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Risk factors for and perinatal outcomes of major depression during pregnancy: a population-based analysis during 2002–2010 in Finland

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ABSTRACT

Objectives: To identify risk factors for and the consequences (several adverse perinatal outcomes) of physician-diagnosed major depression during pregnancy treated in specialised healthcare.

Design: A population-based cross-sectional study.

Setting: Data were gathered from Finnish health registers for 1996–2010.

Participants: All singleton births (n=511 938) for 2002–2010 in Finland.

Primary outcome measures: Prevalence, risk factors and consequences of major depression during pregnancy.

Results: Among 511 938 women, 0.8% experienced major depression during pregnancy, of which 46.9% had a history of depression prior to pregnancy. After history of depression, the second strongest associated factor for major depression was fear of childbirth, with a 2.6-fold (adjusted OR (aOR=2.63, 95% CI 2.39 to 2.89) increased prevalence. The risk profile of major depression also included adolescent or advanced maternal age, low or unspecified socioeconomic status (SES), single marital status, smoking, prior pregnancy terminations, anaemia and gestational diabetes regardless of a history of depression. Outcomes of pregnancies were worse among women with major depression than without. The contribution of smoking was substantial to modest for small-for-gestational age newborn (<−2 SD below mean birth), low birth weight (<2500 g), preterm birth (<37 weeks) and admission to neonatal intensive care associated with major depression, whereas SES made only a minor contribution.

Conclusions: Physician-diagnosed major depression during pregnancy was found to be rare. The strongest risk factor was history of depression prior to pregnancy. Other associated factors were fear of childbirth, low SES, lack of social support and unhealthy reproductive behaviour such as smoking. Outcomes of pregnancies were worse among women with major depression than without. Smoking during pregnancy made a substantial to modest contribution to adverse outcomes associated with depression during pregnancy.

Strengths and limitations of this study

- Strengths of this study were the population-based data gathered from three mandatory national health registers and physician-diagnosed depression defined by International Classification of Diseases (ICD) 10 codes.
- Possible limitations were that we did not have information on women diagnosed and treated for major depression during pregnancy in primary healthcare, information on history of depression was based on outpatient and inpatient visits only since 1998 and 1996, respectively, and we did not have information on antidepressant medication at an individual level.
- Another limitation is that we did not have information on other maternal mental health problems such as anxiety and stress-related diagnosed disorders.

INTRODUCTION

Depression is globally one of the leading causes of disease burden for women.[1] A previous large population-based study reported that 0.8% of 32.2 million women had physician-diagnosed depression at the time of delivery in USA during 1998–2005.[2] A recent systematic review concluded that, according to multivariable analyses, life stress, lack of social support and domestic violence were associated with an increased risk of depression during pregnancy, whereas maternal anxiety, history of depression, unintended pregnancy, lack of private medical insurance, low income, low education, smoking, single marital status and poor relationship were only significant predictors in bivariable analysis.[3] The authors of this review highlighted several limitations of previous studies, such as differences in the methods used to screen depression, study population, risk factors and confounders

included in statistical analyses. It has been suggested that use of self-reported screening methods may overestimate the prevalence of depression, which in turn suggests that their sensitivity and specificity are not adequate.[4] Further, several previous studies have shown that diabetes mellitus, gestational diabetes,[2 5] preeclampsia,[2 6] anaemia, caesarean section (CS) and placental abnormalities[2] are more prevalent among women suffering from perinatal depression.

Antepartum and postpartum depression represent a risk for children's short-term and long-term well-being.[7] Several studies have reported an association between antepartum depression and risk of preterm birth, but no association with other adverse outcomes, such as low birth weight (LBW), admission to a neonatal intensive care unit (NICU) and low Apgar scores, as shown in a systematic review and meta-analysis.[8] However, many of these studies were potentially underpowered because of small sample sizes and were also heterogeneous with respect to the study population and analyses. Further, the use of different methods to measure and define depression raises questions about whether all studies really measured clinically diagnosed major depression.[8] Further, the previous mentioned large population-based study from USA found that physician-diagnosed depression at the time of birth was associated with an increased prevalence of preterm birth, fetal growth restriction, fetal abnormalities, fetal distress and fetal death.[2]

The aim of the present large population-based cross-sectional study was to identify risk factors for major depression during pregnancy based on ICD-10 codes (International Classification of Diseases) treated in specialised healthcare units, especially an association between a prior history of depression and antepartum depression that was only examined by a few smaller studies.[3] Furthermore, we studied whether major depression during pregnancy was associated with adverse perinatal outcomes and the degree to which this association was attenuated by women's socioeconomic status (SES) and smoking (strongly associated with adverse perinatal outcomes)[9] during pregnancy in Finland. Most previous studies considering an association between adverse perinatal outcomes and depression were small and population-based studies were scarce.[8] Further, differences in healthcare services such as access to antenatal care might limit generalisability of the large previous study from the USA.[2] In Finland, with around 5.5 million residents, healthcare services are mainly publicly funded and all women have free access to antenatal care.

MATERIALS AND METHODS
Data and population
Data were gathered from three national health registers currently maintained by the National Institute for Health and Welfare and were linked using women's encrypted unique personal identification numbers. The Finnish Medical Birth Register (MBR) contains demographics, pregnancy and delivery characteristics, and diagnoses on all live births or stillbirths delivered after the 22nd gestational week or weighing 500 g or more during the first postnatal week recorded since 1987. The MBR data was supplemented by information on maternal health (major depression, preeclampsia, gestational diabetes, pre-existing diabetes and fear of childbirth) gathered and defined based on ICD-10 codes from the Hospital Discharge Register (HDR). The HDR was established in 1969 and contains information on all aspects of inpatient care and outpatient visits in Finnish hospitals. Information on major congenital anomalies (yes or no) was gathered and the Register of Congenital Malformations established in 1963. Data included all women with singleton births (n=511 938) from 2002 to 2010; multiple births (n=15 767) were excluded because they carry a higher risk of complications. The present time period was chosen since information on depression (ie, a history of depression prior to pregnancy) was available since 1996 for inpatient visits and since 1998 for outpatient visits.

The National Institute for Health and Welfare approved the study plan and use of the data for the study as required by the national data protection legislation in Finland (reference number 1749/5.05.00/2011).

Variables and definitions
Physician-diagnosed depression was defined by ICD-10 codes F31.3, F31.5 and F32–34 and women were grouped into four categories; (1) no major depression during pregnancy and no history of depression prior to pregnancy, (2) no major depression during pregnancy with a history of depression prior to pregnancy, (3) major depression during pregnancy with no history of depression prior to pregnancy and (4) major depression during pregnancy with a history of depression prior to pregnancy. Information on major depression was based on outpatient visits (patients without overnight hospitalisation) to specialised healthcare since 1998 and inpatient visits (at least an overnight stay at a hospital) to specialised healthcare since 1996 gathered from the HDR. In Finland, general practitioners and midwives in healthcare centres provide primary healthcare such as antenatal care, and specialists in regional and university teaching hospitals provide specialised healthcare. Healthcare professionals at both levels are instructed to evaluate the mother's mental well-being as part of all appointments. Parity was categorised as either nulliparous, if women had no prior births, or multiparous, if women had at least one prior birth. The gestational age was estimated based on first-trimester or second-trimester ultrasonography measurements. Mode of delivery was classified as vaginal spontaneous, breech, forceps, vacuum-assisted or CS. A smoking habit during pregnancy based on self-reported information was grouped into three categories: non-smoking, quit smoking during the first trimester and continued smoking after the first trimester, that is, smoking. Marital

status was classified as either married (including women living with a partner) or single. SES was grouped into five categories based on the Finnish Classification of Occupations,[10] which was developed according to international recommendations: upper white-collar workers, such as physicians and lawyers; lower white-collar workers, such as nurses and secretaries; blue-collar workers, such as cooks and cashiers; others; and missing information, as categorised and published elsewhere.[11] 'Others' comprised 25.9% (n=132 391) of all cases and included all births with unspecified occupations, such as entrepreneurs, students, retired, unemployed and housewives. The category with missing SES information comprised 17.4% (n=89 041) of all births. Information on prior CS, induction, miscarriages and pregnancy terminations was dichotomous (yes or no). Information on in vitro fertilisation (IVF) included intracytoplasmic sperm injection and frozen embryo transfers. Anaemia was defined as haemoglobin levels ≤100 g/L. Placenta praevia (O44), placental abruption (O45), preeclampsia (O14 and O15), gestational diabetes (O24.4) and maternal pre-existing diabetes (O24.0 and O24.1) were gathered from the HDR based on ICD-10 codes. Fear of childbirth was defined by national ICD-10 code O99.80. Women's feelings towards childbirth are asked for in antenatal care; women experiencing significant fear of childbirth, who cannot be counselled during antenatal visits in primary healthcare, or women making CS requests due to fear of childbirth, are referred to specialist maternity care as described previously.[12 13]

Adverse perinatal outcomes: Admission to an NICU was defined as at least 24 h surveillance at NICU. Stillbirth was defined as fetal death from 22 gestational weeks onwards or birth weight 500 g or more and early neonatal death as death during the first seven postnatal days. Preterm birth was defined as gestational age <37+0 weeks. LBW was defined as a birth weight of less than 2500 g. Small-for-gestational age (SGA) was defined as a sex-specific and parity-specific birth weight more than 2 SD below the mean weight for gestational based on the national 2013 population-based reference.[14] Apgar scores <7 at 5 min and infant's vein pH<7.15 were considered low (taken by indication and both available since 2004).

Statistical analyses

Differences between the four categories of women defined by their depression history as described previously were evaluated by χ^2 test for dichotomous or categorical variables and Kruskal-Wallis test for continuous variables. Unadjusted and adjusted ORs of major depression were determined by using logistic regression analyses. The outcome event of interest was major depression during pregnancy (categories 3 and 4), and the reference group was all women without major depression without or with a history of depression prior to pregnancy (categories 1 and 2). All covariates were determined based on the literature and results of bivariable analyses.

To address the second research aim regarding the contribution of major depression to adverse perinatal outcomes with or without further control for smoking, SES and other covariates, a second set of logistic models was fitted. For each perinatal outcome, a preliminary model (model 1) was used to estimate the association between major depression and perinatal outcome. Then, additional covariates were added in subsequent models: adjustment for age and parity (model 2), adjustment for model 2 variables plus SES (model 3), adjustment for model 2 variables plus smoking (model 4) and adjustment for all variables simultaneously (model 5). Furthermore, multiple imputations were performed to study whether missing information on SES affected our results of logistic regression analysis. The data were analysed using SPSS for Windows V.19.0, Chicago, Illinois, USA. Differences were deemed to be significant if p<0.05. In addition, 95% CIs were calculated.

RESULTS

In total, 0.8% (n=4120) of 511 938 women with singleton pregnancy suffered from major depression during pregnancy as diagnosed by ICD-10 codes in specialised healthcare units. Of all the women with major depression during pregnancy, 53.1% (2189 of 4120) did not have a history of depression prior to pregnancy. Table 1 shows demographics, delivery characteristics and reproductive factors for women with and without major depression during pregnancy according to their history of depression prior to pregnancy. Women who suffered from major depression during pregnancy were more frequently nulliparous, younger and gave birth by CS to a male infant, and had a lower mean birth weight compared with women with no depression during pregnancy. Further, they more frequently were smokers, of unspecified SES and had reproductive risk factors, such as prior pregnancy terminations, anaemia, major congenital anomalies, gestational diabetes and maternal pre-existing diabetes, and suffered more frequently from fear of childbirth compared with women with no major depression during pregnancy.

Table 2 shows risk factors for major depression during pregnancy (categories 3 and 4) using women with no major depression without or with a history of depression prior to pregnancy (categories 1 and 2) as a reference population. The strongest risk/associated factors for major depression during pregnancy were a history of depression prior to pregnancy and fear of childbirth, which were associated with a 22.4-fold and 2.6-fold increased prevalence of major depression during pregnancy, respectively. An increased prevalence of major depression during pregnancy was also associated with adolescent and advanced maternal age, smoking during pregnancy, single marital status, prior pregnancy terminations, low or unspecified SES, anaemia and gestational diabetes. We performed all the analyses using multiple imputed data, but the results did not change (data not shown).

Table 1 Delivery characteristics and reproductive risk factors among women with singleton pregnancies with and without major depression during pregnancy, and with and without a history of depression prior to pregnancy from 2002 to 2010 in Finland

Characteristic	No major depression during pregnancy, n=493 037 (96.3%)	No major depression during pregnancy, n=14 781 (2.9%)	Major depression during pregnancy, n=2189 (0.4%)	Major depression during pregnancy, n=1931 (0.4%)	p Value*
A history of depression prior to pregnancy	No	Yes	No	Yes	
Nulliparous, %	42.0	45.1	45.5	50.0	≤0.001
Multiparous	58.0	54.9	54.5	50.0	
Mean maternal age, years (SD)	29.6 (5.4)	27.6 (6.0)	28.4 (6.2)	28.7 (6.6)	≤0.001
Mean gestational age, week (SD)	39.8 (1.8)	39.7 (1.9)	39.4 (2.0)	39.5 (2.0)	≤0.001
Mode of delivery, %					≤0.001
Vaginal spontaneous	75.8	74.8	72.6	70.4	
Breech	0.6	0.6	0.2	0.4	
Forceps	0.1	0.1	0.1	0.0	
Vacuum assistance	7.2	7.5	7.5	7.7	
Caesarean section	15.9	17.1	19.6	21.5	
Mean birth weight, g (SD)	3531.4 (550)	3479.0 (568)	3453.1 (580)	3456.3 (608)	≤0.001
Male fetal sex, %	51.2	50.0	51.1	51.8	0.04
Major congenital anomalies, %	4.0	5.2	5.6	5.9	≤0.001
Smoking status, %					
Non-smoking	83.2	63.4	66.1	59.5	≤0.001
Quit smoking during first trimester	3.7	6.9	6.5	8.3	
Smoking after first trimester	10.5	26.7	25.1	29.3	
Missing information	2.6	2.9	2.3	3.0	
Married or living with a partner, %	93.5	86.3	83.1	83.0	≤0.001
Socioeconomic status, %					
Upper white-collar worker	8.6	3.7	4.0	3.8	≤0.001
Lower white-collar worker	34.5	25.8	27.9	25.5	
Blue-collar worker	14.2	16.0	14.9	15.3	
Others†	25.7	31.0	31.9	30.0	
Missing information	17.2	23.6	21.3	25.3	
Prior miscarriages, %	20.7	23.6	23.3	23.2	≤0.001
Prior terminations, %	12.2	22.4	19.8	21.7	≤0.001
In vitro fertilisation, %	1.6	1.2	0.9	1.3	≤0.001
Anaemia, ≤100 g/L, %	1.6	2.6	3.5	2.8	≤0.001
Placenta praevia, %	0.3	0.2	0.2	0.4	0.54
Placental abruption %	0.3	0.4	0.5	0.7	0.07
Preeclampsia, %	1.2	1.3	0.9	1.2	0.52
Gestational diabetes, %	11.2	13.4	14.5	17.6	≤0.001
Pre-existing diabetes, %	8.4	10.9	11.6	13.6	≤0.001
Prior caesarean section, %	10.6	10.5	10.3	10.2	0.90
Fear of childbirth, %	4.6	11.4	15.0	17.5	≤0.001

*The χ^2 or Kruskal–Wallis test.
†'Others' comprise entrepreneurs, students, retired women, unemployed women, housewives and all unclassifiable cases.

Table 2 Unadjusted and adjusted OR of major depression during pregnancy among women with singleton pregnancies from 2002 to 2010 in Finland using women with no major depression during pregnancy without and with a history of depression prior to pregnancy as a reference population (categories 1 and 2)

Characteristic	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
A history of depression prior to pregnancy	29.43 (27.62 to 31.35)	22.36 (20.86 to 23.98)
Maternal age (years)		
≤19	3.14 (2.79 to 3.52)	1.58 (1.38 to 1.81)
20–29	1	1
30–39	0.86 (0.81 to 0.92)	1.19 (1.11 to 1.28)
≥40	1.41 (1.22 to 1.63)	1.65 (1.41 to 1.94)
Nulliparous women	1.25 (1.18 to 1.33)	1.21 (1.12 to 1.30)
Multiparous women	1	1
Smoking status		
Non-smoking	1	1
Quit smoking during first trimester	2.52 (2.23 to 2.84)	1.57 (1.38 to 1.80)
Smoking after first trimester	3.25 (3.03 to 3.49)	1.67 (1.53 to 1.81)
Missing information	1.32 (1.09 to 1.60)	1.09 (0.88 to 1.35)
Married/living with a partner	1	1
Single	2.86 (2.62 to 3.11)	1.63 (1.48 to 1.79)
SES		
Upper white-collar worker	1	1
Lower white-collar worker	1.69 (1.43 to 1.99)	1.42 (1.20 to 1.69)
Blue-collar worker	2.29 (1.93 to 2.73)	1.53 (1.27 to 1.84)
Others†	2.59 (2.20 to 3.05)	1.67 (1.40 to 1.98)
Missing information	2.88 (2.43 to 3.40)	1.66 (1.39 to 1.98)
Prior miscarriages	1.15 (1.07 to 1.24)	1.09 (1.00 to 1.18)
Prior terminations	1.82 (1.69 to 1.97)	1.14 (1.04 to 1.24)
IVF	0.70 (0.53 to 0.94)	0.78 (0.58 to 1.07)
Anaemia ≤100 g/L	2.02 (1.70 to 2.41)	1.49 (1.22 to 1.81)
Gestational diabetes	1.49 (1.37 to 1.62)	1.29 (1.11 to 1.50)
Pre-existing diabetes	1.56 (1.42 to 1.71)	1.10 (0.93 to 1.31)
Fear of childbirth	3.80 (3.49 to 4.13)	2.63 (2.39 to 2.89)
Male fetal sex	1.01 (0.95 to 1.07)	0.97 (0.91 to 1.04)

*ORs of major depression adjusted by history of depression prior to pregnancy, maternal age, parity, smoking status, marital status, SES, prior miscarriages, prior terminations, IVF, anaemia, gestational diabetes, pre-existing diabetes, fear of childbirth and fetal sex.
†Others comprise entrepreneurs, students, retired women, unemployed women, housewives and all unclassifiable cases.
IVF, in vitro fertilisation; SES, socioeconomic status.

Pregnancies of women who suffered from major depression during pregnancy more frequently resulted in adverse perinatal outcomes, such as stillbirth, preterm birth, LBW, SGA, Apgar scores <7 at 5 min, fetal venous pH <7.15 at birth, admission to an NICU and major congenital anomalies, compared with women without major depression during pregnancy (table 3). Major depression was not associated with early neonatal death. Smoking appeared to contribute the most to the increased prevalence of SGA, LBW, preterm birth, stillbirth and admission to an NICU associated with major depression, but made only a minor contribution to the increased prevalence of other perinatal outcomes, except early neonatal death and low fetal venous pH, associated with major depression during pregnancy. SES made a minor contribution to the increased prevalence of all perinatal outcomes, except admission to a NICU, early neonatal death and low fetal venous pH, associated with major depression during pregnancy.

DISCUSSION
Main findings
The prevalence of major depression during pregnancy among women with singleton births was 0.8%, which is consistent with a previous population-based and diagnosis-based study,[2] but substantially lower than 3.1–12.8% reported by smaller studies utilising mostly self-reported screening or interviews.[15–17] This finding is likely to indicate that self-reported screening methods such as the Edinburg Depression Scale are likely to be sensitive to early mental health concerns and may overestimate prevalence of depression.[18] Furthermore, self-reported screening methods are not adequate to predict only depressive symptoms; they are suggested to be sensitive also for anxiety and stress-related symptoms.[4 18] More than half of the depression episodes occurred in women without a history of depression prior to pregnancy. The second strongest associated factor for major depression during pregnancy after history of depression was fear of childbirth, which was associated with threefold increased odds

Table 3 Adjusted ORs of major depression during pregnancy associated with adverse perinatal outcomes among singleton births in Finland from 2002 to 2010

Perinatal outcome	Model 1 adjusted by major depression during pregnancy OR (95% CI)	Model 2 adjusted by model 1+age and parity OR (95% CI)	Model 3 adjusted by model 2+SES OR (95% CI)	Model 4 adjusted by model 2 +smoking OR (95% CI)	Model 5 adjusted by model 2+SES and smoking OR (95% CI)
Admission to a NICU	1.79 (1.65 to 1.95)	1.78 (1.64 to 1.94)	1.78 (1.64 to 1.93)	1.68 (1.55 to 1.83)	1.69 (1.55 to 1.84)
Stillbirth	1.97 (1.33 to 2.93)	2.01 (1.35 to 2.99)	1.86 (1.25 to 2.76)	1.88 (1.27 to 2.80)	1.77 (1.19 to 2.63)
Early neonatal death	1.08 (0.49 to 2.42)	1.13 (0.50 to 2.51)			
Preterm birth (<37 weeks)	1.57 (1.39 to 1.77)	1.57 (1.39 to 1.77)	1.55 (1.37 to 1.75)	1.49 (1.32 to 1.68)	1.48 (1.31 to 167)
LBW (<2500 g)	1.56 (1.36 to 1.79)	1.55 (1.35 to 1.79)	1.53 (1.33 to 1.76)	1.37 (1.19 to 1.58)	1.36 (1.18 to 1.56)
SGA (<−2 SD below mean birth weight)	1.46 (1.27 to 1.67)	1.41 (1.23 to 1.62)	1.39 (1.21 to 1.59)	1.18 (1.03 to 1.36)	1.17 (1.02 to 1.35)
Apgar scores (<7 at 5 min)*	2.13 (1.79 to 2.54)	2.11 (1.77 to 2.51)	2.07 (1.74 to 2.47)	2.05 (1.72 to 2.45)	2.02 (1.70 to 2.41)
Fetal venous pH <7.15 at birth*,†	1.37 (1.06 to 1.76)	1.32 (1.03 to 1.71)	1.33 (1.03 to 1.72)	1.35 (1.05 to 1.74)	1.36 (1.06 to 1.76)
Major congenital anomaly	1.47 (1.29 to 1.67)	1.48 (1.29 to 1.69)	1.47 (1.29 to 1.68)	1.44 (1.26 to 1.65)	1.44 (1.26 to 1.64)

*Available since 2004.
†Gathered selectively by indication.
LBW, low birth weight; NICU, neonatal intensive care unit; SES, socioeconomic status; SGA, small-for-gestational age.

of major depression during pregnancy. Major depression during pregnancy occurred most frequently in women with low or unspecified SES, single marital status and unhealthy behaviour, such as smoking. Outcomes of pregnancies in women with major depression were substantially worse than in women with no major depression during pregnancy. Smoking during pregnancy contributed substantially to an increased prevalence of SGA, LBW, preterm birth and admission to a neonatal unit associated with major depression during pregnancy.

Strengths and limitations

The present study has several strengths: the data included the entire childbearing population gathered from three national health registers with high-quality data,[19 20] depression during pregnancy was diagnosed by a physician, and some novel risk factors, such as fear of childbirth, were studied. However, we acknowledge several limitations with the present study. Information on depression covered only cases diagnosed and treated in specialised medical care units. We did not have information on women who experienced major depression during pregnancy who were diagnosed and treated in primary healthcare. However, it is likely that most high-risk pregnancies such as women with diagnosed depression were treated by specialised maternity care, thus providing us with information on most women with major depression. Further, information on depression was available only since 1996 for inpatient visits and since 1998 for outpatient visits, and therefore we may not have had complete information on all pre-pregnancy depression episodes. It is also of note that maternal perinatal mental health is influenced by several factors such as

parental relationship (such as domestic violence), substance abuse and personal characteristics not studied in the present study. It has been suggested that depressive, anxiety and stress-related symptoms are much more common than doctor-diagnosed disorders such as depression and anxiety.[4 18] However, we did not have information on all possible confounders and other maternal mental health concerns such as anxiety and stress-related diagnosed disorders. In addition, we had no information on antidepressant medication at an individual level or history of adverse pregnancy outcomes, and thus could not assess their roles as confounders in the multivariable analyses. Further, information on SES could not be defined or was missing for approximately 40% of the births. SES is self-reported and optional, and due to confidentiality concerns, some women chose not to provide it. However, the sociodemographics (such as smoking, maternal age and parity) of this group were close to those of the general population, and multiple data imputations of missing information did not change the results (data not shown). Further, SES was solely defined based on maternal occupation at birth that is related to education and income in Finland, and is an appropriate available indicator for studies on socioeconomic health disparity.[21 22] Further, due to data protection issues we did not have information on spouses' SES. No adjustment was made for multiple comparisons, and model results should be interpreted accordingly.

Interpretation

History of depression prior to pregnancy was the strongest predisposing factor for major depression during pregnancy. However, more than half of the women with

major depression during pregnancy had no history of depression, indicating that the first episode of depression is not uncommon during pregnancy. A previous systematic review[3] did not report a positive association between a history of depression prior to pregnancy and antenatal depression, but there were only three studies with multivariable analyses. The three previous studies were with small sample sizes and had heterogeneity in assessment for a prior history of depression.[3] A novel finding of the present study was that physician-diagnosed fear of childbirth was associated with a threefold increased prevalence of major depression during pregnancy. Several previous studies reported an association between anxiety disorders and major depression during pregnancy as previously reviewed.[3] We also showed that low SES, lack of social support and unhealthy reproductive behaviour, such as smoking, were risk factors for major depression during pregnancy. These results are partly in line with a previous systematic review suggesting that smoking, anxiety symptoms, lower SES, life stress and lack of social support were associated with an increased prevalence of antepartum depression.[3] Further, the association between gestational diabetes and maternal pre-existing diabetes was in accordance with the results of previous studies.[2][5] However, our results did not confirm the association between preeclampsia and perinatal depression found in previous studies.[2][6] In general, it has been suggested that depression and other pregnancy morbidities, such as diabetes and preeclampsia, would have a partially common physiological pathway.[23] Risk factors for major depression during pregnancy did not vary substantially between women with and without a history of depression (data not shown).

Our results showed that outcomes of pregnancies affected by major depression during pregnancy were worse than pregnancies not affected by major depression during pregnancy. Several previous studies reviewed found a positive association between preterm birth and depression during pregnancy, but not with other outcomes such as LBW, Apgar scores and admission to NICU.[8] However, the authors suggest that the results might be affected by differences in definition of perinatal outcomes (many studies did not use standard definitions), and that many studies were underpowered or did not have all the important covariates such as maternal smoking.[8]

Adverse perinatal outcomes are strongly associated with SES and health behaviour such as smoking.[9] In the present study, it seemed that smoking mediated the association between adverse perinatal outcomes and depression during pregnancy. However, whether there is causation between smoking and depression and how these are linked, that is, whether depression leads to smoking or smoking alters the risk of depression, could not be fully evaluated in the present setting; thus exact meditational analyses were not conducted. On the basis of previous systematic reviews and meta-analysis, antidepressant medication use during pregnancy has been shown to be associated with preterm birth,[24] lower Apgar scores[24] and poor neonatal adaptation,[25] but not with major congenital anomalies.[26] Further, exposure specifically to selective serotonin reuptake inhibitors (SSRIs) has been shown to be associated with preterm birth[27] and low Apgar scores,[28] but not with stillbirth, neonatal mortality or postnatal mortality.[29] A limitation in the present study was that we could not assess the contribution of antidepressant medication to adverse perinatal outcomes associated with depression during pregnancy, since we did not have access to this information on an individual level. Among the total delivering population, the use of SSRIs ranged from 0.5% in 1997 to 3.7% in 2010 in Finland.

Conclusions

Using a large 9-year national population-based data on all singleton births, we concluded that physician-diagnosed episodes of major depression in specialised healthcare units during pregnancy were rare. Maternal perinatal mental health is a complex issue and influenced by several psychosocial factors, and it has been shown that depression, anxiety and other stress-related symptoms measured by self-reported screening, not studied in the present study, have been suggested to be much more common than diagnosed disorders such as perinatal depression. The strongest risk factor for major depression was history of depression prior to pregnancy. This result may help clinicians to recognise the risk of depression. Other risk factors for major depression during pregnancy were low SES, lack of social support and unhealthy behaviour during pregnancy, such as smoking. Major depression was also associated with fear of childbirth. Outcomes of pregnancies among women affected by major depression during pregnancy were worse than in unaffected women, but smoking during pregnancy made a substantial or modest contribution to the increased prevalence of SGA, LBW, preterm birth and admission to a neonatal unit associated with depression during pregnancy. Furthermore, it is of note that women with history of depression prior to pregnancy or major depression during pregnancy are more likely to experience postpartum depression,[30][31] and consequences of postpartum depression might be more severe for women, since it has shown to be associated with an increased risk of self-harm such as suicide.[32][33] Therefore, because of possible severe maternal and fetal consequences and high risk of relapse, treatment of antepartum depression should be managed actively by a multiprofessional team.

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