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Fear of childbirth and psychiatric disorders decrease the likelihood of subsequent births: a retrospective register-based cohort study

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Abstract

Background Mirroring other developed countries globally, the birth rate has decreased in Finland in recent years. The effects of a fear of childbirth (FOC) and psychiatric disorders on the likelihood of having more than one child remain relatively unstudied. This study aims to assess the influence of FOC, psychiatric disorders, and the mode of first delivery on the likelihood of the second birth among primiparous women.

Methods Data were collected from the Medical Birth Register, the Hospital Discharge Register, and Statistics Finland census data. We used the t-test to compare continuous variables and the chi-square test or test for relative proportions to compare categorical variables. We calculated the hazard ratios (HRs) and 95% confidence intervals (CIs) using the Cox regression analysis.

Results Altogether, 317 219 women delivering their first child in 2006–2016 met the inclusion criteria, 216 521 of whom (68.3%) had their second birth during that time. A total of 11 108 (3.5%) of women were diagnosed with FOC during their first pregnancy, 34 381 (10.8%) women were diagnosed with a psychiatric disorder before or during their first pregnancy and 10 331 (3.3%) women received a new diagnosis of a psychiatric condition following the first birth. Between 2006–2021, the second child was born to 47.5% of women with FOC (n = 5276), 56.8% of women with a psychiatric disorder before or during their first pregnancy (n = 19 540), 53.4% of women receiving a psychiatric diagnosis after their first delivery (n = 5514) and 70.2% of women without either of these diagnoses (n = 191 572). Women with FOC had a 22% lower likelihood of the second birth [aHR 0.78 (95% CI 0.76–0.80)] compared to women without FOC. A psychiatric disorder before or during the first pregnancy decreased the likelihood of the second birth by 28% [aHR 0.72 (95% CI 0.71–0.73)] and by 51% (aHR 0.49 (95% CI 0.48–0.50)] with a psychiatric disorder following a first birth compared with women without a diagnosed psychiatric disorder. Among all women, a caesarean section as the mode of a first delivery reduced the likelihood of the second birth.

Conclusion FOC and psychiatric disorders are associated with a low birthrate following the first delivery. Caesarean section as the mode of delivery decreases the likelihood of the second birth among women with FOC and psychiatric disorders.

Keywords Fear of childbirth, Psychiatric disorders, Mode of delivery, Birth rate

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Plain Language Summary

This register-based study among 317 219 women who had their first child in 2006–2016, aimed to determine if women with fear of childbirth during their first pregnancy or diagnosed with psychiatric disorder either before, during or following their first pregnancy have fewer subsequent births compared to women without such diagnoses. In total, 216 521 women (68.3%) had their second birth during 2006–2021. Moreover, 11 108 (3.5%) of women experienced fear of childbirth during their first pregnancy, 5276 (47.5%) of whom had the second birth. The likelihood of the second birth decreased by 22% compared with women without such fears. A psychiatric disorder was diagnosed in 34 381 (10.8%) women before their first birth, 19 540 (56.8%) of whom had a subsequent birth. A 28% reduction in the likelihood of the second birth was noted among these women compared with women without psychiatric diagnoses. A new psychiatric disorder was diagnosed following the first birth in 10 331 (3.3%) of women. Among them, 5514 (53.4%) had the second birth, resulting in a 51% lower likelihood of the second birth compared with women without a diagnosis. According to our findings, among women who had both fear of childbirth and psychiatric disorder during their first pregnancy, the likelihood of a subsequent birth was lowest (40.8%) compared with those without either of those diagnoses (70.2%). Women who delivered their first child via caesarean section had fewer second births regardless of their fear of childbirth or psychiatric disorders.

Introduction

Over time, the birth rates have decreased substantially in Finland [1]. Factors influencing the decision to have children have been investigated from many perspectives [2, 3]. The Population Research Institute in Finland published the Family Barometer (Perhebarometri) in 2022, in which 27% of mothers to one child indicated that a fear of childbirth (FOC) or their previous childbirth experience delayed their attempts to have another, still-desired child [3]. The influence of psychiatric disorders, however, has not emerged in these studies. According to the Family Barometer, in the 2020s, Finns on average hope to have two children. About half wish for two children, while almost a third hope for three or more children [3].

FOC is an increasing challenge [4], which may lead, if left unidentified and untreated during pregnancy and delivery to long-lasting effects on women's health [5, 6]. In Finland, 2.5% to 8% of primiparous women suffer from severe FOC [4, 7–9], with quite similar prevalences to other Nordic countries [10–12]. The diagnosis of FOC (diagnostic code O99.80 in the Finnish version of ICD-10) is assigned to those women receiving specialized treatment for FOC at maternity outpatient clinics.

According to register-based studies, the prevalence of severe mental disorders in the Finnish adult female population varies from 3.4% to 7.8% [13, 14]. However, according to a recent Finnish cohort study using several questionnaires, about 15% to 20% of people aged 20–39 years, sought healthcare services for problems related to their mental health in 2020 [15]. Furthermore, another Finnish study reported that 14.5% of women have used psychotropic medication before a pregnancy and 24.6% following a pregnancy [7]. Depression and anxiety represented the most common psychiatric disorders during pregnancy [7]. In previous studies from other countries, the prevalence of depression, anxiety, and mental disorders during pregnancy have varied from 9.3% to 24.2% [16–19]. FOC appears to associate with significant mental morbidity during pregnancy [6, 7, 9, 20] and seems to increase the likelihood of postpartum depression and post-traumatic stress disorder (PTSD) [21]. In only one previous study, FOC was more common among women with psychiatric diagnosis (11.4%) compared to those without psychiatric diagnosis (4.9%) [18].

The aim of this study was to determine whether FOC diagnosed during the first pregnancy or psychiatric disorders before and during first pregnancy or after first birth influence on the probability of having the second birth. An influence of both FOC and psychiatric disorders to the likelihood of the second birth was also studied. In addition, the role of the mode of delivery among the women with FOC or psychiatric disorders to the likelihood of having the second birth was assessed.

Materials and methods

The Finnish Medical Birth Register (MBR) was used in this retrospective register-based cohort study. MBR is maintained by the Finnish Institute for Health and Welfare, and it includes data on all live births and stillbirths at 22 gestational weeks or after, or a birth weight of 500 g or more, as well as demographic and socioeconomic data. We also collected data from the Hospital Discharge Register (HDR) which includes information on diagnoses of inpatient care and outpatient visits in secondary or tertiary level Finnish hospitals. The quality of the registers has been ensured previously [22, 23].

All women (n = 317 945) giving birth to their first child during 2006–2016 were collected from the MBR. Multiple births (3.0%), deliveries ending in perinatal death (0.5%), and women with an incomplete personal identity

code (0.3%) were excluded from further analysis. Ultimately, we included a total of 317 219 primiparous women aged 13–56 years in this study (Fig. 1). The second births of these women during the years 2006–2021 were collected from the MBR. Exposure data were collected from the HDR and the MBR (diagnosis of FOC, ICD-10 code O99.80; psychiatric diagnoses, ICD-10 codes F00–F99). Data from possible dependent variables were collected from the MBR (maternal age, marital status, use of artificial reproductive technologies (ARTs), mode of delivery, pain relief methods used, delivery complications, and infant outcome), and from Statistics Finland census data (maternal education and migrant origin).

Statistical analyses

We compared continuous variables using the t-test, and categorical variables using the chi-square test or the test for relative proportions. We considered $p < 0.05$ as statistically significant.

Cox regression analysis was used to calculate the hazard ratios (HRs) and 95% confidence intervals (CIs). Follow-up began with the first birth and ended with the second birth or on 31 December 2021. In model 1 HRs were adjusted for maternal age, marital status [married, registered relationship, cohabiting (yes or no)], highest maternal education (low, medium, or high), migrant status (yes or no), ART [yes, including in vitro fertilization (IVF), intracytoplasmic sperm injection (ICSI), frozen embryo transfer (FET), or none], mode of delivery in the first birth [spontaneous, instrumental birth, planned caesarean section (CS), or emergency CS], and diagnoses related to mental, behavioral, or a neurodevelopmental disorder (ICD-10 codes F00–F99) one year before or during the first pregnancy and within five years after the first birth.

When analyzing the likelihood of the second birth, we calculated adjusted HRs with 95% CIs using four additional models:

Model 2: model 1 + pain relief methods used during the first birth [invasive (including epidural, spinal, a combination) or noninvasive techniques]; women with planned CS not included in model 2.
Model 3: model 1 + complications during the first birth (including manual placenta removal, uterine curettage, third- or fourth degree perineal tear, or blood transfusion).
Model 4: model 1 + newborn care in neonatal intensive care unit (NICU) following the first birth.
Model 5: including all variables in models 1, 3, and 4.

We calculated the adjusted HRs with 95% CIs separately for the mode of delivery, for women with FOC, women with a psychiatric disorder one year before or during the first pregnancy, and women with such a diagnosis within five years following the first birth.

We also completed three sensitivity analyses. First, we restricted the analyses to a five-year follow-up period. Second, we restricted our analysis to primigravida women based on self-reported information on previous miscarriages, ectopic pregnancies, and induced abortions

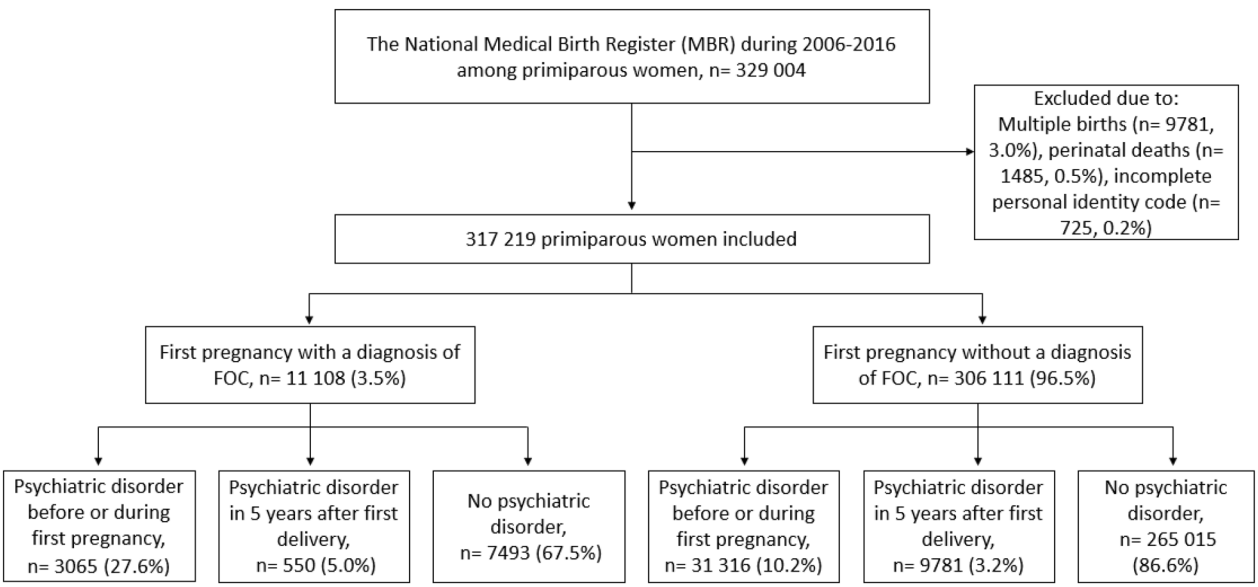

Fig. 1 Flowchart of women included in the study

(n = 244,904). Third, we excluded 47,424 first births with perinatal problems: premature birth before 37 weeks gestational age, a low birthweight under 2500 g, or any congenital anomaly recorded in the MBR during the first week of life.

All statistical analyses were performed using SAS version 9.4.

Results

From the 317,219 primiparous women included in our study, 11 108 (3.5%) were diagnosed with FOC during their first pregnancy, 34 381 (10.8%) were diagnosed with a psychiatric disorder before or during their first pregnancy, and 10 331 (3.3%) women received a new psychiatric diagnosis within five years following the first birth. Altogether, 272 762 (86.0%) women had neither FOC nor psychiatric diagnoses during their first pregnancy. From the women diagnosed with psychiatric disorder before or during the first pregnancy, 3065 (8.9%) received a FOC diagnosis during their first pregnancy. Among women with FOC, 27.6% had psychiatric diagnosis before or during the first pregnancy. Women with FOC experienced a greater proportion of planned CS (31.6% vs. 4.4%, p < 0.001) and emergency CS (18.8% vs. 14.8%, p < 0.001) compared with women with no FOC. In addition, women with psychiatric disorder before or during their first pregnancy experienced more planned CS (6.7% vs. 5.2%, p < 0.001) and emergency CS (15.2% vs. 14.9%, p < 0.001). Table 1 summarizes the background, obstetric, and neonatal characteristics of the women included to the study.

During the study period, a total of 216 521 women (68.3%) experienced the second birth. However, women with FOC in their first pregnancy, experienced fewer second births compared to women with no FOC (47.5% vs. 69.0%, p < 0.001): the background-adjusted HRs were similar for model 1 and model 5 [aHR 0.78 (95% CI 0.76–0.80)] (Tables 2 and 3). Adding pain relief methods to the model [model 2: aHR 0.82 (95%

Table 1 Background, obstetric and neonatal variables among women who had their first child between 2006 and 2016

	Diagnosed with a fear of childbirth		No diagnosis of fear of a childbirth		p value
	n = 11,108		n = 306,111		
Age (mean, standard deviation, 1–99% percentiles)	30.0, ± 5.9, 18–43		28.5, ± 5.2, 18–41		
	n	%	*n*	%	
Artificial reproductive technologies	892	8.0	17,408	5.7	< 0.001
Psychiatric disorder before or during first pregnancy[a]	3065	27.6	31,316	10.2	< 0.001
Psychiatric disorder five years following first delivery[a]	550	5.0	9781	3.2	< 0.001
Medium level of education	4507	40.6	128,046	41.8	0.008
High level of education	4747	42.7	134,133	43.8	0.024
Married or cohabiting	9207	81.3	26,465	86.1	< 0.001
Migrant origin	973	8.8	29,621	9.7	0.001
Premature birth before gestational age 37 weeks + 0	643	5.8	18,251	6.0	0.448
Birthweight < 2500 g	301	2.7	12,204	4.0	< 0.001
Congenital anomalies diagnosed at birth	773	7.0	17,980	5.9	< 0.001
Spontaneous vaginal delivery[c]	4179	37.6	197,541	64.5	< 0.001
Assisted vaginal delivery[c]	1331	12.0	49,681	16.2	< 0.001
Planned caesarean section[c]	3509	31.6	13,488	4.4	< 0.001
Emergency caesarean section[c]	2089	18.8	45,390	14.8	< 0.001
Spinal, epidural, or combined anaesthesia[b]	4787	86.9	189,109	76.5	< 0.001
Other analgesia[b]	4813	87.4	207,084	83.8	< 0.001
Manual placenta removal[b]	143	2.6	5179	2.5	0.001
Third -or fourth degree perineal tear[b]	116	2.1	4950	2.3	< 0.001
Uterine curettage	51	0.5	2373	0.8	< 0.001
Blood transfusion	411	3.7	9882	3.2	0.006
Infant treated in neonatal intensive care unit	1342	12.1	40,078	13.1	0.002
Apgar score at 5 min < 7	311	2.8	8686	2.8	0.814
Umbilical artery pH < 7.05	101	0.9	4795	1.6	< 0.001

[a] ICD10 codes F00-F99

[b] Among vaginal deliveries

[c] Mode of delivery missing for 11 deliveries

Table 2 Second births and diagnosis of a fear of childbirth or psychiatric disorders

	Second birth		p value
	n	%	
Diagnosis of FOC[a]	5 726	47.5	< 0.001
No diagnosis of FOC[a]	211 245	69.0	
F-dg[b] before or during first pregnancy	19 540	56.8	< 0.001
No F-dg[b] before or during first pregnancy	196 980	69.9	
F-dg[b] following first delivery	5 514	53.4	< 0.001
No F-dg[b] following first delivery	211 007	68.8	
Both F-dg[b] before or during first pregnancy and FOC[a]	1 252	40.8	< 0.001
Diagnosis of FOC[a] with no F-dg before or during first pregnancy[b]	4 024	50.0	
Both F-dg[b] following delivery and FOC[a]	241	43.8	0.076
Diagnosis of FOC[a] with no F-dg after first delivery[b]	5 035	47.7	
Neither diagnosis of FOC[a] nor F-dg[b]	191 572	70.2	

[a] Diagnosed with a fear of childbirth during the first pregnancy (ICD-10 code O99.80)

[b] Diagnosed with a psychiatric disorder (ICD-10 codes F00-F99)

Table 3 The likelihood for the second birth models 1 and 5

	HR (95% CI)	p value
Model 1		
Maternal age	0.95 (0.94–0.95)	< 0.001
Marital status	1.46 (1.44–1.48)	< 0.001
Secondary education	0.61 (0.61–0.65)	< 0.001
Tertiary education	0.88 (0.85–0.91)	< 0.001
Migrant origin	0.80 (0.79–0.81)	< 0.001
Infertility treatment	0.94 (0.92–0.96)	< 0.001
Instrumental delivery	0.98 (0.97–0.99)	0.001
Planned caesarean section	0.85 (0.83–0.86)	< 0.001
Emergency caesarean section	0.84 (0.83–0.85)	< 0.001
F-dg[a] before or during first pregnancy	0.72 (0.71–0.73)	< 0.001
F-dg[a] following pregnancy	0.49 (0.48–0.50)	< 0.001
Fear of childbirth	0.78 (0.76–0.80)	< 0.001
Model 5		
Maternal age	0.95 (0.94–0.95)	< 0.001
Marital status	1.46 (1.44–1.48)	< 0.001
Secondary education	0.63 (0.61–0.65)	< 0.001
Tertiary education	0.88 (0.85–0.91)	< 0.001
Migrant origin	0.80 (0.78–0.81)	< 0.001
Infertility treatment	0.94 (0.92–0.96)	< 0.001
Instrumental delivery	0.99 (0.98–1.00)	0.046
Planned caesarean section	0.85 (0.83–0.86)	< 0.001
Emergency caesarean section	0.85 (0.84–0.87)	< 0.001
F-dg[a] before or during first pregnancy	0.72 (0.71–0.73)	< 0.001
F-dg[a] following pregnancy	0.49 (0.48–0.50)	< 0.001
Complications during first birth	0.93 (0.92–0.95)	< 0.001
Infant treated in neonatal intensive care unit	0.92 (0.91–0.93)	< 0.001
Fear of childbirth	0.78 (0.76–0.80)	< 0.001

[a] Diagnosis of a psychiatric disorder (ICD-10 code F00–F99)

CI 0.79–0.84)], complications in the first birth [model 3: aHR 0.78 (95% CI 0.76–0.80)] or child's treatment in NICU in perinatal period [model 4: aHR 0.78 (95% CI 0.76–0.80)] did not change the results (Table 3).

In addition, women diagnosed with psychiatric disorder before or during their first pregnancy experienced fewer second births compared to those with no diagnosis (56.8% vs. 69.9%, $p < 0.001$): background-adjusted HRs were similar for model 1 and for model 5 [aHR 0.72 (95% CI 0.71–0.73)]. Accordingly, women who received a psychiatric diagnosis following a first birth, experienced fewer births compared with women receiving no diagnosis (53.4% vs. 68.8%, $p < 0.001$): background-adjusted HRs were similar for model 1 and for model 5 [aHR 0.49 (95% CI 0.48–0.50); Tables 2 and 3]. Out of women with neither FOC nor psychiatric disorders 191,572 (70.2%) experienced the second birth.

Different groups of women diagnosed with FOC during their first pregnancy were examined further. Women diagnosed with both psychiatric disorder before or during their first pregnancy and FOC experienced fewer second births compared to those only diagnosed with FOC (40.8% vs. 50.0%, $p < 0.001$; Table 2). Women with FOC during their first pregnancy and diagnosed with psychiatric disorder following their first birth tended to have fewer second births than women with only FOC (43.8% vs. 47.7%), although this finding did not reach statistical significance (Table 2).

The likelihood of the second birth among women with FOC was higher if they had a spontaneous (52.9%, reference) or instrumental vaginal birth during their first pregnancy [51.6%; aHR 1.09 (95% CI 0.997–1.19)] compared with women with a planned CS [42.3%; aHR

0.73 (95% CI 0.68–0.78)] or an emergency CS (42.9%; aHR 0.79 (95% CI 0.73–0.85); Table 4].

The mode of delivery also influenced the likelihood of the second birth in the group of women with a psychiatric condition before or during their first pregnancy. The likelihood of the second birth was higher following a spontaneous (60.1%, reference) or instrumental vaginal birth [55.5%; aHR 0.99 (95% CI 0.95–1.03)] compared with a planned CS [44.9%; aHR 0.73 (95% CI 0.68–0.77)) or an emergency CS [49.9%; aHR 0.85 (95% CI 0.82–0.89; Table 4)].

In the group of women diagnosed with a psychiatric disorder for the first time following their first pregnancy, we observed similar results. Following a spontaneous (55.8%, reference) or instrumental vaginal delivery [52.7%; aHR 1.08 (95% CI 0.996–1.16)] the likelihood of the second birth was higher compared with a planned CS [46.6%, aHR 0.91 (95% CI 0.81–1.03)] or an emergency CS [48%, aHR 0.93 (95% CI 0.87–1.01); Table 4].

The mode of delivery did not explain the difference in the likelihood of the second birth between women with and without FOC. Women with FOC experienced less second births despite the mode of delivery (Table 4). The same result was found among women diagnosed with psychiatric disorders both before or during the first pregnancy and following the first delivery.

Naturally, older women have fewer pregnancies than younger women. Similarly, the absence of a partner decreases the likelihood of pregnancy (Table 3). The results were similar for women with FOC and for those diagnosed with psychiatric disorders, when we restricted analyses to primigravida [aHR 0.77 (95% CI 0.75–0.79), model 5] and after excluding cases with perinatal problems [prematurity, low birthweight or any congenital anomalies diagnosed at birth: aHR 0.77 (95% CI 0.75–0.80. model 5)]. Furthermore, limiting the follow-up to five years did not change the results (data not shown).

Table 4 Second births among women with FOC or psychiatric disorders according to the mode of the first delivery

Mode of delivery[a]	**Diagnosis of FOC**[1]			**No diagnosis of FOC**[1]			**p value**[b]
	No second birth	**Second birth**		**No second birth**	**Second birth**		
	n	**n**	**%**	**n**	**N**	**%**	
Spontaneous vaginal delivery	1970	2209	52.9	56,164	141,377	71.5	< 0.001
Assisted vaginal delivery	644	687	51.7	16,095	33,586	67.6	< 0.001
Planned caesarean section	2026	1483	42.3	5019	8469	62.8	< 0.001
Emergency caesarean section	1192	897	42.9	17,585	27,805	61.3	< 0.001
Mode of delivery[a]	**Psychiatric disorder**[2]			**No psychiatric disorder**[2]			
	No second birth	**Second birth**		**No second birth**	**Second birth**		
	n	**n**	**%**	**n**	**n**	**%**	
Spontaneous vaginal delivery	8725	13,131	60.1	49,409	130,455	72.5	< 0.001
Assisted vaginal delivery	2208	2752	55.5	14,532	31,520	68.4	< 0.001
Planned caesarean section	1280	1041	44.9	5765	8911	60.7	< 0.001
Emergency caesarean section	2628	2615	49.9	16,149	26,087	61.8	< 0.001
Mode of delivery[a]	**Psychiatric disorder**[3]			**No psychiatric disorder**[3]			
	No second birth	**Second birth**		**No second birth**	**Second birth**		
	N	**n**	**%**	**n**	**n**	**%**	
Spontaneous vaginal delivery	2767	3492	55.8	55,367	140,094	71.7	< 0.001
Assisted vaginal delivery	764	849	52.6	15,976	33,423	67.7	< 0.001
Planned caesarean section	342	298	46.6	6703	9654	59.0	< 0.001
Emergency caesarean section	949	875	48.0	17,828	27,827	61.0	< 0.001

[1] Diagnosed with a fear of childbirth (ICD-10 code O99.80)

[2] Diagnosed with a psychiatric disorder before or during first pregnancy (ICD-10 codes F00-F99)

[3] Diagnoses with a psychiatric disorder following the first delivery (ICD-10 code F00-F99)

[a] Mode of delivery missing for 11 deliveries

[b] The p value for the difference in the likelihood of the second birth

Discussion

Fear of childbirth was determined to represent an important factor influencing the probability of women to having more than one child. Our novel finding was that psychiatric disorders appear to decrease the probability of having the second birth as well. Furthermore, having psychiatric condition together with FOC seemed to decrease the likelihood of the second birth even more irrespective whether the psychiatric diagnosis made before or during the first pregnancy or within five years following the first birth. Following CS, women with FOC or psychiatric disorder had fewer second births compared with those who delivered their first child vaginally.

In Finland, all pregnant women are screened for their fears towards childbirth during antenatal visits in primary health care. If guidance, antenatal classes, and support are not sufficiently helpful or if a woman requests CS, they are referred to a maternity outpatient clinic for further evaluation, support, and treatment. In this study, all women with FOC had been referred to secondary level healthcare. Thus, we can assume that these women experienced more severe FOC than those treated in primary care settings. We used two different registries, unlike the previous similar study, and thus our dataset is broader and includes more explanatory variables [24]. However, the results considering FOC are similar. In one small Swedish study, most women with FOC had two children [25], however, they gave birth more than two times less frequently than women with no FOC. In our study, most of the women with FOC gave birth only once. In another Swedish study of 541 women, neither FOC nor postpartum depression associated with subsequent reproduction [26]. This result differs from our study, likely due to the different methods to define or treat FOC and postpartum depression. To our knowledge, the association between FOC and subsequent live births has not been examined in other countries.

Similar to our study, one population-based cohort study from Denmark also reported that women with postpartum psychiatric disorders (defined within six months postpartum) experienced fewer second births compared to women with no psychiatric disorders [27]. To our knowledge, our study is the first to investigate the probability of the second birth among women with psychiatric disorders before or during their first pregnancy. Further, women with FOC experienced more psychiatric disorders than women without FOC, and women with psychiatric disorders more often experienced FOC compared with women without psychiatric disorders. Women with both FOC and psychiatric disorders had the fewest second births. To our knowledge, there is no previous study regarding this association.

FOC has been associated with a higher risk of both elective and emergency CS and other interventions during birth [6, 28, 29]. Psychiatric disorders have also been associated with CS as a mode of delivery [17–19, 30]. In our study, women with FOC experienced significantly more CS than women without FOC, consistently with previous studies [4, 6, 12, 29]. Women with psychiatric disorders before or during their first pregnancy also experienced more CS compared to those women without psychiatric disorders. In our study, the mode of delivery associated with the likelihood of the second birth in women with FOC as well as among women diagnosed with psychiatric disorders; women who delivered vaginally experienced more second births compared with women who underwent CS. This trend was also observed among women without FOC or psychiatric disorders. Previous studies reported that women delivering via CS are less likely to have a subsequent birth compared with women who deliver vaginally [31–33]. Our study supports that finding. FOC as an indication for CS has not been studied separately. However, out study demonstrates that CS as a mode of delivery also among women with FOC or a psychiatric disorder predicts fewer subsequent births.

One may speculate that psychiatric disorders, FOC, mode of delivery, and the childbirth experience are deeply intertwined, cumulatively impacting the same women. A previous Finnish study showed that effective treatment for FOC decreases the number of CS [28] and might also have a positive impact on the childbirth experience [34]. Knowledge is limited about the influence of FOC treatment designed specifically for women with both FOC and psychiatric disorders. One previous study from the Netherlands suggested that women with psychiatric disorders experience a higher number of unintended pregnancies compared to women with no psychiatric disorders [35]. FOC is also associated with unintended pregnancies [6]. According to our study, women with FOC became pregnant more often via ART compared with women with no FOC, as was previously reported in another Finnish study [36]. That might influence the likelihood of the second birth. Women in the FOC group were also older, which naturally impacts the likelihood of a subsequent birth. Furthermore, in our study, women with FOC were more often single. The associations between psychiatric disorders or FOC and low social support or not having a partner were previously reported [6, 37–39]. Women with psychiatric diagnoses or FOC might also experience challenges in mother–infant bonding and with motherhood [40–44]. This might also influence on decisions among women regarding whether to have more than one child.

The strength of our study is the use of a large and reliable nationwide dataset from the MBR. In addition, using

census data from Statistics Finland and the HDR allowed us to gather even more data. We formed multiple models to take into consideration many possible confounding factors influencing the probability of the second birth and included a long follow-up time.

Our study also has several limitations. The information in the registers is provided by healthcare professionals, whereby some information might be missing. It is possible that some women suffering from FOC were not identified and did not receive a diagnosis. In our research, we used both the MBR and HDR to collect psychiatric disorder diagnoses, which permit us to identify women who have received treatment from secondary level healthcare professionals. In the Finnish healthcare system, most minor psychiatric disorders are treated in primary healthcare settings by general practitioners, via occupational healthcare, or via student healthcare services. Therefore, we can assume that women with psychiatric disorders in our study experience more severe mental health problems, and that women with minor psychiatric disorders are missing from our dataset. In our study, all psychiatric disorders were examined as one group. If the diagnoses were studied individually, the results might differ slightly. In addition, we only had information about second pregnancies ending in deliveries since the registers do not include data on miscarriages or induced abortions. Women with FOC or psychiatric disorders might undergo an induced abortion in their subsequent pregnancy more often than other women. In this study, we had no data on the childbirth experience. Previously, FOC was found to serve as an independent risk factor for a negative childbirth experience [29, 45]. According to our knowledge, there are no studies about the association between psychiatric disorders and the childbirth experience. Emergency CS and instrumental vaginal delivery are known to negatively impact the childbirth experience [46]. A negative childbirth experience might influence family planning since it can result in more severe FOC or even PTSD, and may decrease the desire for another child [47, 48]. Within the limits of our dataset, it was impossible to further study women with a migrant origin since the time of immigrating to Finland or possibly emigrating and having second deliveries in other countries remained unknown. Our study suggests that women with a migrant origin experience FOC less compared with Finnish women, but also experience fewer second births. It may be that FOC among immigrant women remains undiagnosed.

Whether good quality treatment for FOC as well as for psychiatric disorders impact the family planning of women and families remains unclear, all of which warrant further study. According to our research, women with diagnoses of FOC and psychiatric disorders experience significantly fewer subsequent births than women without those diagnoses. Unfortunately, we are not aware of the type of treatment the women had received. Appropriate combined multidisciplinary treatment for FOC, a negative childbirth experience, and psychiatric disorders both during pregnancy and postpartum require further development. It is also important to possess knowledge regarding those women who do not yet have children: Is there a degree of FOC among those women preventing them from becoming pregnant at all? In our current system, the treatment of FOC is directed only at those women who are already pregnant. It would be important to study the group of immigrants more in detail, if FOC and psychiatric disorders are recognized and treated sufficiently among them. Factors influencing on the childbirth experience should be further studied especially among women with psychiatric disorders.

Conclusions

Women suffering from FOC or psychiatric disorders have fewer second births compared with women with no such fears or disorders. The likelihood of the second birth was smallest in the group of women who experienced both FOC and a psychiatric disorder. It is essential that women with FOC are identified and offered effective treatment both during pregnancy and delivery in order to achieve a positive childbirth experience and further to increase the birth rate. Recognition and treatment of psychiatric disorders during the antenatal and perinatal periods are also necessary along with the availability of various services targeted to families with children. A multidisciplinary approach taking into account both FOC and mental health would be the most recommended.

Abbreviations

ART	Artificial reproductive technologies
CS	Caesarean section
FET	Frozen embryo transfer
FOC	Fear of childbirth
HDR	Hospital Discharge Register
ICSI	Intracytoplasmic sperm injection
IVF	In vitro fertilization
MBR	Medical Birth Register
NICU	Neonatal intensive care unit
PTSD	Post-traumatic stress disorder

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Author contributions

E.S, T.S., T.M., K.S-A., M.G and L.L have participated in the preparation of this manuscript. All authors were responsible for the design of the study. MG collected the data from registers and completed the statistical analyses with E.S. ES drafted the manuscript. All authors critically revised the manuscript and have approved the submitted version. All authors have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Data availability
The data are not publicly available due to confidentiality and data protection regulations, and the authors do not have permission to share the data. Similar data can be requested from Findata, the Finnish Social and Health Data Permit Authority (https://findata.fi/en/) and Statistics Finland (https://www.stat.fi/meta/tietosuoja/kayttolupa_en.html).

Declarations

Ethics approval and consent to participate
The study data were extracted from the Invest Full Population Data study (https://invest.utu.fi/fi/investkokonaisdata/information-about-the-research/), which was approved by the ethical working group at the Finnish Institute for Health and Welfare (THL). The register data used in this study were collected by the University of Turku and THL. THL and Statistics Finland granted their permissions to use their register data in the Invest research project. All data are pseudonymized and processed in a secure remote access environment maintained by Statistics Finland. The data are accessible only to researchers who have been granted a research permit.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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