria	6 (10.4)	80(14)	0.436

[a] Exact fisher`s test used.
[b] Gestational week 28 to postpartum.
[c] EPDS ≥ 10 in gestational week 28. [d]According to WHO definition fasting plasma glucose ≥7.0 mmol/l and/or 2-h plasma glucose ≥7.8 mmol/l).

the same residential area in the capital of Norway, we used the same cut-off value for all the women. Lastly, heterogeneity within the ethnic groups is another concern, not least in the merged ethnic minority group, and we do not presume homogeneity within the ethnic minority groups. Nevertheless, we still consider the substantially higher symptom load in the minority compared with the majority population residing in the same area important to report.

7. Implications

The implications of our findings are that clinicians should be aware of the increased risk of PPDS among ethnic minorities compared to Western European women. Women with clinical depression should be offered evidence-based care accordingly (Dennis and Allen, 2008). From a public health perspective, knowledge of factors that can explain why the ethnic minorities are at increased risk is of particular importance. Some ethnic groups may be more vulnerable. Our findings clearly indicate that integration is a cue. Furthermore, our results suggest that three of four Western European women with PPDS already had depressive symptoms in pregnancy. In ethnic minority women, however, the majority of PPDS cases would probably not be identified by screening during pregnancy only. Lastly, there is a need for more nuanced studies among specific ethnic groups in the future.

National screening programs based on the EPDS to identify women with perinatal depression are still under debate (Howard et al., 2014; Norweigan Directorate of Health, 2016), as there is a lack of strong trial evidence of cost-effectiveness and acceptability among new mothers.

The National Institute of Health and Care Excellence (NICE) guidance recommends that, in the UK, general practitioners can consider asking the two Whooley questions to identify potential depression in vulnerable women in need of enhanced support and treatment. There is little difference in the diagnostic accuracy between the Whooley questions and the EPDS, but Whooley questions could be a less time consuming alternative for busy clinicians (Bosanquet et al., 2015; Howard et al., 2018).

8. Conclusion

Our main finding was that ethnic minority women, particularly from the Middle East and South Asia, were at higher risk of developing PPDS. Recent adverse life events, lack of social support, and depressive symptoms in index pregnancy were independently associated with PPDS. However, there were relatively more new cases postpartum in the ethnic minority groups, while a higher proportion of Western European women with PPDS also had depressive symptoms in pregnancy. Furthermore, the significant association with level of social integration may suggest that this could at least partly mediate the increased risk in ethnic minorities. However, cultural factors and SEP most probably also contribute.

Authors' contributions

NS performed the statistical analysis, supported by RSF (except the PCA analyses), wrote the first draft and revised the paper, LS contributed with the data acquisition and performed the PCA analyses on socio-economic and integration variables, ME-G, KS, and EWM contributed with expert knowledge about the EPDS and other instruments to capture depressive symptoms. AKJ initiated and was the project leader of the STORK Groruddalen study. All authors contributed to the interpretation of data, revised the manuscript critically, checked for clarity and content, and approved the final version.

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Conflict of interest

The authors declare that they have no conflict of interest.

Ethics approval and consent to participate

The study was approved by The Regional Committee for Medical and Health Research Ethics for South Eastern Norway (reference number: 2007.894) and The Norwegian Data Inspectorate. All participants gave their written informed consent.

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Table 3
Odds ratio (OR) for postpartum depressive symptoms, unadjusted and adjusted values, models with ethnicity and with social integration.

	Unadjusted OR			Adjusted OR					
				*Model 1 (R^2 = 29)			**Model 2 (R^2 = 27.6)		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Ethnic minority, not depressed in pregnancy (ref)									
Western European, no depressive symptoms in pregnancy	0.12	0.035–0.388	<0.001	0.2	0.05–0.59	0.005			
Western European, depressive symptoms in pregnancy	4.6	1.81–11.56	0.001	4.0	1.36–11.43	0.012			
Ethnic minority, depressive symptoms in pregnancy	3.2	1.59–6.41	0.001	2.1	0.93–4.67	0.076			
Age at inclusion	0.95	0.90–1.0	0.068	0.95	0.89–1.02	0.127	0.92	0.86–0.99	0.020
[a]Adverse life-events (0–1 = ref)									
2 events	3.4	1.64–6.89	0.001	2.9	1.34–6.35	0.007	2.3	1.03–5.15	0.041
3 or more events	9.3	4.56–18.95	<0.001	6.4	2.77–14.88	<0.001	6.4	2.78–14.55	<0.001
Mother's socioeconomic position, SEP (highest 60% = ref)									
Lowest 40%	2.6	1.52–4.47	0.001	1.6	0.83–3.08	0.165	2.4	1.27–4.58	0.007
Lack of social support (no = ref)									
Yes	3.4	1.82–6.28	<0.001	3.4	1.59–7.07	0.001	3.3	1.57–6.81	0.002
Mothers's level of social integration (highest 60% = ref)									
Lowest 40%	1.8	1.07–3.10	0.028				2.1	1.11–3.95	0.022
History of depression	4.7	2.70–8.21	<0.001				3.3	1.66–6.44	0.001
[b]Depressive symptoms index pregnancy	6.0	3.31–10.92	<0.001						
Weeks postpartum	0.99	0.89–1.09	0.796						
Offspring gender (boy = ref)	1.3	0.76–2.29	0.319						
[c]Gestational diabetes	0.7	0.30–1.70	0.438						

[a] Gestational week 28 to postpartum.
[b] EPDS ≥ 10 during pregnancy.
[c] According to WHO definition (fasting plasma glucose ≥ 7.0 mmol/l and/or 2-h plasma glucose ≥ 7.8 mmol/l).
* Model 1: multiple logistic regression analysis with adjusted ORs for included variables.
** Model 2: multiple logistic regression analysis with adjusted ORs for included variables.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2018.07.056.

References

Alberti, K.G., Zimmet, P.Z., 1998. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabet. Med. J. Br. Diabet. Assoc. 15, 539–553.

Ali, N.S., Ali, B.S., Azam, I.S., 2009. Post partum anxiety and depression in peri-urban communities of Karachi, Pakistan: a quasi-experimental study. BMC Public Health 9, 384.

Aydin, N., et al., 2004. Validation of the Turkish version of the Edinburgh Postnatal Depression Scale among women within their first postpartum year. Soc. Psychiatry Psychiatr. Epidemiol. 39, 483–486.

Barakat, S., et al., 2014. What do we know about gestational diabetes mellitus and risk for postpartum depression among ethnically diverse low-income women in the USA? Arch. Women's Ment. Health 17, 587–592.

Beck, C.T., 2001. Predictors of postpartum depression: an update. Nurs. Res. 50, 275–285.

Benjamin, D., et al., 2005. Validation of the Tamil version of Edinburgh post-partum depression scale. J. Obstet. Gynecol. India 55, 242–243.

Berle, J.O., et al., 2003. Screening for postnatal depression. Validation of the Norwegian version of the Edinburgh Postnatal Depression Scale, and assessment of risk factors for postnatal depression. J. Affect. Disord. 76, 151–156.

Bhugra, D., Becker, M.A., 2005. Migration, cultural bereavement and cultural identity. World Psychiatr. Off. J. World Psychiatr. Assoc. (WPA) 4, 18–24.

Bjerke, S.E., et al., 2008. Postpartum depression among Pakistani women in Norway: prevalence and risk factors. J. Matern.-Fetal Neonatal Med. Off. J. Eur. Assoc. Perinat. Med. Fed. Asia Ocean. Perinat. Soc. Int. Soc. Perinat. Obstet. 21, 889–894.

Bosanquet, K., et al., 2015. Diagnostic accuracy of the Whooley questions for the identification of depression: a diagnostic meta-analysis. BMJ Open 5, e008913.

Cox, J., Holden, J., 2003. A Guide to the Edinburgh Postnatal Depression Scale. State Perinatal Mental Health Reference Group, Western Australia.

Cox, J.L., Holden, J.M., Sagovsky, R., 1987. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. Br. J. Psychiatr. J. Mental Sci. 150, 782–786.

Crowther, C.A., et al., 2005. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N. Engl. J. Med. 352, 2477–2486.

Dennis, C.L., Allen, K., 2008. Interventions (other than pharmacological, psychosocial or psychological) for treating antenatal depression. Cochrane Database Syst. Rev (Online), CD006795.

Dennis, C.L., Dowswell, T., 2013. Psychosocial and psychological interventions for preventing postpartum depression. Cochrane Database Syst. Rev (Online) 2, Cd001134.

Dennis, C.L., Hodnett, E., 2007. Psychosocial and psychological interventions for treating postpartum depression. Cochrane Database Syst. Rev (Online), Cd006116.

Dorheim, S.K., Bjorvatn, B., Eberhard-Gran, M., 2012. Insomnia and depressive symptoms in late pregnancy: a population-based study. Behav. Sleep Med. 10, 152–166.

Dorheim, S.K., Bjorvatn, B., Eberhard-Gran, M., 2014. Can insomnia in pregnancy predict postpartum depression? A longitudinal, population-based study. PloS One 9, e94674.

Eberhard-Gran, M., et al., 2001a. Review of validation studies of the Edinburgh Postnatal Depression Scale. Acta Psychiatr. Scand. 104, 243–249.

Eberhard-Gran, M., et al., 2002. Depression in postpartum and non-postpartum women: prevalence and risk factors. Acta Psychiatr. Scand. 106, 426–433.

Eberhard-Gran, M., et al., 2001b. The Edinburgh Postnatal Depression Scale: validation in a Norwegian community sample. Nordic J. Psychiatr. 55, 113–117.

Eberhard-Gran, M., et al., 2010. Postnatal care: a cross-cultural and historical perspective. Arch. Women's Mental Health 13, 459–466.

Evagorou, O., Arvaniti, A., Samakouri, M., 2016. Cross-cultural approach of postpartum depression: manifestation, practices applied, risk factors and therapeutic interventions. Psychiatr. Q. 87, 129–154.

Falah-Hassani, K., et al., 2015. Prevalence of postpartum depression among immigrant women: a systematic review and meta-analysis. J. Psychiatr. Res. 70, 67–82.

Fung, K., Dennis, C.L., 2010. Postpartum depression among immigrant women. Curr. Opin. Psychiatr. 23, 342–348.

Ganann, R., et al., 2016. Predictors of postpartum depression among immigrant women in the year after childbirth. J. Women's Health (2002) 25, 155–165.

Gonidakis, F., et al., 2011. The relationship between acculturation factors and symptoms of depression: a cross-sectional study with immigrants living in Athens. Transcult. Psychiatr. 48, 437–454.

Grace, S.L., Evindar, A., Stewart, D.E., 2003. The effect of postpartum depression on child cognitive development and behavior: a review and critical analysis of the literature. Arch. Women's Mental Health 6, 263–274.

Gulamani, S.S., et al., 2013. A review of postpartum depression, preterm birth, and culture. J. Perinat. Neonatal Nurs. 27, 52–59 quiz 60-51.

Harris, B., et al., 1989. The use of rating scales to identify post-natal depression. Br. J. Psychiatr. J. Mental Sci. 154, 813–817.

Hay, D.F., et al., 2003. Pathways to violence in the children of mothers who were depressed postpartum. Dev. Psychol. 39, 1083–1094.

Hay, D.F., et al., 2001. Intellectual problems shown by 11-year-old children whose mothers had postnatal depression. J. Child Psychol. Psychiatr. Allied Discip. 42, 871–889.

Hernan, M.A., et al., 2002. Causal knowledge as a prerequisite for confounding evaluation: an application to birth defects epidemiology. Am. J. Epidemiol. 155, 176–184.

Hewitt, C., et al., 2009. Methods to identify postnatal depression in primary care: an integrated evidence synthesis and value of information analysis. Health Technol. Assess. 13 (1–145), 147–230.

Howard, L.M., et al., 2014. Antenatal and postnatal mental health: summary of updated NICE guidance. BMJ (Clin. Res. Ed.) 349, g7394.

Howard, L.M., et al., 2018. Accuracy of the Whooley questions and the Edinburgh Postnatal Depression Scale in identifying depression and other mental disorders in

early pregnancy. Br. J. Psychiatr. J. Mental Sci. 212, 50–56.
Husain, N., et al., 2006. Prevalence and social correlates of postnatal depression in a low income country. Arch. Women's Mental Health 9, 197–202.
Husain, N., et al., 2012. Social stress and depression during pregnancy and in the postnatal period in British Pakistani mothers: a cohort study. J. Affect. Disord. 140, 268–276.
Husain, N., et al., 2011. Prevalence and psychosocial correlates of perinatal depression: a cohort study from urban Pakistan. Arch. Women's Mental Health 14, 395–403.
Jenum, A.K., et al., 2012. Impact of ethnicity on gestational diabetes identified with the WHO and the modified International Association of Diabetes and Pregnancy Study Groups criteria: a population-based cohort study. Eur. J. Endocrinol./Eur. Fed. Endocr. Soc. 166, 317–324.
Jenum, A.K., et al., 2010. The STORK Groruddalen research programme: a population-based cohort study of gestational diabetes, physical activity, and obesity in pregnancy in a multiethnic population. Rationale, methods, study population, and participation rates. Scand. J. Public Health 38, 60–70.
Kendler, K.S., et al., 1993. The lifetime history of major depression in women. Reliability of diagnosis and heritability. Arch. Gen. Psychiatr. 50, 863–870.
Kjeldgaard, H.K., et al., 2017. History of depression and risk of hyperemesis gravidarum: a population-based cohort study. Arch. Women's Mental Health 20, 397–404.
Marshall, D.J., Bethell, K., 2006. Department of Health, Government of Western Australia. Edinburgh Postnatal Depression Scale (EPDS): Translated Versions-Validated. State perinatal Mental Health Reference Group, Perth, Western Australia.
Melo, E.F., et al., 2012. The prevalence of perinatal depression and its associated factors in two different settings in Brazil. J. Affect. Disord. 136, 1204–1208.
Murray, L., et al., 2011. Maternal postnatal depression and the development of depression in offspring up to 16 years of age. J. Am. Acad. Child Adolesc. Psychiatr. 50, 460–470.
Murray, L., Carothers, A.D., 1990. The validation of the Edinburgh Post-natal Depression Scale on a community sample. Br. J. Psychiatr. J. Mental Sci. 157, 288–290.
Nilaweera, I., Doran, F., Fisher, J., 2014. Prevalence, nature and determinants of postpartum mental health problems among women who have migrated from South Asian to high-income countries: a systematic review of the evidence. J. Affect. Disord. 166, 213–226.
Norhayati, M.N., et al., 2015. Magnitude and risk factors for postpartum symptoms: a literature review. J. Affect. Disord. 175, 34–52.
Norweigan Directorate of Health, H.N. Anbefalinger fysisk aktivitet, gravide og etter fødsel, www.helsedirektoratet.no (accessed december 2017).
O'Hara, M., Swain, A., 1996. Rates and risk of postpartum depression-a meta-analysis. Int. Rev. Psychiatr. 8 (1), 37–54.
O'Hara, M.W., McCabe, J.E., 2013. Postpartum depression: current status and future directions. Ann. Rev. Clin. Psychol. 9, 379–407.
Pascoe, E.A., Smart Richman, L., 2009. Perceived discrimination and health: a meta-analytic review. Psychol. Bull. 135, 531–554.
Pawlby, S., et al., 2008. Postnatal depression and child outcome at 11 years: the importance of accurate diagnosis. J. Affect. Disord. 107, 241–245.
Rich-Edwards, J.W., et al., 2006. Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. J. Epidemiol. Community Health 60, 221–227.
Richardsen, K.R., et al., 2016. Objectively recorded physical activity in pregnancy and postpartum in a multi-ethnic cohort: association with access to recreational areas in the neighbourhood. Int. J. Behav. Nutr. Phys. Act. 13, 78.
Robertson, E., et al., 2004. Antenatal risk factors for postpartum depression: a synthesis of recent literature. Gen. Hosp. Psychiatr. 26, 289–295.
Rubertsson, C., et al., 2005. Depressive symptoms in early pregnancy, two months and one year postpartum-prevalence and psychosocial risk factors in a national Swedish sample. Arch. Women's Mental Health 8, 97–104.
Savarimuthu, R.J., et al., 2010. Post-partum depression in the community: a qualitative study from rural South India. Int. J. Soc. Psychiatr.. 56, 94–102.
Shakeel, N., et al., 2015. A prospective cohort study of depression in pregnancy, prevalence and risk factors in a multi-ethnic population. BMC Pregnancy Childbirth 15, 5.
Shrier, I., Platt, R.W., 2008. Reducing bias through directed acyclic graphs. BMC Med. Res. Methodol. 8, 70.
Silva, C.S, et al., 2017. Association between postpartum depression and the practice of exclusive breastfeeding in the first three months of life. J. Pediatr. 93, 356–364.
Sletner, L., et al., 2014. Maternal life course socio-economic position and offspring body composition at birth in a multi-ethnic population. Paediatr. Perinat. Epidemiol. 28, 445–454.
Turkcapar, A.F., et al., 2015. Sociodemographic and clinical features of postpartum depression among Turkish women: a prospective study. BMC Pregnancy Childbirth 15, 108.
Unlu Ince, B., et al., 2014. The relationship between acculturation strategies and depressive and anxiety disorders in Turkish migrants in the Netherlands. BMC Psychiatr. 14, 252.
Wittkowski, A., Patel, S., Fox, J.R., 2017. The experience of postnatal depression in immigrant mothers living in western countries: a meta-synthesis. Clin. Psychol. Psychother. 24, 411–427.