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Fear of childbirth predicts postpartum depression: a population-based analysis of 511 422 singleton births in Finland

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ABSTRACT

Objectives: To study how reproductive risks and perinatal outcomes are associated with postpartum depression treated in specialised healthcare defined according to the International Classification of Diseases (ICD)-10 codes, separately among women with and without a history of depression.

Design: A retrospective population-based case–control study.

Setting: Data gathered from three national health registers for the years 2002–2010.

Participants: All singleton births (n=511 422) in Finland.

Primary outcome measures: Prevalence of postpartum depression and the risk factors associated with it.

Results: In total, 0.3% (1438 of 511 422) of women experienced postpartum depression, the prevalence being 0.1% (431 of 511 422) in women without and 5.3% (1007 of 18 888) in women with a history of depression. After adjustment for possible covariates, a history of depression was found to be the strongest risk factor for postpartum depression. Other strong predisposing factors for postpartum depression were fear of childbirth, caesarean birth, nulliparity and major congenital anomaly. Specifically, among the 30% of women with postpartum depression but without a history of depression, postpartum depression was shown to be associated with fear of childbirth (adjusted OR (aOR 2.71, 95% CI 1.98 to 3.71), caesarean birth (aOR 1.38, 95% CI 1.08 to 1.77), preterm birth (aOR 1.65, 95% CI 1.08 to 2.56) and major congenital anomaly (aOR 1.67, 95% CI 1.15 to 2.42), compared with women with no postpartum depression and no history of depression.

Conclusions: A history of depression was found to be the most important predisposing factor of postpartum depression. Women without previous episodes of depression were at an increased risk of postpartum depression if adverse events occurred during the course of pregnancy, especially if they showed physician-diagnosed fear of childbirth.

Strengths and limitations of this study

- Physician-diagnosed postpartum depression and the population-based data gathered from three mandatory national health registers.
- Information on history of depression was based on outpatient and inpatient visits only since 1998 and 1996, respectively. We did not have information on cases diagnosed and treated in primary healthcare before the year 2004.
- Information on postpartum depression was gathered until six weeks after birth since its defined as onset of episodes within four to six weeks after birth, and thus women with later access to health care were not included.

postpartum psychosis[1] with onset of episodes within 4–6 weeks after birth.[2] It has been suggested that about 50–80% of women suffer from baby blues after birth,[1] but estimates of the prevalence of postpartum depressive disorders vary substantially depending on the assessment and timing of screening, sample size and population characteristics. Most of the previous studies have identified depressive symptoms by interviews or self-report depression screening instruments, such as the Edinburgh Postnatal Depression Scale (EPDS),[3] whereas studies based on doctor diagnoses are scarce. A systematic review by Gavin et al[4] suggested that approximately 20% of women suffer from minor or major depression during the first 3 months after the birth. Similarly, a systematic review by Gaynes et al[5] suggested that the prevalence of major depression ranges from 1.0% to 5.9%, while the prevalence of major and minor depression varies from 6.5% to 12.9% during the first postpartum year. However, the studies included in both systematic reviews primarily had small sample sizes, which were not population representative. This might have affected the reliability of the results, and therefore there is a need for further studies with larger populations. A previous 20-year population-based study from the USA reported that only

INTRODUCTION

Postpartum depression encompasses disorders ranging in severity from baby blues to

0.06% and 0.26% of 2.4 million women were hospitalised with definite or possible postpartum depression, respectively, identified based on the International Classification of Diseases (ICD) in the USA.[6]

The aetiology of postpartum depression is still unclear, but several predisposing risk factors may be important. According to Beck's[7] meta-analysis, prenatal depression, low self-esteem, childcare stress, prenatal anxiety, life stress, low social support, poor marital relationship, history of depression, infant temperament, maternity blues, single marital status, low socioeconomic status (SES) and unwanted pregnancy were associated with an increased risk of postpartum depression. Women with adverse perinatal outcomes, such as caesarean[8] or preterm birth,[9] have also been shown to suffer more frequently from postpartum depression. Furthermore, women with perinatal depression have been shown to suffer more frequently from diabetes mellitus and gestational diabetes.[10 11]

The present study analysed the data on the deliveries of 511 422 women with singleton births in Finland for a 9-year period from 2002 to 2010. Information on history of depression was based on ICD-10 codes assigned during all inpatient visits since 1996 and hospital outpatient visits since 1998 gathered from the national Hospital Discharge Register (HDR). Information on postpartum depression was gathered until 6 weeks after birth. The aim of the present work was to investigate how reproductive risk factors and perinatal outcomes associate with postpartum depression defined according to ICD-10 codes. The specific aim was to study what kind of antenatal and perinatal exposures were associated with postpartum depression as an outcome, especially in women with no history of depression, because such information would be useful for prediction and counselling in clinics. Finland has around 5.5 million residents and a welfare system with mainly publicly funded health services.

MATERIALS AND METHODS
Data and population
The sources of the data were three national health registers currently maintained by the National Institute for Health and Welfare; the Finnish Medical Birth Register (MBR), the HDR and the Congenital Malformations Register. The MBR was established in 1987 and contains demographic, pregnancy and delivery information on all live births or stillbirths delivered after the 22nd gestational week or weighing 500 g or more during the first postnatal week. The MBR data for 2002–2010 were supplemented by data on ICD-10 codes assigned for depression from 1996–2010 and fear of childbirth obtained from the HDR, which was established in 1969 and contains information on all aspects of inpatient care and outpatient visits in Finnish hospitals. The Congenital Malformations Register gathers information on major congenital anomalies (yes/no) until 1 year of age from several health registers, such as the MBR and HDR. The information gathered from the three registers was linked together using women's encrypted unique personal identification numbers. Data included all singleton births (n=511 422) in Finland from 2002–2010, whereas multiple births were excluded since they carry a higher risk of complications.

Authorisation to use the data was obtained from the National Institute for Health and Welfare as required by the national data protection legislation law in Finland (Reference number 1749/5.05.00/2011).

Variables and definitions
Depression defined by ICD-10 codes F31.3, F31.5 and F32–34 was used to group women into four categories: (1) no postpartum depression and no history of depression, (2) no postpartum depression with a history of depression, (3) postpartum depression without a history of depression and (4) postpartum depression with a history of depression. A history of depression was defined as any depression diagnosed between 1996 and delivery. Information on depression was gathered until 6 weeks after birth. Depression was defined based on previous mentioned diagnoses and temporal association to pregnancy. SES categorisation was based on international recommendations applied to Finland's National Classification of Occupations.[12] SES was grouped into five categories based on maternal occupation at birth: upper white-collar workers, for example, physicians and teachers; lower white-collar workers, for example, nurses and secretaries; blue-collar workers, for example, cooks and cashiers; others; and missing information as published elsewhere.[13] 'Others' included all unspecified occupations, such as entrepreneurs and students, retired, unemployed and housewives, while the category with missing SES information comprised 17.4% (n=89 041) of all the births. Self-reported smoking during an index pregnancy was grouped into three categories: non-smoking, quitted smoking during the first trimester or continued smoking after the first trimester, that is, smoking. Women with no prior births were classified as nulliparous and women with at least one previous birth were classified as multiparous. Fear of childbirth was defined according to the ICD-10 code O99.80 established in 1997. In Finland, feeling towards childbirth is asked for every woman during pregnancy in antenatal visits. Women experiencing a significant fear of childbirth who cannot be helped during antenatal visits in primary healthcare and/or having CS request due to fear of childbirth are referred to phobia clinics in maternity care. Physicians diagnose fear of childbirth if a woman is referred for maternity care for this reason, or if fear of childbirth is manifested and dealt with during a maternity care visit. Marital status was classified as either married/living with a partner or single. Information on in vitro fertilisation (IVF) included intracytoplasmic sperm injection and frozen embryo transfers. Information on prior miscarriages and terminations was dichotomous (yes or no). Body mass index was defined as an individual's body mass divided by the square of their height from data available in the registries since 2004. Anaemia was defined as haemoglobin levels ≤6.2 mmol/L

during pregnancy. Stillbirth was defined as fetal death and early neonatal death as death during the first seven post-natal days. The gestational age was estimated based on the first-trimester or second-trimester ultrasonography measurements. Preterm birth was defined as gestational age <37+0 weeks. Small for gestational age (SGA) was defined

Table 1 Delivery characteristics and reproductive risk factors among singleton births (n=511 422) in Finland from 2002 to 2010 according to postpartum depression and history of depression

Mead (SD) or per cent	No postpartum depression, n=492 103 (96.2%)	No postpartum depression, n=17 881 (3.5%)	Postpartum depression, n=431 (0.1%)	Postpartum depression, n=1007 (0.2%)	p Value*
History of depression	No	Yes	No	Yes	
Nulliparous	42.0	45.5	52.2	49.0	≤0.001
Multiparous	58.0	54.5	47.8	51.0	
Mean maternal age, years (SD)	29.6 (5.4)	27.8 (6.1)	29.0 (5.9)	28.9 (5.9)	≤0.001
Mean gestational age, weeks (SD)	39.8 (1.8)	39.6 (1.9)	39.2 (2.7)	39.5 (2.0)	≤0.001
Mode of delivery, per cent					
Vaginal spontaneous	75.8	74.4	66.2	69.2	≤0.001
Breech	0.6	0.5	0.7	0.2	
Forceps	0.1	0.1	0.0	0.0	
Vacuum assistance	7.7	7.5	8.2	7.8	
Caesarean section	15.9	17.5	24.9	22.9	
Mean birthweight, g (SD)	3531.5 (549)	3475.7 (551)	3388.7 (697)	3437.0 (599)	≤0.001
Male fetal sex, per cent	51.2	50.2	53.1	51.9	0.06
Induction percentage	16.6	19.8	17.4	21.7	≤0.001
Smoking status					≤0.001
Non-smoking	83.2	63.3	74.7	63.5	
Quit smoking during 1st trimester	3.7	7.0	5.1	7.1	
Smoking after 1st trimester	10.5	26.8	16.0	26.8	
Missing information	2.6	2.9	4.2	2.6	
Married or living with a partner	93.5	85.7	89.2	83.3	≤0.001
Socioeconomic status					≤0.001
Upper white-collar worker	8.6	3.7	6.7	4.4	
Lower white-collar worker	34.5	26.0	29.2	25.6	
Blue-collar worker	14.2	15.8	13.2	15.4	
Others†	25.7	31.1	28.8	29.9	
Missing information	17.2	23.4	22.0	24.7	
Mean prepregnancy BMI (SD)‡	24.2 (4.7)	24.7 (5.3)	24.8 (5.3)	25.2 (5.7)	≤0.001
Prior miscarriages	20.7	23.6	17.9	22.3	≤0.001
Prior terminations	12.2	22.0	17.2	21.6	≤0.001
In vitro fertilisation	1.6	1.3	2.3	0.1	≤0.001
Anaemia (≤6.2 mmol/L)	1.6	2.7	1.6	2.9	≤0.001
Chorionic villus biopsy	1.0	1.3	0.7	1.1	0.05
Amniocentesis	2.5	2.3	4.2	3.0	0.03
Placenta praevia	0.3	0.3	0.7	0.3	0.36
Placental abruption	0.3	0.4	0.7	0.4	0.30
Pre-eclampsia	1.2	1.2	2.3	0.9	0.11
Gestational diabetes	11.2	13.8	17.4	17.6	≤0.001
Diabetes mellitus	8.4	11.1	14.6	13.3	≤0.001
Prior caesarean section	10.6	10.4	12.3	11.7	0.35
Fear of childbirth	4.6	12.0	11.8	19.1	≤0.001

*χ^2 or Kruskal-Wallis test.
†'Others' comprise entrepreneurs, students, retired women, unemployed women, housewives and all unclassifiable cases.
‡BMI gathered since 2004.
BMI, body mass index.

as sex-specific and parity-specific birth weight more than two SDs below the mean weight for gestation based on the current Finnish population-based reference.[14] Low birth weight (LBW) was defined as less than 2500 g. Five minute Apgar scores of <7 and infant's vein pH<7.15 were considered low (this information was available in the registries from 2004).

Statistical analyses

Differences between groups of categorical variables were evaluated by χ^2 test and that of continuous variables were evaluated by the Kruskal-Wallis test. The risk factors for postpartum depression were determined by three multivariable logistic regression analyses: among the total population using women with no postpartum depression without or with a history of depression (categories 1 and 2) as a reference group, and subgroup analysis separately for women with postpartum depression with and without a history of depression using women with no postpartum depression and no history of depression (category 1) as a reference group. Candidate confounders and mediators were selected based on bivariable analyses (p<0.1). Differences were deemed to be significant if p<0.05. In addition, 95% CIs were calculated. The data were analysed using SPSS for Windows V.19.0, Chicago, Illinois, USA.

RESULTS

The prevalence of postpartum depression was 0.3% (1438 of 511 422) among all women with singleton births: 0.1% (431 of 511 422) among women without and 5.3% (1007 of 18 888) among women with a history of depression (table 1). Women who experienced postpartum depression were more often nulliparous and

smokers with single marital status and unspecified SES, and gave birth more frequently by caesarean section compared with women without postpartum depression (tables 1). Furthermore, women experiencing postpartum depression were more likely to have reproductive risk factors, such as prior terminations, anaemia, amniocentesis, gestational diabetes, maternal diabetes mellitus and fear of childbirth compared with women without postpartum depression (table 1).

Table 2 shows the prevalence of perinatal outcomes according to postpartum depression and a history of depression. It appeared that women with postpartum depression more frequently had children born preterm or stillbirth and delivered by caesarean as well as children with LBW, SGA, low 5 min Apgar score and a major congenital anomaly and had more admissions to a neonatal intensive care unit regardless of a history of depression compared with women without postpartum depression.

After adjustment for possible confounders, a history of depression was found to be the strongest risk factor for postpartum depression: depression during pregnancy was associated with a 140-fold (OR 139.35, 95% CI 120.40 to 161.28) and depression before pregnancy a threefold (OR 3.14, 95% CI 2.72 to 3.64) greater odds of postpartum depression compared with women without a history of depression (table 3). Other associated risk factors were nulliparity, caesarean birth, fear of childbirth and a major congenital anomaly. An IVF-achieved pregnancy was associated with a 47% (adjusted OR (aOR) 0.53, 95% CI 0.28 to 0.99) lower odds of postpartum depression.

Table 4 presents multivariable analyses of risk factors for postpartum depression, separately for women without and with a history of depression, using women with no postpartum depression and no history of depression as a

Table 2 Prevalence of perinatal outcomes among singleton births from 2002 to 2010 in Finland according to postpartum depression and history of depression

	No postpartum depression, n/data available (%)	No postpartum depression, n/data available (%)	Postpartum depression, n/data available (%)	Postpartum depression, n/data available (%)	p Value*
History of depression	No	Yes	No	Yes	
Admission to a neonatal intensive care unit	48 450/492 605 (9.8)	2372/17 894 (13.3)	80/431 (18.6)	187/1007 (18.6)	≤0.001
Stillbirth	1514/492 606 (0.3)	67/17 894 (0.4)	5/431 (1.2)	8/1007 (0.8)	≤0.001
Early neonatal death	656/492 606 (0.1)	28/17 894 (0.2)	3/431 (0.7)	2/1007 (0.2)	0.01
Preterm birth (delivery weeks <37)	22 052/491 089 (4.5)	1045/17 826 (5.9)	51/535 (12.0)	65/1004 (6.5)	≤0.001
Low birthweight (<2500 g)	16 109/492 095 (3.3)	763/17 871 (4.3)	40/429 (9.3)	51/1006 (5.1)	≤0.001
Small for gestational age (<−2SD)	18 162/490 771 (3.7)	814/17 815 (4.7)	27/422 (6.4)	54/1004 (5.4)	≤0.001
Low Apgar score (<7 at 5 min)†	6970/326 860 (2.1)	384/13 275 (2.9)	14/299 (4.7)	46/770 (6.0)	≤0.001
Fetal venous pH <7.15 at birth‡	4707/127 320 (3.7)	190/5703 (3.3)	5/129 (3.9)	16/335 (4.8)	0.36
Major congenital anomaly	19 491/492 606 (4.0)	945/17 894 (5.3)	33/431 (7.7)	62/1007 (7.7)	≤0.001
Caesarean section	78 091/492 606 (15.9)	3133/17 894 (17.5)	107/431 (24.8)	230/1007 (22.8)	≤0.001

*χ^2 test.
†In registry since 2004.
‡Determined by indication, in registry since 2004.

Table 3 Adjusted ORs (aORs) of postpartum depression (n=1320) among women with singleton births from 2002 to 2010 in Finland, using women with no postpartum depression (without or with history of depression) as the comparison group (n=490 287)

Characteristics	Adjusted OR (95% CI)
Depression before pregnancy	3.14 (2.72 to 3.64)
Depression during pregnancy	139.35 (120.40 to 161.28)
Maternal age, years	
≤19	1
20–29	1.27 (0.96 to 1.687)
30–39	1.37 (1.02 to 1.84)
≥40	1.30 (0.87 to 1.95)
Nulliparous	1.24 (1.08 to 1.41)
Multiparous	1
Smoking status	
Non-smoking	1
Quit smoking during 1st trimester	1.07 (0.83 to 1.37)
Smoking after 1st trimester	1.10 (0.75 to 1.60)
Missing information	1.09 (0.75 to 1.60)
Married/living with a partner	1
Single	1.10 (0.92 to 1.31)
Socioeconomic status	
Upper white-collar worker	1
Lower white-collar worker	1.00 (0.75 to 1.32)
Blue-collar worker	1.05 (0.77 to 1.42)
Others*	1.15 (0.87 to 1.53)
Missing information	1.23 (0.92 to 1.64)
Mode of delivery	
Vaginal spontaneous	1
Breech	0.83 (0.32 to 2.18)
Forceps	NA
Vacuum assistance	1.10 (0.87 to 1.37)
Caesarean section	1.23 (1.06 to 1.43)
Prior miscarriages	0.92 (0.80 to 1.07)
Prior terminations	1.15 (0.98 to 1.35)
In vitro fertilisation	0.53 (0.28 to 0.99)
Anaemia (≤6.2 mmol/L)	1.08 (0.74 to 1.59)
Pre-eclampsia	0.92 (0.54 to 1.58)
Gestational diabetes	1.29 (0.99 to 1.69)
Maternal diabetes mellitus	1.04 (0.77 to 1.39)
Fear of childbirth	1.58 (1.33 to 1.88)
Major congenital anomaly	1.33 (1.04 to 1.71)
Admission to neonatal intensive care unit	1.19 (1.00 to 1.43)
Stillbirth	2.00 (0.93 to 4.27)
Low-birth weight (<2500 g)	1.12 (0.83 to 1.50)
Preterm birth (≤37 weeks)	0.81 (0.71 to 0.93)
Male fetal sex	1.07 (0.95 to 1.21)

*'Others' comprise entrepreneurs, students, retired women, unemployed women, housewives and all unclassifiable cases.
NA, not applicable.

reference group. An increased prevalence of postpartum depression among women without a history of depression was associated with nulliparity, smoking during pregnancy, caesarean birth, prior terminations, fear of childbirth, a major congenital anomaly and preterm birth compared with the reference group with no postpartum depression.

The strongest risk factor was fear of childbirth, which was associated with a 2.7-fold (aOR 2.71, 95% CI 1.98 to 3.71) increased odds of postnatal depression. Among women with postpartum depression and a history of depression, the strongest risk factors were fear of childbirth, stillbirth, smoking, low or unspecified SES and single marital status compared with the reference group with no postpartum depression and no history of depression. Increased prevalence of postpartum depression was also associated with an advanced maternal age (≥40), anaemia, prior terminations, gestational diabetes, a major congenital anomaly and admission to neonatal intensive care unit. Correspondingly, an IVF-achieved pregnancy was associated with a 93% lower prevalence of postpartum depression (aOR 0.07, 95% CI 0.01 to 0.49).

DISCUSSION

In 2002–2010, among the total Finnish population of women delivering singleton births, 0.3% experienced major physician-diagnosed postpartum depression as indicated by ICD-10 codes assigned during any medical visit in the 6 weeks following delivery. This figure is consistent with a previous large population-based study from the USA, which reported that 0.1–0.3% of women were hospitalised due to postpartum depression as defined by ICD-codes.[6] As expected, in the present study, two-thirds of all cases occurred in women with a history of depressive symptoms before or during pregnancy, but one-third of all cases were considered low risk with no history of depression, making it difficult for healthcare professionals to identify these patients. The novel and main finding of the present study was that an eventful obstetric history, including preterm birth, major congenital anomaly and caesarean birth, and especially physician-diagnosed fear of childbirth, were associated with postpartum depression in low-risk women with no history of depression before or during pregnancy. The fear of childbirth appeared to increase the prevalence of postpartum depression by about three-fold in women without a history of depression and five-fold in women with known depressive disease.

The strengths of this study include population-based detection of physician-diagnosed postpartum depression and the availability of data on a large number of possible additional risk factors contained in the three mandatory national health registers. The utilisation of diagnoses to define postpartum depression lead to high specificity, whereas smaller studies based on self-reported screening by EPDS have reported a prevalence of 7.5–13.0%.[15–17] A possible limitation was that information on prior history of depression was based on outpatient and inpatient visits only since 1998 and 1996, respectively. Furthermore, we did not have complete information on cases diagnosed and treated in primary healthcare. Information on postpartum depression was gathered until 6 weeks after birth since it is defined as onset of episodes within 4–6 weeks after birth, and thus women with later access to

Table 4 Adjusted OR of postpartum depression among women with singleton births from 2002 to 2010 in Finland

Characteristics	Postpartum depression without depression before and/or during pregnancy, n=400 Adjusted OR (95% CI)	Postpartum depression with depression before and/or during pregnancy, n=936 Adjusted OR (95% CI)
Maternal age, years		
≤19	1.88 (0.95 to 3.75)	1.20 (0.89 to 1.62)
20–29	1.02 (0.59 to 1.75)	1
30–39	1.08 (0.63 to 1.83)	1.04 (0.90 to 1.20)
≥40	1	1.37 (1.01 to 1.88)
Nulliparous	1.41 (1.13 to 1.76)	1.33 (1.15 to 1.54)
Multiparous	1	1
Smoking status		
Non-smoking	1	1
Quit smoking during 1st trimester	1.34 (0.86 to 2.10)	2.12 (1.64 to 2.70)
Smoking after 1st trimester	1.43 (1.07 to 1.92)	2.62 (2.23 to 3.08)
Missing information	1.41 (0.81 to 2.46)	1.19 (0.78 to 1.83)
Married/living with a partner	1	1
Single	1.22 (0.87 to 1.72)	1.93 (1.61 to 2.31)
Socioeconomic status		
Upper white-collar worker	1	1
Lower white-collar worker	1.02 (0.67 to 1.54)	1.37 (0.97 to 1.92)
Blue-collar worker	0.95 (0.59 to 1.53)	1.63 (1.14 to 2.34)
Others*	1.31 (0.86 to 2.00)	2.01 (1.43 to 2.82)
Missing information	1.38 (0.90 to 2.13)	2.38 (1.68 to 3.35)
Mode of delivery		
Vaginal spontaneous	1	1
Breech	1.25 (0.41 to 3.92)	0.38 (0.09 to 1.51)
Forceps	NA	NA
Vacuum assistance	1.19 (0.82 to 1.71)	0.99 (0.78 to 1.28)
Caesarean section	1.38 (1.08 to 1.77)	1.10 (0.93 to 1.30)
Prior miscarriages	0.90 (0.69 to 1.16)	1.11 (0.94 to 1.30)
Prior terminations	1.41 (1.08 to 1.84)	1.42 (1.21 to 1.67)
In vitro fertilisation	1.40 (0.74 to 2.66)	0.07 (0.01 to 0.49)
Anaemia (≤6.2 mmol/l)	1.02 (0.48 to 2.16)	1.66 (1.13 to 2.44)
Pre-eclampsia	1.32 (0.68 to 2.56)	0.67 (0.33 to 1.35)
Gestational diabetes	1.24 (0.78 to 1.96)	1.62 (1.23 to 2.14)
Maternal diabetes mellitus	1.59 (0.97 to 2.59)	1.03 (0.75 to 1.40)
Fear of childbirth	2.71 (1.98 to 3.71)	4.95 (4.18 to 5.87)
Major congenital anomaly	1.67 (1.15 to 2.42)	1.38 (1.06 to 1.81)
Admission to neonatal intensive care unit	1.32 (0.97 to 1.78)	1.81 (1.51 to 2.18)
Stillbirth	1.70 (0.52 to 5.60)	3.69 (1.77 to 7.69)
Low-birthweight (<2500 g)	1.31 (0.80 to 2.16)	0.93 (0.63 to 1.36)
Preterm birth (≤37 weeks)	1.65 (1.08 to 2.56)	1.01 (0.72 to 1.41)
Male fetal sex	1.06 (0.87 to 1.29)	1.05 (0.92 to 1.19)

The reference group was women with no postpartum depression and no history of depression (n=472 183) in both analyses.
*'Others' comprise entrepreneurs, students, retired women, unemployed women, housewives and all unclassifiable cases.
NA, not applicable.

healthcare were not included. In addition, SES could not be determined for 17.4% of the women, which may be explained by the age of the parturient, since a large proportion were students or housewives, and therefore more likely to stay at home to take care of children compared with older women. Furthermore, due to concerns over confidentiality, a number of women did not provide that sensitive information.

The study showed that a history of depression before and/or during pregnancy was the most important risk factor for postpartum depression. A novel finding was that physician-diagnosed fear of childbirth was the strongest risk factor after a history of depression and increased the prevalence of postpartum depression by around threefold and fivefold among women without and with a history of depression, respectively. These results are consistent with a prior meta-analysis, which suggested that prenatal depression and maternal anxiety are risk factors for postpartum depression.[7] Interestingly, women with a history of depression and an IVF-achieved pregnancy experienced a substantially less postpartum depression. Other predisposing risk factors for postpartum depression among women with

a history of depression were smoking, single marital status and low or unspecified SES, again was in line with the meta-analysis of Beck *et al.*[7] This suggests that low self-esteem, lack of social support, single marital status and low SES could be used as predictors of postpartum depression. Furthermore, women with a history of depression and gestational diabetes experienced postpartum depression more frequently compared with women without depression, which was in line with several previous studies.[10] [11] [18] This observation suggests that the proinflammatory state related to gestational diabetes may facilitate the development of postpartum depression.[19] Correspondingly, pregnancies of women without a history of depression but with subsequent postpartum depression more frequently resulted in adverse perinatal outcomes, such as major congenital anomaly, preterm or caesarean birth, compared with women with no history of depression and no postpartum depression. Previous studies have also found an association among preterm birth, LBW, infant illness[9] and caesarean birth.[8]

Based on this large, 9-year population-based study, we concluded that the burden of major physician-diagnosed postpartum depression, as defined by ICD-10 codes, is most frequent among women with a history of depression, but one-third of all cases occur in low-risk women with no history of depression. The challenge is to recognise this low-risk group in a timely manner and to identify the factors placing these apparently low-risk women at high risk of developing postpartum depression. Adverse obstetric outcome has been known to lead to psychological distress, but a novel finding of the present study was that the physician-diagnosed fear of childbirth is also an important exposure and should be acknowledged by healthcare professionals.

The present study did not reveal whether giving birth was the ultimate trigger of depression in one-third of women with no history of the disease or whether affected women would have been free of depression for the rest of their lives if they had remained childless. Therefore, the long-term prognosis of postpartum depression recognised for the first time during pregnancy would be an interesting area of future research.

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