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Antecedents of maternal pregnancy-related anxiety trajectories: The FinnBrain birth cohort study

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Abstract

Objective: Little is known about the normative courses of pregnancy-related anxiety throughout pregnancy and their antecedents. We examined in a large scale pregnancy cohort which potentially distinct trajectories of pregnancy-related anxiety across pregnancy can be identified, and which factors predict these trajectories.

Methods: A general sample of pregnant women ($n = 2928$) from the FinnBrain Birth Cohort participated in this study. Several questionnaires were filled in at 14, 24, and 34 weeks of gestation, including the pregnancy-related anxiety questionnaire-revised as main outcome. Latent Growth Mixture Modeling was applied to identify the trajectories of pregnancy-related anxiety across pregnancy, and t-tests and chi-quare tests were conducted to find antecedents of these trajectories.

Results: Two distinct trajectories were identified: (1) a low symptoms group, $N = 2594$ (88.6%), with lower and slightly increasing levels of pregnancy-related anxiety (2) a moderately-high symptoms group, $N = 334$ (11.4%) reported higher and slightly decreasing levels of anxiety. Correlates of the moderately-high anxious group included a lower monthly income, drinking alcohol or smoking in early pregnancy, more daily hassles and less joy, more early life adversities, younger age, primiparity, single parenthood, using depression medication, and having higher scores on depression and general anxiety.

Conclusions: Although the majority of pregnant women fall within a low risk trajectory of pregnancy-related anxiety, another group with consistently higher

levels of pregnancy anxiety throughout pregnancy may need more clinical attention, as their high pregnancy-related anxiety scores may indicate a risk profile that includes a variety of general and more pregnancy-specific risk factors, which together can negatively affect fetal and infant development and behavior.

KEYWORDS

early adversities, general risk factors, latent growth trajories, pregnancy-related anxiety

1 | INTRODUCTION

During pregnancy, it is relatively common for women to experience feelings of anxiety. As an example, a systematic review and meta-analysis among pregnant women reported prevalence rates for self-reported (general) anxiety ranging from 18.2% in the first trimester to 19.1% in the second and 24.6% in the third trimester.[1] For women who are pregnant for the first time, these feelings of anxiety may be associated with the changes they experience when they go through this major life transition that needs adaption: new responsibilities as a parent, new daily routines, combining work with family life, and changes in the partner relationship.[2,3] Even when the current pregnancy is not the first one, new adaptations in the (family) life can be expected. Moreover, if the previous pregnancy or childbirth process was experienced as less positive, the new pregnancy may again lead to symptoms of anxiety or depression.[4]

To assess these symptoms of anxiety or depression in pregnancy, general measures have been used in most studies. Particularly instruments assessing symptoms of general anxiety in this period may not adequately identify feelings of anxiety that are unique during pregnancy.[5] During pregnancy, other more specific concerns and worries may arise, often referred to as pregnancy-related anxiety, including worries about the health of one's (unborn) baby, fears about the upcoming delivery and the pain and loss of control it may cause, and worries about the body changes women experience in pregnancy.[5,6] Pregnancy-related anxiety has shown to have high predictive validity for birth and child outcomes.[7–9]

Thus far, little is known about the (normative) course of pregnancy-related anxiety throughout pregnancy and its antecedents. Several studies did examine general anxiety trajectories from pregnancy into the postpartum period and their antenatal predictors,[10–12] often reporting a low and stable pattern of anxiety from pregnancy into the postpartum period, with a smaller group showing a moderately high level of anxiety, with some decline over time. Another study focused on prenatal general anxiety trajectories as predictors of infant outcomes, showing that an increasing maternal prenatal anxiety trajectory was related to lower infant development scores.[13] However, as our study focused only on the pregnancy period, it is useful to report the few studies that examined trajectories of general anxiety limited to this period in more detail. One study examined trajectories of anxiety across three time points in pregnancy, starting at 14 weeks of gestation,[14] in the FinnBrain study ($n = 3202$). Four different trajectories of general anxiety symptoms among pregnant women were identified, including a consistently low level of anxiety throughout pregnancy, which fitted with most women, and a consistently high level of symptoms of anxiety, to which only a very small group of women belonged (1%). The two other trajectories could be described as high and decreasing levels of symptoms, and moderate and increasing levels of symptoms, respectively, each fitting best with 7% of the participants. Korja et al.[14] also examined several sociodemographic factors in relation to these distinct trajectories and found that mothers with consistently high symptom levels were more often multiparous and using

Significant outcomes

- Two distinct trajectories of pregnancy-related anxiety across pregnancy could be found, with the majority of women fitting with a low level of anxiety and 11.4% fitting with a moderately high level.
- General risk factors for mental health disorders, such as lower income, substance use, and early life adversities also predicted the moderately high trajectory of pregnancy-related anxiety, as did a younger age, primiparity and single parenthood.

Limitations

- Our study included a general population of pregnant women in Finland, mostly highly educated and from urban environments, which may hamper generalizabitiy to more at-risk women.

SSRIs during pregnancy. In contrast, the consistently low symptoms group consisted of higher educated mothers of older age, who did not smoke and lived with the father of their child. A smaller group ($n = 188$) was examined in an Australian sample, using anxiety measures taken at each trimester of pregnancy and showing a high-anxiety trajectory for 13.3% of women, and low-anxiety trajectory for the remaining large majority in their study.[15]

Thus far, only one study has actually examined pregnancy-related anxiety trajectories in a longitudinal set-up. In a sample of 180 well-educated pregnant women, of whom 54.2% were nulliparous, Mudra et al.[16] used the Pregnancy-Related Anxiety Questionnaire-Revised-2 (PRAQ-R2[17]) in each trimester to measure pregnancy-related anxiety, which were fitted in growth curve trajectories. Mudra et al.[16] found two distinct trajectories for the total PRAQ-R2 scale and for the subscales as well, that consisted of items measuring *Fear of Giving Birth*, *Worries about bearing a physically and mentally handicapped child*, and *Concern about own appearance*. Overall, about two-thirds of participants had a lower anxiety score at baseline, whereas the remaining one-third starting at a higher level of pregnancy-related anxiety. The slope was often not significant for these classes, implying that the level of pregnancy-related anxiety in both classes remained stable over time. Only for *Fear of Giving Birth*, the slope increased for both groups, which is not surprising, given the fact that when delivery is approaching, these worries become more salient. In contrast, the subscale *Worries about bearing a physically or mentally handicapped child*, the group that started with low levels of anxiety, showed a slightly declining trajectory over time, which may be due to confirmation of the health status of the growing fetus by ultrasounds and by feeling fetal movements.

More insight into trajectories of pregnancy-related anxiety and their antecedents is needed. The first aim of this study is therefore to examine, in a large general population pregnancy cohort, whether and what kind of potentially distinct trajectories of pregnancy-related anxiety across pregnancy can be identified.

Moreover, understanding which factors correlate with high levels of pregnancy-related anxiety and particularly, stable patterns of moderate-high pregnancy-related anxiety across gestation may inform involved health care professionals and lead to targeted prevention.

Both a previous review of Guardino and Dunkel Schetter[18] and empirical work of Dunkel Schetter et al.[19] reported a range of risk factors associated with high levels of pregnancy related anxiety at 24–26 weeks of gestation, including unintended pregnancy, first birth, high medical risk (e.g., high BMI, smoking or alcohol use), low perceived control and low self-esteem, and different forms of stress. Less is known about which factors are associated with pregnancy-related anxiety trajectories. Based on Mudra's study (2020) and other previous research focusing on general anxiety trajectories across pregnancy, one can expect that several socio-demographic factors may also predict pregnancy-related anxiety trajectories. We expect that stable low trajectories of pregnancy-related anxiety, may be related to: higher age of the mother, higher level of income (higher SES), no smoking or drinking during pregnancy, and living together with the father of the child as has been found in a previous study on general anxiety as well.[14] As correlates of moderate to high stable trajectories of pregnancy-related anxiety, primiparity, previous (general) anxiety or depression[10,20] and medication use for these symptoms (i.e., selective serotonin reuptake inhibitors (SSRI)) may be relevant.[14] Several indicators of general well-being, in addition to more disease-related indicators, will be studied as antecedents as well. These factors include quality of life and relationship satisfaction. Finally, early life adversities, including physical, sexual or emotional abuse or neglect, may be associated with moderate to high stable trajectories of pregnancy-related anxiety as well.[21,22] The second aim of this study was to examine the above-mentioned factors as correlates of subgroup membership, with a focus on antecedents of moderate to high trajectories of pregnancy-related anxiety.

2 | METHODS

2.1 | Sample

The sample was drawn from the longitudinal FinnBrain Birth Cohort Study, Finland (www.finnbrain.fi). The recruitment took place at maternal welfare clinics between December 2011 and April 2015 in the South-Western Hospital District and the Åland Islands in Finland. The recruitment was performed in the three maternity welfare clinics of a defined geographical area which performed pregnancy ultrasound scans for the women eventually referred to give birth at Turku University Hospital in the Southwest Finland Hospital District and the Aland Islands in Finland. These clinics are tax-funded and free for the user and follow national guidelines for the follow-up of pregnancy, thus all women had access to prenatal health care. Written informed consent was obtained from all study subjects at the time of recruitment. The study population ($N = 3808$ families) comprises of women that attended the free-of charge ultrasound at the gestational week 12, their children-to-be-born and fathers of the children/partners of the mothers. Verified pregnancy and sufficient knowledge of either Finnish or Swedish (the official languages in Finland) were required for participation, and literacy level was 100%. Of those informed about the study

($N = 5790$), a total of $N = 3808$ mothers and $N = 2623$ fathers or other partners of the mothers decided to participate. Out of these, $N = 3235$ pregnant mothers filled out at least one questionnaire during pregnancy. For more details on the full cohort sample see Karlsson et al.[23] and Korja et al.,[14] reporting that the study population largely resembles the source population, with the possible exceptions of lower prevalence of younger, multiparous, and smoking women in the current study cohort.

In this study, we used data from mothers that had filled out the Pregnancy-related Anxiety questionnaire (PRAQ-R2; see below) at least once during pregnancy, resulting in $N = 2928$.

2.2 | Questionnaires

Participants filled out questionnaires during pregnancy at gestational week 14, 24, and 34. *Pregnancy-Related Anxiety Questionnaire-Revised-2 (PRAQ-R2)*, a 10-items self-reported questionnaire, was used to assess anxiety specifically related to pregnancy and the well-being of the child. It is validated for both nulliparous and multiparous women.[17] Scores on each item range from 1 (definitely not true) to 5 (definitely true), and the range of the total sum score is 10–50. For the current study, only the sum score was used. Cronbach Alphas ranged between 0.83 and 0.85.

Depressive symptoms were assessed using the 10-items self-reported Edinburgh Postnatal Depression Scale,[24] on a 4-point Likert scale. The total scores range between 0 and 30. The internal consistency of the scale was good at each time point (Alphas 0.82–0.84).

General anxiety symptoms were screened using the anxiety scale of the Symptom Checklist 90 (SCL-90[25]). The anxiety subscale consists of 10 items rated from 1 to 5, and after recoding the range of the total sum score is 0–40. Alphas ranged between 0.83 and 0.85.

Quality of Life was assessed only at gestational week 14 and 24 with an 8-item questionnaire (WHO) on satisfaction of different aspects of everyday life. A 5-point Likert scale from 0 (not at all) to 5 (very good, very satisfying) was used, yielding a total sum score ranging from 15 to 40. Alphas ranged between 0.79 and 0.81. *Relationship satisfaction was assessed* only at gestational week 34 with the Revised Dyadic Adjustment Scale (RDAS[26]). With a 14-item self-report Consensus (6 items), Satisfaction (4 items), and Cohesion (3 items) within the partner relationship are assessed, using a 6-point Likert scale, (except for one 5-point scale question). Factor scores and total sum can be used. Higher scores refer to lower satisfaction on different domains of relationship. The scored ranged between 4 and 36 for each subdomain, and 15 and 78 for the sum score. Alphas ranged between 0.74 and 0.76.

Adverse childhood experiences were assessed (at gestational week 14) with the Trauma and Distress Scale (TADS[27]), covering five domains of childhood adversities: emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. A total sum of childhood adversities was also calculated. The TADS consists of 43 items measuring frequency of maltreatment exposure using a 5-point scale (0 = never, 4 = almost always). Raw TADS scores, ranging between 0 and 20 for different subdomains, and 0–86 for total score, were used in the analyses. Cronbach Alpha was adequate 0.92 for the sum score, but between 0.60 and 0.87 for the subdomains.

*Background variables (*assessed at gestational week 14) included age, parity, relationship status, education and income level. Smoking and alcohol consumption, and the use of serotonin reuptake inhibitors (SSRIs) were assessed at gestational week 14 and 34.

2.3 | Statistical analyses

We used Mplus 8.0 software[28] and Latent Growth Mixture Modeling (LGMM[29]) to identify the trajectories of pregnancy-related anxiety. SPSS version 28.0 was used for statistical comparisons between the latent groups and the maternal factors. Bonferroni corrected p values were used when reporting Independent Samples t tests and Chi-square tests.

LGMM[29] was employed to identify change trajectories of individual's levels of pregnancy-related anxiety (PRAQ-R2 scores), by defining subgroup trajectories with intercept and slope as latent variables.[30] LGMM classifies individuals into subgroups based on their similarity of model parameters across varying time points.

To determine the model fit, we used the Akaike Information Criterion (AIC[31]), Bayesian Information Criterion (BIC[32]), entropy values,[33] and the Lo–Mendell–Rubins Adjusted Likelihood Ratio Test (LRT[34]). With reference to the AIC and BIC, the lower the values, the superior the fit.[29] To examine the improvement to the model by adding another class, the differences in AIC and BIC is calculated.[35] If the LRT for a particular class solution is deemed significant (<0.05), then the solution is deemed acceptable. Entropy is a statistic ranging from 0.00 to 1.00 and is one summary indicator of the conditional probabilities of individuals' group membership.[36] High entropy (>0.80) indicate that individuals are classified with confidence and there is adequate separation between the latent classes.

3 | RESULTS

We found a 2-group solution of the PRAQ-R2 score, for which the sample descriptive statistics of all our measures for the total group and the results of the group comparisons between the high versus low PRAQ-R2 trajectories are firstly presented in Table 1. More details on the group solution can be found further down.

The fit indices of the LGMM models specifying 1- to 5-class solutions are shown in Table 2.

A 2-group solution of the PRAQ-R2 sum score was selected, resembling the solution reported in Mudra et al.[16] This solution provided acceptable overall fit: the only fit-indicator below the suggested value was entropy (0.68 vs. >0.80) (see Table 2). A 4-group (versus a 3-group) solution also provided good fit with the data. In the 4-group solution, there was a "very low, sharply increasing group", $N = 18$, "High, decreasing group", $N = 9$, "Moderate, decreasing group", $N = 373$, and "Low, mildly increasing group", $N = 2531$. However, the group sizes became too small (participants <10 in some groups) for statistical comparisons, and also the interpretability of the different groups was difficult. In the selected 2-group solution, the first group of pregnant women, labeled "The low symptoms group", $N = 2594$ (88.6%), reported lower and slightly increasing levels of pregnancy-related anxiety (estimate of intercept = 20.606, $p < 0.001$, estimate of slope = 0.744, $p < 0.001$). The second group, "The high symptoms group", $N = 334$ (11.4%) reported higher and slightly decreasing levels of anxiety (estimate of intercept = 33.886, $p < 0.001$, estimate of slope = −1.879, $p = 0.001$), VLMR $p < 0.0001$, LMR, $p = 0.0001$. See Figure 1 for group means.

3.1 | Sociodemographic factors

The mothers in the high versus low symptom group tended to be younger ($t(2926) = 4.534$, $p < 0.001$, 95% CI 0.149–0.378), less often married/cohabiting and more often single parents ($\chi^2(4) = 13.000$, $p = 0.011$, Eta 0.049). Further, their income level was generally lower ($\chi^2(3) = 15.283$, $p < 0.01$, Eta 0.072).

3.2 | Quality of life, relationship satisfaction

The high symptoms group reported lower quality of life in early ($t(2748) = 9.287$, $p < 0.001$, 95% CI 0.439–0.676) and late pregnancy ($t(2585) = 7.953$, $p < 0.001$, 95% CI 0.376–0.623).

They also reported lower Consensus ($t(2540) = -4.183$, $p > 0.001$, 95% CI −0.389 to −0.141, higher score indicating lower consensus), while the level of Satisfaction and Cohesion did not differ between the groups. The high versus the low symptoms group has lower RDAS total score (indicating higher dissatisfaction) ($t(2530) = -2.217$, $p < 0.021$, 95% CI −0.253 to −0.003).

3.3 | Life style factors: Smoking, drinking

The mothers in the high versus low symptoms group reported more smoking during pregnancy ($\chi^2(3) = 24.967$, $p < 0.001$, Eta 0.085) and more drinking in early pregnancy ($\chi^2(1) = 4.259$, $p = 0.039$, Eta 0.039).

3.4 | Parity

The mothers in the high versus low symptoms groups were more often primiparous (χ^2df(1) = 26.972, $p < 0.001$, Eta 0.099).

3.5 | Early-life adversity

Self-reported adverse childhood experiences were higher in the high versus the low symptoms group in each category: Emotional neglect ($t(2755) = -6.533$, $p < 0.001$, 95% CI −0.573 to −0.337), Emotional abuse ($t(2755) = -6.277$, $p < 0.001$, 95% CI −0.584 to −0.348), Physical neglect ($t(2755) = -4.635$, $p < 0.001$, 95% CI −0.440 to −0.204), Physical abuse ($t(2755) = -4.227$, $p < 0.001$, 95% CI −0.435 to −0.200), and Sexual abuse ($t(2755) = -7.248$, $p = 0.031$, 95% CI −0.294 to −0.059).

4 | DISCUSSION

In this study, we identified two trajectories of pregnancy-related anxiety across pregnancy that seem to fit best to our data: one of the vast majority of pregnant women in our data (88.6%) with low total PRAQ-R2 scores that slightly increased over time, and one smaller group (11.4%) with moderately-high scores that slightly decreased during pregnancy.

Predictors, or correlates as we cannot determine causality, for the latter group included a range of demographic or lifestyle factors that have been associated with mental health problems, such as lower monthly income, drinking alcohol or smoking in early pregnancy, but also more early life adversities. Other correlating factors of

TABLE 1 Descriptives of the sample characteristics, and for the low and high (PRAQ-R2 sum) symptom scores groups.

		All	Consistently low symptoms	High and slightly decreasing symptoms	*p*
Age at due date, *M* (SD)		30.72 (4.71)	31.11 (4.47)	29.92 (4.73)	<0.001
Relationship status (%)	Married/cohabiting	93.2	93.8	88.6	0.011
	In a relationship	5.0	4.6	8.5	
	Divorced	0.4	0.4	0.7	
	Single	1.3	1.2	2.3	
Living environment	Urban/Rural (%)	71.1/28.9	70.4/29.6	78.0/22.0	0.005
Monthly income (%)	≤1500	38.8	37.9	46.2	0.002
	1501–2500	51.6	49.4	51.9	
	2501–3500	8.1	8.6	4.1	
	>3500	1.4	1.6	0.3	
Primiparity (%)		52.0	50.2	65.8	<0.001
Pregnancy-related medical condition (%)[a]	Yes	17.9%	17.4%	22.0%	0.042
Smoking (%)	Yes, early pregnancy	9.4	9.3	10.8	<0.001
	Yes, late pregnancy	5.6	4.9	11.4	
Drinking (%)	Yes, early pregnancy	21.0	20.4	25.5	0.039
	Yes, late pregnancy	10.5	10.9	8.1	0.154
SSRI/SNRI (%)	Gwk 14 or Gwk 34	4.3	4.0	6.7	0.039
	Gwk 14 and Gwk 34	2.2	2.1	2.8	0.421
Depression, *M* (SD) (EPDS sum)	Gwk 14	4.89 (3.92)	4.84 (3.87)	7.73 (4.39)	<0.001
	Gwk 24	4.62 (3.94)	4.60 (3.86)	8.12 (4.70)	<0.001
	Gwk 34	4.58 (3.89)	4.62 (3.95)	7.30 (4.47)	<0.001
General anxiety, *M* (SD) (SCL-90 sum)	Gwk 14	3.12 (3.89)	3.01 (3.65)	5.50 (5.08)	<0.001
	Gwk 24	3.68 (4.24)	3.46 (3.80)	7.49 (5.72)	<0.001
	Gwk 34	3.00 (3.81)	2.92 (3.66)	5.81 (5.42)	<0.001
EPDS, ≥ 12 (%)	Gwk 14/24/34	7.4/7.3/7.3	6.1/5.4/6.2	18.0/21.7/16.3	< 0.001
Quality of Life, *M* (SD) (QoL)	Gwk14	31.13 (4.03)	32.32 (3.96)	30.10 (4.06)	<0.001
	Gwk34	32.08 (4.27)	32.31 (4.21)	30.19 (4.41)	<0.001
Relationship (dis) satisfaction, (RDAS), *M* (SD), Gwk 34	Consensus	12.68 (3.00)	12.60 (3.01)	13.40 (3.04)	<0.001
	Satisfaction	8.54 (2.55)	8.52 (2.51)	8.71 (2.82)	0.122
	Cohesion	9.67 (2.77)	9.69 (2.76)	9.64 (2.96)	0.399
	RDAS Total score	30.88 (6.52)	30.78 (6.43)	31.70 (7.18)	0.021
Early-life adversity (TADS), *M* (SD), Gwk 14	Emotional neglect	3.84 (3.75)	3.67 (3.65)	5.38 (4.43)	<0.001
	Emotional abuse	2.25 (3.27)	2.10 (3.12)	3.62 (4.13)	<0.001
	Physical neglect	2.22 (2.37)	2.14 (2.30)	2.90 (2.79)	<0.001
	Physical abuse	1.23 (2.23)	1.17 (2.13)	1.88 (2.86)	<0.001
	Sexual abuse	0.50 (1.78)	0.45 (1.60)	0.75 (2.41)	0.031
	TADS sum	10.03 (10.88)	9.54 (10.32)	14.52 (13.73)	<0.001

Abbreviation: Gwk, gestational weeks.

[a]Pregnancy-related medical condition: yes/no any of the following ICD-10 diagnoses (Pre-eclampsia O12, O13, O14; Gestational diabetes O24; Antepartum hemorrhage O46; Other maternal diseases classifiable elsewhere but complicating pregnancy, childbirth and the puerperium O99.

TABLE 2 The fit indices for PRAQ-R2 sum score latent growth mixture models.

	Log L.	AIC	BIC	Entropy	Class proportions	Average latent class posterior probabilities	LRT
PRAQ-R2							
1 Class	−18449.981	36915.963	36963.819	1.000	1.000	1.000	
2 Class	−18386.847	36795.694	36861.497	0.682	0.89/0.11	0.93/0.75	<0.0001
3 Class	−18323.841	36675.682	36759.431	0.975	0.01/0.01/0.98	0.86/0.88/0.99	0.273
4 Class	−18265.596	36565.191	36666.887	0.82	0.82/0.01/0.16/0.01	0.92/0.94/0.75/0.90	<0.0001
5 Class	−18251.354	36542.708	36662.349	0.81	0.86/0.01/0.11/0.01/0.00	0.91/0.62/0.71/0.88/0.999	0.265

Note: AIC = Akaike Information Criterion[31]; BIC = Bayesian Information Criterion[32]; Entropy[33]; LRT = Lo–Mendell–Rubins Adjusted Likelihood Ratio Test.[34]

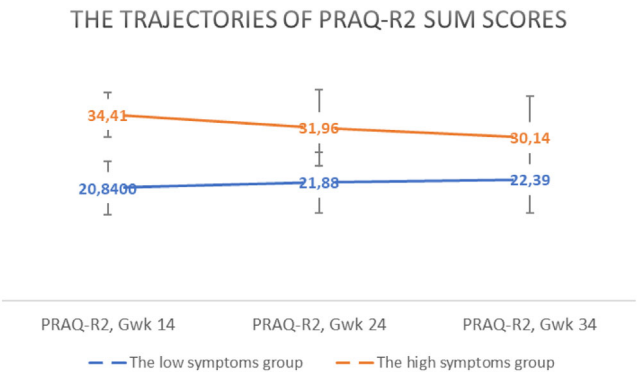

FIGURE 1 The trajectories of PRAQ-R2 symptom scores in the high and low symptom score groups.

the moderately-high trajectory were younger age, primiparity, not being married or cohabiting, single parenthood, using depression medication, having symptoms of depression or general anxiety.

Our findings fit very well with the study of Viswasam et al.,[15] who used a much smaller sample and three different general anxiety questionnaires, but also reported that 13.3% women belonged to a high-anxiety trajectory group and the remaining 86.7% to a low-anxiety trajectory, based on a latent class growth analysis. Nonetheless, as pregnancy-related anxiety is regarded as a relatively distinct concept, largely independent of general anxiety,[6] and focuses on specific concerns in the pregnancy period. Indeed, we did find different class-solutions than the study of Korja et al.,[14] which was also conducted with the FinnBrain cohort, but focused on general anxiety trajectories based on SCL-90 anxiety scores. Therefore, we compare our findings primarily with Mudra et al.,[16] showing that our findings partly replicate their results with the PRAQ-R2 in a rather similar, albeit much smaller sample of pregnant women. Mudra et al.[16] also reported to have found two trajectories, although a smaller proportion (about 67%) of women fitted best with a stable low-trajectory of pregnancy-related anxiety with the remaining one third fitting with a stable high-trajectory of pregnancy-related anxiety. The fact that we did find significant slopes for both growth curve trajectories and Mudra et al.[16] did not, may have to do with the much larger group of participants and thus larger statistical power in our study. With an even larger group of participants, it might have been possible to find more trajectories, as our data now showed very small sample sizes in some groups when we applied a 4-class solution. Our results and those of others seem to suggest that, within a general population of pregnant women, two relatively stable groups (i.e., low vs. moderate-high) could be distinguished for pregnancy-related anxieties. There was less consistent evidence for growth trajectories, in which levels would clearly change across pregnancy.

The smaller group of women with relatively high scores throughout pregnancy requires more attention, both from researchers and from health care workers involved with pregnant women, as research has repeatedly shown that high levels of pregnancy-related anxiety appear to be robust predictors of birth-, infant- and child outcomes, especially when compared to more general measures of anxiety during pregnancy. For example, an increased likelihood of preterm birth[8,37] and low birth weight,[7] but also elective cesarean section and epidural analgesia[38] were associated with high levels of pregnancy-related anxiety. In addition, as summarized in a recent review of Garcia et al.,[39] infants of mothers with higher pregnancy-specific anxiety were reported to show higher negative affect at 3 months,[40] at 6 months,[9] and in middle/later childhood.[41] Also, internalizing and externalizing problems,[42] or increased levels of internalizing problems in girls[43,44] and conduct problems or hyperactivity in boys[43] were reported in (early) childhood in relation to higher levels of maternal pregnancy-related anxiety.

Our results suggest that a range of demographic, lifestyle factors, and early life adversities but also pregnancy-related risk factors are associated with the high and slightly decreasing trajectory of pregnancy-related anxiety. Some of these factors could be used as a help in preventing pregnancy-related anxiety or intervene in a

timely manner already during pregnancy. For instance, offering social support to young pregnant women, or those who will be single parent to their child, may help them to cope with this key transitional phase and boost their resilience. Moreover, supporting healthy lifestyles in this group may be useful to improve their quality of life, and indirectly, lower their worries during pregnancy. In addition, it might prove worthwhile to provide these women at risk for high levels of pregnancy-related anxiety throughout pregnancy with psychoeducation about changes they may expect in this translation period of life and help them through mental health support, using for example cognitive behavioral approaches, in dealing with unrealistic fears and worries in time.

A lot of research has been conducted on perinatal depression, yielding advances in its assessment and treatment.[45] Studies, including the current one, show that depression in or before pregnancy is also associated with pregnancy-related anxiety.[47] Yet, it is also clear that pregnancy-related anxiety can be regarded as a distinct concept, with its independent predictive validity.[46] Our analyses showed that only 16.3%–21.7% of the high and slightly decreasing PRAQ trajectory group score ≥ 12 in the EPDS scale during pregnancy (See Table 2). Thus, when clinicians only screen for depression symptoms among pregnant women, a group of women with high levels of pregnancy-related anxiety will be missed. Additional screening for pregnancy-anxiety could support women in providing the best possible environment, both prenatally and after birth, for their child to grow up in.

The current study has several strengths: large sample size, variety in background characteristics and parity, relatively large number of correlates that could be included, and the longitudinal design. A limitation is that our sample reflects a general population of pregnant women, with many women who are highly educated from mostly urban environments, hampering generalization to more at-risk groups for high anxiety levels. However, the PRAQ-R2 scores in our study were rather similar to several other, yet smaller studies.[16,48] Also, the overall scores for depression and general anxiety were relatively low in our study, fitting with the general population that we included. We did not have information on whether women received mental health care, which may also be a limitation. In our sample, less variation in these background characteristics and mental health indices may have been present than in other studies, particularly those with higher rates of poverty, adverse life circumstances and less access to health care. Our sample characteristics could therefore explain why we did not find enough cases for more at-risk trajectories of pregnancy-related anxiety. Also, we did not have information on whether the pregnancies were planned or unplanned, nor did we have information on previous pregnancies. For women with unplanned pregnancies or previous pregnancies with complications or adverse outcomes, it may be that they would report higher pregnancy-related anxiety. We could not include these potential predictors in our model. Finally, we could not test for causality of predicting factors that were associated with the pregnancy-related anxiety trajectories.

Not withstanding these limitations, we can conclude that two trajectories of pregnancy-related anxiety can be distinguished: a low (stable or slightly increasing) and high (stable or slightly decreasing) trajectory from first to last trimester of pregnancy. Although the majority of pregnant women fall within the low trajectory group, the group with high levels of pregnancy anxiety throughout pregnancy may need more clinical attention, as their high pregnancy-related anxiety scores may indicate a risk profile that includes a variety of general and more pregnancy-specific risk factors, which together can negatively affect fetal and infant development and behavior.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the last author (Hasse Karlsson). the data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

The Ethics Committee of the Hospital District of Southwest Finland (ETMK: 57/180/2011, § 370) approved the study protocol.

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