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Hyperemesis gravidarum and eating disorders before and after pregnancy: A register-based study

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Abstract

Objective: Hyperemesis gravidarum (HG) is a severe form of excessive vomiting during pregnancy. The connection between psychiatric morbidity and HG has been debated, but only a few studies have focused on eating disorders (EDs). The objective of this study was to evaluate the association between HG and both pre-pregnancy and new post-pregnancy EDs.

Methods: A register-based controlled study. HG diagnoses were retrieved from healthcare registers between 2005 and 2017. Women with HG in their first pregnancy resulting in delivery were chosen as cases ($n = 4265$; the HG group) and women with no HG as controls ($n = 302{,}663$; the non-HG group). The associations between EDs and HG were analyzed by binary logistic regression, adjusted with age, body mass index, smoking, socioeconomic status, and pre-pregnancy psychiatric diagnoses.

Results: In the HG group, 1.6% and in the non-HG group, 0.2% had a pre-pregnancy ED. Women with ED were more likely to have HG in their first pregnancy compared with women with no history of EDs (adjusted odds ratio [AOR] 9.4, 95% CI 6.52–13.66, $p < .0001$). Moreover, 0.4% of the women in the HG group and 0.1% of the women in the non-HG group had a new ED diagnosis after pregnancy, and thus the women in the HG group were more likely to have an ED diagnosis after pregnancy (AOR I 3.5, 95% CI 1.71–7.15, $p < .001$, AOR II 2.7, 95% CI 1.30–5.69, $p = .008$).

Discussion: We found a bidirectional association between ED and HG, suggesting a shared etiology or risk factors between these disorders. This finding emphasizes the importance of collaboration across various specialties when treating these patients.

Public Significance: Our findings suggest a bidirectional association between HG and EDs before and after pregnancy. This finding provides essential information for healthcare professionals working with pregnant women. As both of these disorders are known to have far-reaching effects on the lives of both the mother and her offspring, our results help clinicians to target special attention and interventions to the patients suffering from these disorders.

KEYWORDS
eating disorder, hyperemesis gravidarum, nausea, pregnancy, vomiting, woman

1 | INTRODUCTION

Hyperemesis gravidarum (HG) is a severe form of nausea and vomiting of pregnancy (NVP). The international consensus definition describes HG as severe symptoms of NVP starting in early pregnancy associated with the inability to eat and/or drink normally and strongly limiting daily activities (Jansen et al., 2021). Although NVP is very common in early pregnancies, affecting as many as 85% of pregnant women (Ellilä et al., 2018; McParlin et al., 2016; Yeh et al., 2018), HG is infrequent occurring in ~0.3%–3.6% of all pregnancies (Austin et al., 2019). Nevertheless, it is the most common reason for hospitalization during the first trimester of pregnancy (Gazmararian, 2002), and readmissions are common (Fiaschi et al., 2016; Nurmi et al., 2022).

Eating disorders (EDs) are potentially severe mental disorders affecting millions worldwide regardless of nationality, race, socioeconomic status, or sex (Schaumberg et al., 2017). EDs are usually characterized by abnormal eating and weight-control behaviors and disturbed body image. In addition, psychiatric comorbidities are common in more than 70% of cases (Treasure et al., 2020). In general, the lifetime prevalence of EDs in women ranges from 0.1% to 14.6% (Galmiche et al., 2019) and in Finland, the lifetime prevalence of EDs for women has been reported to be up to 17.4% (Silén et al., 2020). Furthermore, in Western countries, 5.5%–17.9% of young women have undergone an ED by early adulthood (Silén & Keski-Rahkonen, 2022). During pregnancy, prevalences of EDs ranging from 5.1% to 15.3% have been observed (Dörsam et al., 2019; Easter et al., 2013; Martínez-Olcina et al., 2020). Maternal ED is a significant and challenging condition, since it may negatively impact adaptation to motherhood (Koubaa et al., 2008) and maternal infant bonding (Astrachan-Fletcher et al., 2008; Patel et al., 2002). Maternal ED has also been reported to be associated with negative psychological and cognitive development of the offspring (Barona et al., 2016; Martini et al., 2023). Further, an association between maternal ED and ED in the child in later life has been observed (Martini et al., 2020).

Both HG and EDs are considered multifactorial disorders. The exact etiology and pathophysiology remain unclear in both disorders. In HG, the predisposing factors may be biological (e.g., genetic predisposition and hormonal aspects; Austin et al., 2019; London et al., 2017) as well as maternal and pregnancy related (Nurmi et al., 2020). In EDs, the predisposing factors can be biological (often genetic predisposition) (Treasure et al., 2020), but the environmental context (e.g., cultural idealization, dieting, bullying) also plays an important role as a risk factor for EDs (Schaumberg et al., 2017). In the development of EDs, there seems to be a complex interaction between genetics and environment—patients who are genetically more predisposed to EDs are the most susceptible to environmental influences and pressures (Schaumberg et al., 2017). The prevalence of EDs is high already in adolescents (Galmiche et al., 2019) and in women of early reproductive age (Linna et al., 2014), and younger maternal age has also been associated as a risk factor for HG (Fell et al., 2006; Nurmi et al., 2020). For both HG and ED, the involvement of the serotonin system in the etiology has attracted interest, and fluctuations in the 5-hydroxytryptamine (5-HT) system are associated with both HG and EDs (Hudon Thibeault et al., 2019). This, as well as possible connections to gut microbiota (Balci et al., 2022; Glenny et al., 2017; Schwensen et al., 2018) and certain hormones and cytokines (Dostálová et al., 2010; Fejzo et al., 2018; Tsai et al., 2018) may share some common background between HG and ED.

HG has been shown to be associated with EDs (Abraham, 1998; Koubaa et al., 2005; Mantel et al., 2020; Mitchell et al., 1991; Torgersen et al., 2008) although the research in the field is limited. A recent systematic review describes that women with ED before or during pregnancy have higher rates of HG (das Neves et al., 2022), but the connection between HG and subsequent EDs after pregnancy remains unknown. The aim of our study was to evaluate the association between EDs and HG. We hypothesized a bidirectional association: on one hand, women with previous ED diagnosis would be more likely to have HG in their pregnancy, and on the other hand, women with HG would be more susceptible having new EDs diagnosed after their HG pregnancy. Further, we evaluated the time interval between these disorders.

2 | METHODS

2.1 | Participants

The data were collected from Finnish healthcare registers. Data from women who had at least one pregnancy resulting in delivery between 2005 and 2017 ($n = 437{,}465$) were included. The HG and the psychiatric diagnoses were drawn from the Finnish Hospital Discharge Register (FHDR) including all public hospital outpatient and inpatient care. The data from FHDR were drawn since 2004 to cover possible pre-pregnancy psychiatric diagnoses in women having delivery during 2005. The delivery data were collected from the Finnish Medical Births Register (FMBR). The flowchart of the study is shown in Figure 1.

In the primary analysis (Figure 1a), women with an HG diagnosis (ICD-10 diagnosis codes O21, O21.0, O21.1, O21.2, O21.8, and O21.9; World Health Organization, 2016) in their first pregnancy resulting in delivery were chosen as cases ($n = 4265$; the HG group). The control women were drawn among women, who had their first pregnancy resulting in delivery and who had never been diagnosed with HG in any possible pregnancy, including pregnancies not resulting in delivery (spontaneous and induced abortions and ectopic pregnancies) either during the study period or earlier ($n = 302{,}663$;

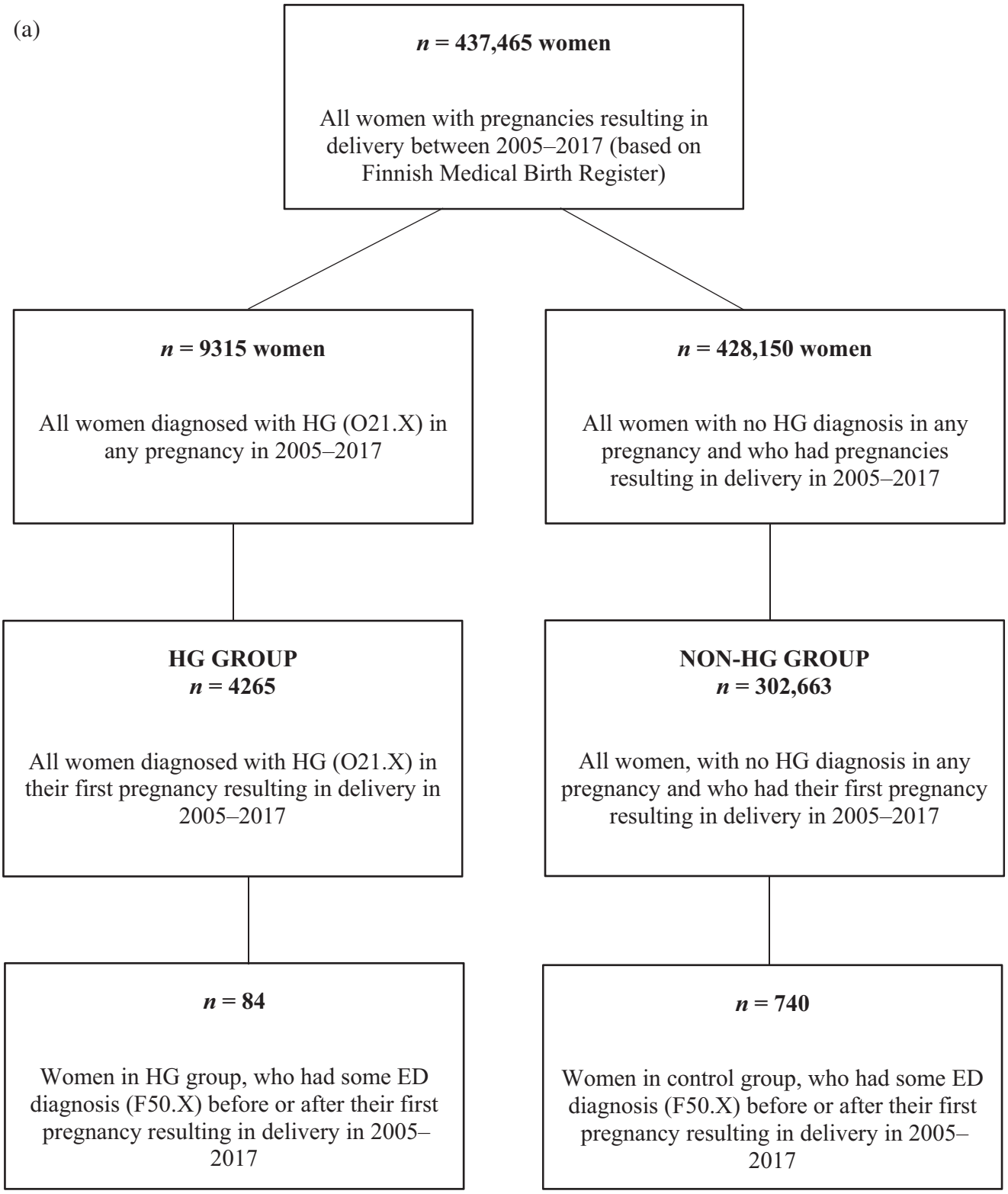

FIGURE 1 (a) The flow-chart of the primary analysis. (b) The flow-chart of the additional analysis. ED, eating disorder; HG, hyperemesis gravidarum.

the non-HG group). The data were restricted to first-time pregnancies to exclude the possible effect of previous HG pregnancy and possible negative experiences related to previous pregnancy or delivery. Abortions (spontaneous and induced) and ectopic pregnancies were excluded; because maternal characteristics (age [years], body mass index [BMI, kg/m^2], smoking [yes/no], socioeconomic status

(b)

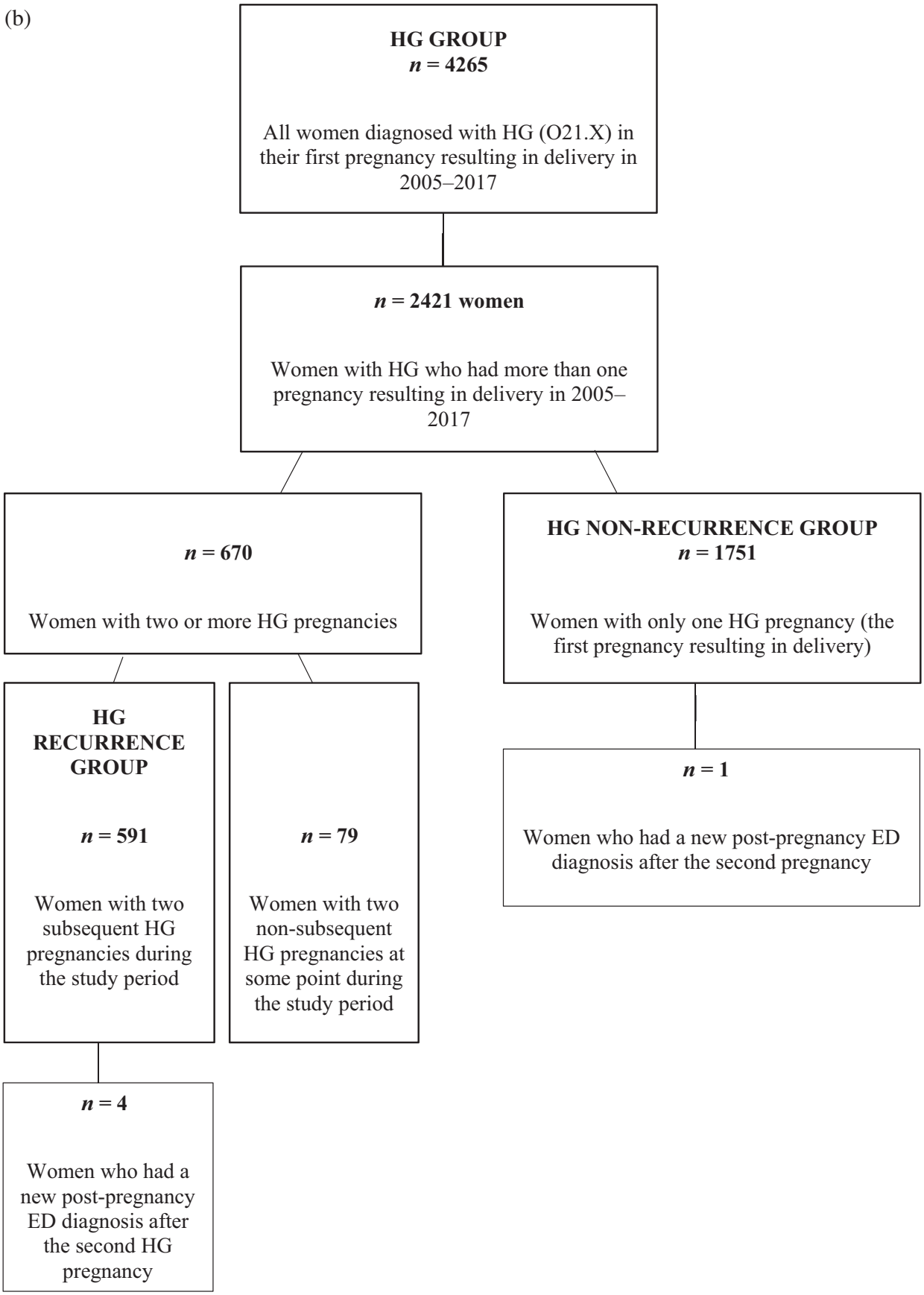

FIGURE 1 (Continued)

[employed/studying or unemployed/at home]) which were used as adjusting factors due to their association with HG were available only in the FMBR, (Fell et al., 2006; Fiaschi et al., 2016; Louik et al., 2006; Verberg et al., 2005; Vikanes et al., 2010). In addition, deliveries with stillborns were excluded. Prepregnancy psychiatric diagnoses (ICD-10 classification F00–F99) were collected from the FHDR.

In the additional analysis (Figure 1b), only women with HG in their first pregnancy resulting in delivery and with subsequent pregnancies resulting in delivery ($n = 2421$) were included in the analysis. Women with two or more HG pregnancies were chosen as cases ($n = 670$; the HG recurrence group) and those with only one HG pregnancy as controls ($n = 1751$; the HG non-recurrence group).

2.2 | Study variables

We evaluated the association between HG and various EDs (ICD diagnosis codes F50.0, F50.1, F50.2, F50.3, F50.4, F50.5, F50.6, F50.7, F50.8, and F50.9). Two separate analyses were performed: (1) the association between prepregnancy ED and HG and (2) the association between HG and subsequent new ED after pregnancy. Only the primary F50 diagnoses were included, and secondary ED diagnoses were disregarded. The analyses were conducted (1) with all the F50 subgroups and (2) excluding all women with a diagnosis of overeating associated with other psychological disturbances (F50.4) and vomiting associated with other psychological disturbances (F50.5), because according to current practice, these diagnoses are no longer in use. The other prepregnancy psychiatric disorders (ICD F codes) than EDs were used as adjusting factors. In addition, we examined the time interval between the two HG pregnancies and the subsequent ED following these two HG pregnancies.

2.3 | Statistical analysis

Variables (HG, age, BMI, smoking, socioeconomic status, prepregnancy EDs, and new EDs after pregnancy) were summarized with descriptive statistics. For analysis, age (≤25, 26–30, ≥31 years) and BMI (<25, 25–29.9, and ≥30 kg/m^2) were categorized. Associations between HG and categorical variables were studied by chi-square test.

The associations between EDs and HG were analyzed using binary logistic regression. The association between prepregnancy EDs and HG was analyzed and thereafter adjusted with age, BMI, smoking, and socioeconomic status. The occurrence of new EDs after pregnancy in relation to HG was analyzed in three models: (1) with HG, (2) with adjusting factors (adjusted odds ratio [AOR] I: age, BMI, smoking, socioeconomic status), and finally (3) with adjusting factors including also prepregnancy psychiatric diagnoses (other than EDs) (AOR II: age, BMI, smoking, socioeconomic status, prepregnancy psychiatric diagnoses). Odds ratios (ORs) with 95% confidence intervals (95% CIs) were reported.

In the additional analysis, the time interval from the first HG pregnancy to the second HG pregnancy was calculated in women in the HG recurrence group. This time interval was compared between the women in the HG recurrence group, who had a new ED diagnosis after pregnancy, and the women in the HG recurrence group, who had no new ED diagnosis.

All tests were performed as two-sided with a significance level set at 0.05. The analyses were performed using the SAS System, version 9.4 for Windows (SAS Institute Inc., Cary, NC, USA).

2.4 | Ethics statement

The data were compiled with permission of the Finnish National Institute for Health and Welfare (THL/658/5.05.00/2012; THL/372/5.05.00/2018). The ethical committee of the Hospital District of Southwest Finland (43/180/2011) approved the study plan. The data were processed and analyzed pseudonymized: only personal research ID was used as the identifier of the women. The General Data Protection Regulations for clinical and register-linkage research were followed strictly.

3 | RESULTS

3.1 | Basic characteristics

The maternal basic characteristics are shown in Table 1. There were no differences between the groups regarding age, BMI, smoking, or socioeconomic status. A total of 25.8% ($n = 1102/4265$) of the women in the HG group and 5.6% ($n = 17{,}056/302{,}663$) of the women in the non-HG group had a psychiatric diagnosis at some point during the study period ($p < .0001$). In the HG group, 15.7% ($n = 668/4265$) and in the non-HG group 2.2% ($n = 6565/302{,}663$) had a prepregnancy psychiatric diagnosis ($p < .0001$). In the HG group, 15.2% ($n = 649$) and in the non-HG group, 2.1% ($n = 6197$) had some prepregnancy psychiatric diagnosis other than ED (ICD diagnosis code F50; $p < .0001$). In addition, in the HG group, 2.0% ($n = 84/4265$) and in the non-HG group, 0.2% ($n = 740/302{,}663$) had an ED either before or after pregnancy during the study period ($p < .0001$). The exclusion of F50.4 and F50.5 diagnoses resulted in the exclusion of four women in the non-HG group, but the results remained the same: in the HG group, 2.0% ($n = 84/4265$) and in the non-HG group, 0.2% ($n = 736/302{,}663$) had an ED (other than F50.4 or F50.5) before or after pregnancy during the study period ($p < .0001$).

3.2 | Associations between prepregnancy EDs and HG

The results of the analysis and subtypes and frequencies of pre-pregnancy EDs are presented in Table 2. In the HG group, 1.6% ($n = 68/4265$) of the women and in the non-HG group, 0.2% ($n = 524/302{,}663$) of the women had a prepregnancy ED. The women in the HG group were more likely to have a prepregnancy ED

TABLE 1 The basic characteristics of the women who had some eating disorder-diagnosis (F50.X) before or after their first pregnancy resulting in delivery during the study period.

		HG group ($n = 84$)		Non-HG group ($n = 740$)	
		Mean ± *SD* (range)		Mean ± *SD* (range)	*p*-Value[a]
	n		*n*		
Age (years)	84	24.7 ± 4.6 (17.0–34.0)	740	25.5 ± 4.8 (15.0–42.0)	
BMI (kg/m^2)	82	22.9 ± 5.1 (15.2–41.0)	727	23.3 ± 5.6 (14.5–51.4)	
		% (*n*)		% (*n*)	
Age years (categories)	84		740		.185
≤ 25		53.6 (45)		54.5 (403)	
26–30		36.9 (31)		29.6 (219)	
≥ 31		9.5 (8)		15.9 (118)	
BMI kg/m^2 (categories)	82		727		.958
< 25		78.0 (64)		76.6 (557)	
25–29.9		11.0 (9)		11.8 (86)	
≥ 30		11.0 (9)		11.6 (84)	
Smoking	81		729		.240
Yes[b]		29.6 (24)		23.7 (173)	
No		70.4 (57)		76.3 (556)	
Sosioeconomic status	45		397		.830
Employed/studying		97.8 (44)		97.2 (386)	
Unemployed/at home		2.2 (1)		2.8 (11)	
Prepregnancy psychiatric illness	84		740		<.0001
Other diagnosis than F50		64.3 (54)		23.8 (176)	

Note: The study period: years 2005–2017. Age and BMI are presented as continuous variables and categorical variables (the analyses were made by using the categorical variables).
Abbreviations: BMI, body mass index; HG, hyperemesis gravidarum; *SD*, standard deviation.
[a]Chi-square test.
[b]Including smokers who had quit after the first trimester.

TABLE 2 The association between prepregnancy eating disorders and hyperemesis gravidarum.

	HG group	Non-HG group				
	$n = 4265$	$n = 302{,}663$				
Psychiatric illness	**% (*n*[a])**	**% (*n*[a])**	**OR (95% CI)**	**AOR I (95% CI)**	***p*[b]**	***p*[c]**
F50 Eating disorders	1.59 (68)	0.17 (524)	9.34 (7.24–12.05)	9.44 (6.52–13.66)	<.0001	<.0001
F50.0 Anorexia nervosa	0.67 (28)	0.07 (221)				
F50.1 Atypical anorexia nervosa	0.54 (23)	0.03 (88)				
F50.2 Bulimia nervosa	0.56 (24)	0.04 (128)				
F50.3 Atypical bulimia nervosa	0.26 (11)	0.02 (54)				
F50.4 Overeating associated with other psychological disturbances	0.00 (0)	0.00 (4)				
F50.5 Vomiting associated with other psychological disturbances	0.00 (0)	0.00 (4)				
F50.8 Other eating disorders	0.16 (7)	0.01 (18)				
F50.9 Eating disorder, unspecified	0.68 (29)	0.05 (139)				

Note: The frequencies of the various eating disorders.
Abbreviations: AOR, adjusted odds ratio; AOR I, adjusted for age, smoking, BMI, and sosioeconomic status.; BMI, body mass index; CI, confidence interval; HG, hyperemesis gravidarum; OR, odds ratio.
[a]*n*, number of women; one woman might have more than one F50.X diagnosis.
[b]Univariate analysis (logistic regression analysis).
[c]Adjusted analysis I.

diagnosis compared with the women in the non-HG group (OR 9.34, 95% CI 7.24–12.05, $p < .001$, AOR I 9.44, 95% CI 6.52–13.66, $p < .001$). In the HG group, the most frequent diagnoses were anorexia nervosa, bulimia nervosa, and unspecified ED, similar to the non-HG group. In both groups, the rarest diagnoses were overeating associated with other psychological disturbances and vomiting associated with other psychological disturbances. When conducting the analysis excluding all women with a diagnosis of F50.4 and F50.5, the results remained: OR 9.40, 95% CI 7.28–12.12, $p < .001$, AOR 9.48, 95% CI 6.55–13.72, $p < .001$).

3.3 | Associations between HG and subsequent new EDs after pregnancy

The results of the analysis and the frequencies of the new ED subtypes after pregnancy are presented in Table 3. In the HG group, 0.4% ($n = 16/4265$) of the women had a new ED diagnosis after pregnancy, and in the non-HG group, 0.1% ($n = 216/302{,}663$) of the women had a new ED diagnosis after pregnancy. The women in the HG group were more likely to have an ED diagnosis compared with the women in the non-HG group (OR 5.27, 95% CI 3.17–8.77, $p < .001$; AOR I 3.50, 95% CI 1.71–7.15, $p < .001$; AOR II 2.72, 95% CI 1.30–5.69, $p = .008$). Of the subtypes of EDs, in the HG group, the most frequent diagnoses were anorexia nervosa, atypical anorexia nervosa, other EDs, and unspecified EDs, while overeating associated with other psychological disturbances, vomiting associated with other psychological disturbances and atypical bulimia nervosa were the rarest. In the non-HG group, the most frequent diagnoses were bulimia nervosa, unspecified ED, and atypical bulimia nervosa, and the rarest were vomiting associated with other psychological disturbances and overeating associated with other psychological disturbances. When conducting the analysis excluding all women with a diagnosis of F50.4 and F50.5, the results remained: OR 5.30, 95% CI 3.19–8.81, $p < .001$, AOR 3.53, 95% CI 1.73–7.22, $p < .001$, AOR II 2.74, 95% CI 1.31–5.73, $p = .008$).

3.4 | Association between recurrent HG and EDs

Only the HG group was included in the additional analysis evaluating the time interval between recurrent HG and EDs (Figure 1b). Altogether, 56.8% ($n = 2421/4265$) of these women had more than one pregnancy resulting in delivery. Of them, 24.4% ($n = 591/2421$) had two subsequent HG pregnancies (the HG recurrence group), and 72.3% ($n = 1751/2421$) had only one HG pregnancy (the HG non-recurrence group). When evaluating the time interval between the two HG pregnancies and the subsequent ED, only the HG recurrence group ($n = 591$) was included. The women in the HG recurrence group with postpregnancy ED diagnosis ($n = 4$) had almost twice as long time (median 1227 days = 3.4 years) between the two HG pregnancies compared with the women in the HG recurrence group with no postpregnancy ED diagnosis ($n = 587$, median 683 days = 1.9 years).

4 | DISCUSSION

To the best of our knowledge, our study is the first to assess the association between HG and subsequent new-diagnosed EDs. We found

TABLE 3 The association between hyperemesis gravidarum and new eating disorders after pregnancy.

	HG group $n = 4265$	Non-HG group $n = 302{,}663$						
Psychiatric illness	**% (n[a])**	**% (n[a])**	**OR (95% CI)**	**AOR I (95% CI)**	**AOR II (95% CI)**	**p[b]**	**p[c]**	**p[d]**
F50 Eating Disorders	0.38 (16)	0.07 (216)	5.27 (3.17–8.77)	3.50 (1.71–7.15)	2.72 (1.30–5.69)	<.0001	.0006	.0080
F50.0 Anorexia nervosa	0.12 (5)	0.01 (33)						
F50.1 Atypical anorexia nervosa	0.12 (5)	0.01 (30)						
F50.2 Bulimia nervosa	0.09 (4)	0.02 (58)						
F50.3 Atypical bulimia nervosa	0.02 (1)	0.01 (37)						
F50.4 Overeating associated with other psychological disturbances	0.00 (0)	0.00 (2)						
F50.5 Vomiting associated with other psychological disturbances	0.02 (1)	0.00 (0)						
F50.8 Other eating disorders	0.12 (5)	0.01 (33)						
F50.9 Eating disorder, unspecified	0.16 (7)	0.02 (57)						

Note: The frequencies of the various eating disorders.

Abbreviations: AOR, adjusted odds ratio; AOR I, adjusted for age, smoking, BMI, and sosioeconomic status; OR II, adjusted for age, smoking, BMI, sosioeconomic status, and prepregnancy psychiatric illness; OR, odds ratio; CI, confidence interval; HG, hyperemesis gravidarum.

[a]n, number of women; one woman might have more than one F50.X diagnosis.

[b]Univariate analysis (logistic regression analysis).

[c]Adjusted analysis I.

[d]Adjusted analysis II.

that women with HG were more likely to have an ED diagnosis after the pregnancy than women without HG. Furthermore, we found that the women with HG were more likely to have a history of ED before the pregnancy than women without HG. Various factors can explain such bidirectional associations, and a shared etiological background between these two disorders can be speculated. However, to exclude or to confirm common etiological pathways, further research regarding the pathophysiological mechanisms of both conditions will be required.

Previous studies in the field are few and have concentrated on the association between HG and pre-pregnancy EDs. However, the results are contradictory. Mantel et al. (2020) found, in a Swedish population-based cohort study among 1,232,863 women, that all subtypes of EDs were associated with a twofold increased risk of HG. Similarly, Abraham (1998) showed in an over 10-year follow-up study with 43 women that the prevalence of HG was higher among women who had not recovered from their ED at the time of their pregnancy. These findings are in accordance with our results: we found that women with a pre-pregnancy ED had over ninefold higher odds of being diagnosed with HG compared with women with no previous ED history. On the other hand, Torgersen et al. (2008) found, in a large Norwegian prospective cohort study, with a total of 38,038 women, no elevated odds of HG among women with ED compared with women without; however, certain EDs (bulimia nervosa, purging disorder, and ED not otherwise specified with purging) were more frequent in the women with HG, though not reaching a statistical significance.

Two small controlled studies have also reported conflicting findings on the association between HG and EDs. Koubaa et al. (2005) found in a study of 49 women with HG and 68 control women that women with past or current ED were at increased risk of HG. On the other hand, in a controlled comparative study with bulimic patients, Mitchell et al. (1991) could not show any difference in the occurrence of HG between the women with bulimia nervosa ($n = 18$) and women without ($n = 29$).

As for the association between HG and a subsequent new ED after pregnancy, our study revealed, as a novel finding, that women with HG were over fivefold more likely to be diagnosed with an ED after HG. When adjusting for maternal characteristics and prepregnancy psychiatric disorders, the odds were still almost threefold higher. This adjustment was essential, as in general, concurrent mental health disorders are common among persons with EDs (Lewinsohn et al., 2000; Marucci et al., 2018), and women with EDs are also at higher risk of having psychiatric comorbidities, especially anxiety and depression (Hoffman et al., 2011; Knoph et al., 2013). The subtypes of new EDs after pregnancy differed somewhat among women with HG compared with women without. Further, it is notable that the same woman may have several different ED diagnoses. Migration and cross-over between the different subtypes of ED diagnoses are common (Dalle, 2011; Eddy et al., 2008; Milos et al., 2005). For example, anorexia nervosa was more common after pregnancy in women with HG. In contrast, bulimia nervosa was the most represented diagnosis after pregnancy in women without HG. However, in this latter group, anorexia nervosa may have developed into bulimia nervosa in some cases (Eddy et al., 2008). There may be overlap between the diagnoses and therefore, direct conclusions cannot be made regarding why specific subtypes were more common in different groups.

Our findings suggest an association between HG and getting a new ED diagnosis independent of other psychiatric comorbidities. The recurrence rate of HG varies from around 15%–81% depending on the study setting (Dean et al., 2019). In addition, women with recurrent HG pregnancies, who had a new ED diagnosis after the second HG pregnancy, had a longer time interval between the two HG pregnancies than those without a new ED diagnosis. However, the latter results were based on only a very small sample of women and thus could also be chance findings, so precise conclusions cannot be drawn. Due to the small sample size, the time interval between recurrent HG pregnancies and new ED diagnosis could not be accurately estimated, offering an interesting topic for further research.

When considering the reasons behind our results, it can be assumed that women with HG have more negative attitudes towards eating even though they do not have an ED. One can suggest that after having HG, this negative attitude may increase, persist, and develop into an ED. Indeed, some studies have examined the association between eating attitudes and HG during pregnancy, although the findings have not been consistent. Kender et al. (2015) showed in their study (51 women with HG and 41 without) that the women with HG had more negative eating attitudes compared with the control women, whereas Annagür et al. (2014) found no differences between the women with HG ($n = 48$) and the control women ($n = 44$).

One plausible link between HG and ED is the alteration of serotonin (5-HT) system. The serotonin system is involved in food intake and therefore impacts body weight regulation. It can stimulate nausea and vomiting via serotonin signaling between the gastrointestinal tract and the vomiting center (Fejzo et al., 2019) and plays an important role in the motility of the gastrointestinal tract (De Ponti, 2004). Another possible hypothesis is a connection between the placenta and appetite hormone growth/differentiation factor 15 (GDF15), which has been shown to be a genetic risk factor for HG in a large genome-wide association study (Fejzo et al., 2018). GDF15 is known to cause loss of appetite, reduce food intake and body weight (Ouyang et al., 2020), and it also acts on hypothalamic feeding centers, leading eventually to an anorexia–cachexia syndrome characterized by muscle and fat loss (Tsai et al., 2016). A relationship to changes in the gastrointestinal tract microbiome is also of possible interest (Cryan & O'Mahony, 2011; Neufeld & Foster, 2009; Rogers et al., 2016) and a recent case-control study (10 women with HG and 10 control women) showed that the women with HG had different intestinal flora compared with the control women (Balci et al., 2022).

It is also known that EDs often persist or relapse after pregnancy among women who have had pre-pregnancy EDs (Knoph et al., 2013). ED symptoms may improve during pregnancy but worsen postpartum (Crow et al., 2008; Micali et al., 2007), although relapse can also occur during early pregnancy (Sollid et al., 2021). It can be hypothesized that, among women with EDs, NVP may be more likely to develop

into HG due to the nature of the ED: for example, women with purging-type ED are more likely to have NVP during their pregnancy (Torgersen et al., 2008) and women with a history of ED are more likely to present ED symptoms and are known to have more self-induced vomiting during pregnancy (Micali et al., 2007).

4.1 | Strengths and limitations

The main strength of our study was the large register-based data set. In Finland, data about all visits to hospitals and healthcare clinics are systematically collected into centralized registers using the data collection protocols established by the National Institute for Health and Welfare (Gissler et al., 2010). HG and EDs diagnoses were collected from all specialized health care services including outpatient and inpatient facilities, and a study period of 13 years offered an excellent basis for analyses. However, when using health care registers, underdiagnosis may be a challenge, since only women who have been diagnosed with HG or EDs were included in the study. Accordingly, women with possible HG or ED, but who did not seek help for their symptoms were not included, nor were women who sought help only from primary health care services or from the private sector. However, in Finland, public healthcare covers by far the majority of healthcare visits. In addition, healthcare in Finland is practically free of charge, not dependent on insurance or wealth; thus, HG or ED patients are not likely to be treated in the private sector. The Windsor guidelines of the definition of HG (Jansen et al., 2021) were not established during the time of our study, so the diagnosis of HG was based on the judgment of physicians, mainly by specialists in obstetrics and gynecology, as well as on clinical signs or laboratory findings of dehydration. We restricted the data to first-time livebirths as we wanted to minimize the impact of the pregnancy and delivery experiences on psychiatric symptoms. In addition, abortions (spontaneous and induced) and ectopic pregnancies were not included the study, because basic maternal characteristics were available only in the FMBR. In addition, stillbirths were excluded in order to diminish the impact of a potentially traumatic experience during childbirth on possible subsequent psychiatric diagnoses. Furthermore, only primary diagnoses were considered, and secondary diagnoses were excluded from the analysis. We used the FHDR to collect diagnoses of both HG and ED. However, most EDs, especially among people in normal or overweight range, remain undiagnosed. Therefore, a new diagnosis in a register cannot unequivocally be considered a new disorder. In addition, women with HG may have had more frequent healthcare contacts, possibly increasing their likelihood to be diagnosed also with other conditions such as ED. Furthermore, the 13-year follow-up does not cover the entire reproductive period, so longer term morbidity may be higher. Although the ORs in our study were high, the actual number of women was low and, thus, the clinical risk to individual patients was not high. As in the study of Torgersen et al. (2008), the small number of women with HG with specific ED subtypes limited analyses; larger longitudinal studies are needed.

5 | CONCLUSION AND CLINICAL IMPLICATIONS

Our study provides new information on the association between HG and EDs. We found that women with HG were more likely to be set a new ED diagnosis after their pregnancy compared with women without HG. Our findings suggest a bidirectional association, which may imply a shared etiology or shared risk factors. This knowledge will be helpful in patient counseling. Both ED and HG patients are encountered across various specialties and by experts of different professional background such as psychiatrists, gynecologists, and primary care general practitioners, and these patients would benefit from integrated care in collaboration with different specialties.

AUTHOR CONTRIBUTIONS

Eeva Terävä-Utti: Conceptualization; investigation; methodology; project administration; writing—original draft; writing—review and editing. **Miina Nurmi:** Data curation; writing—review and editing. **Linda Laitinen:** Writing—review and editing. **Tiia Rissanen:** Data curation; formal analysis; methodology. **Päivi Polo-Kantola:** Conceptualization; methodology; project administration; supervision; writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Adhering to the EU General Data Protection Regulation (GDPR) and Finnish legislation concerning sensitive data such as health-related information, the authors are not authorized to share the data. Finnish Social and Health Data Permit Authority (FINDATA) can, on a case-by-case basis, grant permission to use the registers for purposes of scientific research. The data outcomes supporting the findings of this study are available on reasonable request from the corresponding author.

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