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RESEARCH ARTICLE



## Recalling the severity of nausea and vomiting of pregnancy – a study using Pregnancy-Unique Quantification of Emesis Questionnaire

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### ABSTRACT

The accuracy of the recall of the severity of nausea and vomiting of pregnancy (NVP) with Pregnancy-Unique Quantification of Emesis (PUQE) questionnaire has been questioned. We aimed to compare PUQE scores of women recalling the worst episode of NVP of their current pregnancy in different gestational weeks (gwks). Total of 2343 pregnant women (gwks 7–40) were recruited. Four groups were formed according to the gwks at reply:  $\leq 16$  gwks ( $n = 554$ ),  $\leq 20$  gwks ( $n = 1209$ ),  $> 20$  gwks ( $n = 1134$ ) and  $\geq 24$  gwks ( $n = 495$ ). PUQE scores were similar between the groups. Consequently, consistency of PUQE scores across the groups endorses the useability of the PUQE questionnaire in retrospective assessment of the overall severity of NVP in different gwks, regardless of passing of the peak NVP symptoms.

### IMPACT STATEMENT

- **What is already known on this subject?** Retrospective evaluation of the severity of nausea and vomiting of pregnancy (NVP) has been argued to be disposed to recall bias. Structured Pregnancy-Unique Quantification of Emesis (PUQE) questionnaire is a validated tool for assessing the severity of NVP.
- **What do the results of this study add?** When the women recalled the most severe NVP symptoms of their current pregnancy, no differences in the PUQE scores were found despite different gestational weeks at reply. Of distinct PUQE questions, women answering in early pregnancy reported longer duration of nausea than women answering in late pregnancy, but other questions were rated similarly.
- **What the implications are of these findings for clinical practice and/or further research?** Our aim was to compare the PUQE scores between the women who filled in the PUQE questionnaire in early or in late pregnancy, instructed to recall their worst symptoms in their current pregnancy. As there were no differences between the groups in total PUQE scores, our results support the application of PUQE questionnaire to assess the severity of NVP during pregnancy not only concurrent to the peak symptoms but also retrospectively.

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### KEYWORDS

Nausea; vomiting;  
pregnancy; PUQE;  
recall; memory



## Introduction

Most women experience some degree of nausea and vomiting of pregnancy (NVP) which has at least temporarily a negative effect on women's overall well-being (Wood *et al.* 2013, Fejzo *et al.* 2019). At the worst, the severe NVP becomes a traumatising experience with even impact on future family planning (Nana *et al.* 2021, Nijsten *et al.* 2021). However, the accuracy of women's recall of the severity of NVP during pregnancy has been questioned (Koren *et al.* 2004).

According to studies of autobiographical memory (White 1989, 2020), rare events in life with emotional intensity are remembered years past. Nowadays, pregnancy could be

considered such a rare event for most women. However, medical details of past pregnancy are variably recalled (Carter *et al.* 2015, Keenan *et al.* 2017). For instance, the intensity of labour pain is mostly forgotten though there is individual variation related to the overall satisfaction of the birth experience (Waldenström and Schytt 2009). Furthermore, a mechanism of forgetting the intensity of the inconveniences of pregnancy is necessary to ensure willingness to future reproduction (Yehuda *et al.* 2010).

Many studies of NVP are based on questionnaire data which often rely on women's retrospective recall of the symptoms since the severity of NVP is rarely routinely labelled in medical records or in medical registers except for

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hospitalisations due to severe NVP. In some studies in the field, the existence of NVP has been inquired even years or decades after pregnancy (Fejzo *et al.* 2008, Parker *et al.* 2014, Colodro-Conde *et al.* 2016). Two previous studies have assessed the recall of the severity of NVP using the Pregnancy-Unique Quantification of Emesis (PUQE) questionnaire (Koren *et al.* 2004, Lacasse *et al.* 2008b). In the study by Koren *et al.* (2004), women initially answered to the PUQE questionnaire when calling to a NVP helpline, and the same women were contacted again a few weeks later. When more time had elapsed since the first interview, the women recalled the severity of NVP symptoms worse compared to their original report. On the contrary, Lacasse *et al.* (2008b) did not find differences in PUQE scores in women answering at different gestational weeks (gwks) when comparing scores of the original version of the PUQE and modified-PUQE covering NVP symptoms of the whole first trimester.

The aim of our study was to compare the severity of NVP assessed by PUQE questionnaire of individual women who recalled their worst NVP episode of their current pregnancy in different gwks.

## Material and methods

The women in this study were recruited from maternal health care clinics (MHCC) in the Turku city region, Finland, during 2011–2014. All women attending to routine MHCC visits, preferably in mid-pregnancy, were offered to take part in the study. In general, more than 99% of pregnant women in Finland attend to free of charge public MHCCs for pregnancy follow-up (Finnish Institute for Health and Welfare 2019). Trained nurses in the MHCCs recruited the women according

to the researchers' instructions. Finnish language skills were required since the study questionnaire was in Finnish but otherwise there were no other exclusion criteria. The Joint Ethics Committees of Turku University Hospital and University of Turku gave ethical approval (58/180/2011), and the study was performed in accordance with the principles stated in the Declaration of Helsinki. Altogether 2411 women participated, of which 2343 women with complete PUQE questionnaire and gwks were eligible into the analysis. All women gave written informed consent.

In the study questionnaire, the women recalled their worst 12-h episode of NVP in their current pregnancy and filled in the PUQE questionnaire accordingly for single time only. The PUQE is a validated, internationally widely used questionnaire (Koren *et al.* 2002, 2005, Koren and Cohen 2021) for assessing the severity of NVP with three questions concerning the duration of nausea in hours (question 1), and the frequency of vomiting episodes (question 2) and retching episodes (question 3). In each question, the points range from 1 to 5 according to the severity of symptoms, giving the PUQE total score of 3–15. The sum is further categorised into 'no NVP' (3 points), 'mild NVP' (4–6 points), 'moderate NVP' (7–12 points) and 'severe NVP' (13–15 points). In this study, PUQE scores were analysed both as categorised according to the original version (Koren *et al.* 2002) and as continuous variables.

Basic characteristics of the women including pre-pregnancy body mass index (BMI, kg/m<sup>2</sup>), previous pregnancies (number), previous deliveries (number), smoking (no/yes), marital status (cohabited/single) and employment (working/not working) were gathered from the Medical Birth Register of the Finnish Institute for Health and Welfare (Table 1). In addition, age was calculated by comparing the date of birth to the answering date. Further, gestational age in weeks

**Table 1.** Basic characteristics of the women according to different gestational weeks.

	≤20 gwks (n = 1209)	>20 gwks (n = 1134)		≤20 gwks (n = 1209)	≥24 gwks (n = 495)		≤16 gwks (n = 554)	≥ 24 gwks (n = 495)	
	Mean (SD, range)/ median [IQR]	Mean (SD, range)/ median [IQR]	<i>p</i> Value	Mean (SD, range)/ median [IQR]	Mean (SD, range)/ median [IQR]	<i>p</i> Value	Mean (SD, range)/ median [IQR]	Mean (SD, range)/ Median [IQR]	<i>p</i> Value
Gwk	17 [15, 18]	23 [22, 25]		17 [15, 18]	26 [25, 28]		15 [14, 16]	26 [25, 28]	
Age (years)	30.0 (4.7, 18–44)	30.6 (4.7, 15–46)	.002	30.0 (4.7, 18–44)	30.8 (4.7, 15–44)	.0008	29.5 (4.7, 18–44)	30.8 (4.7, 15–44)	<.0001
Pre-pregnancy BMI (kg/m <sup>2</sup> )	23.3 [21.2, 26.4]	23.7 [21.5, 26.5]	.074	23.3 [21.2, 26.4]	23.7 [21.7, 26.4]	.036	23.2 [20.9, 26.4]	23.7 [21.7, 26.4]	.020
Previous pregnancies	1 [0, 2]	1 [0, 2]	.901	1 [0, 2]	1 [0, 2]	.982	1 [0, 2]	1 [0, 2]	.180
Previous deliveries	1 [0, 1]	1 [0, 1]	.603	1 [0, 1]	1 [0, 1]	.617	0 [0, 1]	1 [0, 1]	.041
	<i>n</i> (%)	<i>n</i> (%)		<i>n</i> (%)	<i>n</i> (%)		<i>n</i> (%)	<i>n</i> (%)	
Smoking			.859			.104			.068
No	1019 (94.4)	972 (94.3)		1019 (94.4)	432 (96.4)		457 (93.8)	432 (96.4)	
Yes	60 (5.6)	59 (5.7)		60 (5.6)	16 (3.6)		30 (6.2)	16 (3.6)	
Marital status			.647			.753			.640
Cohabited	1121 (96.4)	1062 (96.0)		1121 (96.4)	464 (96.1)		514 (96.6)	464 (96.1)	
Single	42 (3.6)	44 (4.0)		42 (3.6)	19 (3.9)		18 (3.4)	19 (3.9)	
Employment			.297			.628			.158
Working	852 (82.4)	822 (84.1)		852 (82.4)	358 (83.5)		371 (79.8)	358 (83.5)	
Not working	182 (17.6)	155 (15.9)		182 (17.6)	71 (16.5)		94 (20.2)	71 (16.5)	

Notes: Total *n* = 2343. BMI: body mass index; IQR: interquartile range; gwks: gestational weeks; SD: standard deviation.

(range 7–40) was gathered from the study questionnaire. To compare the responses of individual women answering the PUQE questionnaire in early or in late pregnancy, four groups of women were formed according to the gwk when filling in the questionnaire:  $\leq 16$  gwks ( $n = 554$ ),  $\leq 20$  gwks ( $n = 1209$ ),  $> 20$  gwks ( $n = 1134$ ) and  $\geq 24$  gwks ( $n = 495$ ). Due to the grouping method, data were analysed according to gwks and thus, some of the women belonged to several groups.

### Statistical analyses

Categorical variables were described with frequencies and percent and continuous variables with means, standard deviations (SDs) and ranges for normally distributed data or with medians and interquartile ranges (IQR) otherwise. NVP was categorised based on the PUQE scores. In addition, continuous PUQE scores and the points of each PUQE questions were used in the analyses. The mean age between groups ( $\leq 20$  gwks vs.  $> 20$  gwks,  $\leq 20$  gwks vs.  $\geq 24$  gwks and  $\leq 16$  gwks vs.  $\geq 24$  gwks) was compared using two sample t-test. Pre-pregnancy BMI, previous pregnancies, previous deliveries, PUQE total scores and points of PUQE questions between the groups were compared using Mann–Whitney *U* test. Categorical variables (smoking, marital status and employment) were compared between groups using Chi-square test. The analyses were performed with SAS version 9.4 version of SAS Institute Inc. (Cary, NC) and *p* values  $< .05$  were considered significant.

### Results

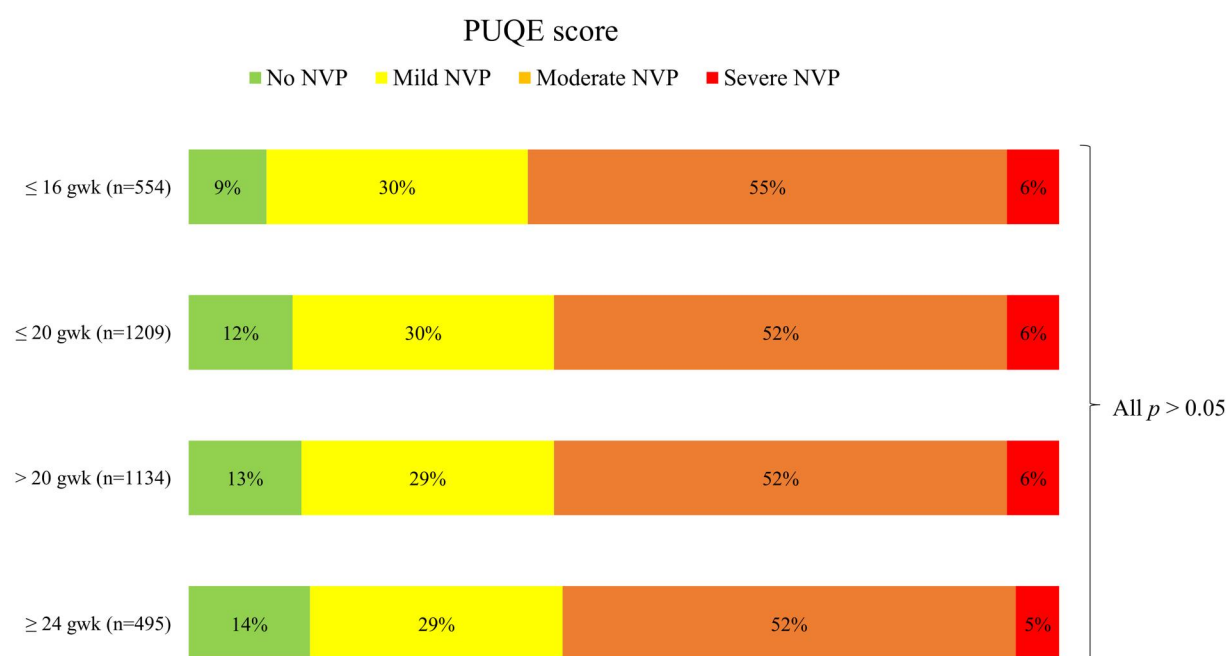
Of basic characteristics, the women answering in lower gwks were younger than the women answering in higher gwks ( $\leq 20$  gwks vs.  $> 20$  gwks,  $\leq 20$  gwks vs.  $\geq 24$  gwks and  $\leq 16$

gwks vs.  $\geq 24$  gwks). In addition, the women answering in lower gwks had lower pre-pregnancy BMI than the women answering in higher gwks ( $\leq 16$  gwks vs.  $\geq 24$  gwks and  $\leq 20$  gwks vs.  $\geq 24$  gwks), and women answering in higher gwks had more previous deliveries ( $\leq 16$  gwks vs.  $\geq 24$  gwks). Otherwise, no differences emerged between the groups (Table 1). The distributions of categorised PUQE scores were similar in all groups (Figure 1).

The continuous PUQE scores and the points of each PUQE questions were similar in women answering  $\leq 20$  gwks and  $> 20$  gwks. For women answering  $\leq 20$  gwks and  $\geq 24$  gwks, the continuous PUQE scores were similar, as well. However, in this comparison, the women answering  $\leq 20$  gwks reported longer duration of nausea (higher mean points in question 1). Instead, the frequency of both vomiting (question 2) and retching (question 3) episodes were similar. Alike, when comparing the women answering in  $\leq 16$  gwks and  $\geq 24$  gwks, the continuous PUQE scores were similar, but the women answering  $\leq 16$  gwks had higher mean points in question 1 (longer duration of nausea) than women answering  $\geq 24$  gwks. Otherwise, the answers to PUQE questions 2 and 3 were similar also in this comparison (Table 2).

### Discussion

According to our results, no divergence was found in the recalled overall severity of NVP assessed by PUQE questionnaire regardless of whether the women answered in early or in late pregnancy. Analysis of the PUQE scores as categorised or continuous scores yielded similar results. In the original studies developing and validating the PUQE questionnaire (Koren *et al.* 2002, 2005), the questionnaire was used in prospective settings and thereby the symptoms were evaluated during the actual occurrence of NVP. Our results suggest that the PUQE



**Figure 1.** PUQE score categories according to the gestational week at reply. Gwks: gestational weeks; NVP: nausea and vomiting of pregnancy; PUQE: Pregnancy-Unique Quantification of Emesis questionnaire.

**Table 2.** Comparisons of PUQE scores and PUQE questions according to different gestational weeks.

	<20 gwks (n = 1209)		>20 gwks (n = 1134)			<20 gwks (n = 1209)		≥24 gwks (n = 495)			≤16 gwks (n = 554)		≥ 24 gwks (n = 495)		
	Mean (SD) Median [IQR]		Mean (SD) Median [IQR]		<i>p Value</i>	Mean (SD) Median [IQR]		Mean (SD) Median [IQR]		<i>p Value</i>	Mean (SD) Median [IQR]		Mean (SD) Median [IQR]		<i>p Value</i>
PUQE total score	7.4 (3.1) 7 [5, 10]		7.4 (3.1) 7 [5, 10]		.683	7.4 (3.1) 7 [5, 10]		7.3 (3.1) 7 [5, 10]		.386	7.6 (3.0) 7 [5, 10]		7.3 (3.1) 7 [5, 10]		.109
PUQE Question 1	3.3 (1.4) 3 [2, 5]		3.2 (1.4) 3 [2, 5]		.081	3.3 (1.4) 3 [2, 5]		3.1 (1.4) 3 [2, 5]		.014	3.4 (1.4) 3 [2, 5]		3.1 (1.4) 3 [2, 5]		.005
PUQE Question 2	1.7 (1.1) 1 [1, 2]		1.8 (1.1) 1 [1, 2]		.084	1.7 (1.1) 1 [1, 2]		1.8 (1.1) 1 [1, 2]		.138	1.8 (1.0) 1 [1, 2]		1.8 (1.1) 1 [1, 2]		.484
PUQE Question 3	2.4 (1.4) 2 [1, 3]		2.4 (1.4) 2 [1, 3]		.682	2.4 (1.4) 2 [1, 3]		2.3 (1.4) 2 [1, 3]		.576	2.4 (1.4) 2 [1, 3]		2.3 (1.4) 2 [1, 3]		.253

Notes: Total  $n = 2343$ . PUQE total score (range 3–15) is the sum of the points of the three PUQE questions (range 1–5 points per question). Gwks: gestational week; IQR: interquartile range; PUQE: Pregnancy-Unique Quantification of Emesis Questionnaire.

questionnaire is a usable instrument to assess the recalled severity of NVP during pregnancy also after the peak of the most severe symptoms, although our findings should be confirmed in the setup with the same women answering at different time points.

The PUQE score categorises the overall severity of NVP with three short questions of the various aspects of NVP. The first PUQE question evaluates the daily duration of nausea in hours. In our study, the daily duration of nausea was the only aspect of NVP where we found differences comparing ratings in early and in late pregnancy. Nausea has been reported the most bothersome symptom of NVP (Chortatos *et al.* 2013, Clark *et al.* 2013). In addition, a notable proportion of women report nausea as the only symptom of NVP (Gadsby *et al.* 1993). Lacasse *et al.* (2008a) emphasised the importance of nausea being the leading symptom decreasing women's quality of life (QoL) in the study where they used a separate VAS scale to rate the intensity of nausea in addition to the PUQE score, 12-Item Short Form Survey (SF-12) and NVP-specific QoL ratings. In their study of 367 women answering in  $\leq 16$  gwks, more intense rated nausea was associated with more severe NVP and worse QoL (Lacasse *et al.* 2008a). In our recent study with hyperemesis gravidarum patients, we confirmed the associations between more severe NVP and worse QoL (Laitinen *et al.* 2022).

In our study, the PUQE scores were similar regardless of the gwks in answering, but the women answering in the first or in the early second trimester reported longer duration of nausea than the women answering in the late second or in the third trimester. To best of our knowledge, only two previous studies have evaluated the recall of the severity of NVP assessed by PUQE (Koren *et al.* 2004, Lacasse *et al.* 2008b). In Koren *et al.*'s (2004) study, the women ( $n = 200$ ) reported longer duration of nausea and more frequent vomiting episodes after more time had passed since the initial estimation of the severity of NVP. It is notable, however, that in that study the same women answered twice, whereas in our study the answers were obtained from different women in different gwks. This dissimilarity in study designs causes that the results are not totally comparable. On the contrary, Lacasse *et al.* (2008b) did not find any recall bias when comparing the answers of 287 women to the original PUQE and to Modified-PUQE encompassing the severity of NVP during the whole first trimester. In their study (Lacasse *et al.* 2008b), the

concordance between the results of the two questionnaires did not change when stratified by gwks. Moreover, in context of the findings regarding autobiographical memory (White 1989, 2020), the exact memory of the various aspects of NVP may fade after time, but the existence of having severe NVP or not at all could be recalled more reliably. Indeed, differences in women's overall burden and individual experience of NVP might, in part, explicate the conflicting results of the recall of the severity of NVP symptoms (Van Der Bergh and Walentynowicz 2016).

The second and the third PUQE questions assess the quantity of vomiting and retching episodes. In our study, we did not find differences between the answers given in early or in late pregnancy. Overall, the mean points of these questions given in our study referred to only a few daily episodes of vomiting and retching. Hence, it is intuitive that these short-term symptoms might be less important to the women's experience of NVP than the intense, on-going nausea. Naturally, individual variation of the perception exists (Chandra *et al.* 2002). To compare the recollection of other kind of symptoms in general populations, for example in studies of pain, short-term pain might be more accurately recalled than chronic, long-lasting pain (Erskine *et al.* 1990). In addition, other determinants, most importantly mental factors, certainly affect the ability to recall of certain symptoms (Erskine *et al.* 1990, Waldenström and Schytt 2009). Likewise, NVP is a spectrum of traits affected also by mental components (Fejzo *et al.* 2019).

Our study has limitations. First, our cohort consisted of individual women answering in different gwks, not of the same women repeating answers during their pregnancy. Therefore, selection bias cannot be ruled out. In addition, comparisons to studies with the same women answering the PUQE repeatedly should be interpreted with caution due to the differences in study designs. Since we lack the information of the exact gwks of the worst NVP, we were not able to estimate the time interval between the worst NVP and the answering date. However, in 90% of women the NVP resolves after 20 gwks (Lacroix *et al.* 2000) and thus, it is likely that women answering during the first or the early second trimester had the shortest time interval from the worst NVP symptoms compared to women answering in late pregnancy. The main merit of our study was the high number of participants in various gwks, which also diminished the possibility of only

by chance findings. A further strength was the use of the validated PUQE questionnaire. In addition, all women answered the questionnaire for the first time, excluding the possibility of learning effect.

In conclusion, the severity of NVP assessed by PUQE questionnaire during pregnancy was similar in individual women recalling the most severe episode of NVP irrespective of the gwks at the time of answering the questionnaire. The results were the same when PUQE scores were evaluated as categorised scores according to the original version (Koren *et al.* 2002) or as continuous scores. Only detailed differences in the recalled duration of nausea were found but these differences did not change the PUQE total scores. Thus, our results support the reliability of the use of PUQE questionnaire also in retrospective evaluation of NVP during pregnancy.

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## Ethical approval

The Joint Ethics Committees of Turku University Hospital and University of Turku gave ethical approval (58/180/2011) and the study was performed in accordance with the principles stated in the Declaration of Helsinki. The participants gave written informed consent.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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## Data availability statement

The dataset of this study is available from the corresponding author upon reasonable request.

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