Nausea and Vomiting of Pregnancy: Using the 24-hour Pregnancy-Unique Quantification of Emesis (PUQE-24) Scale

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Abstract

With up to 80% of pregnant women experiencing nausea and vomiting of pregnancy (NVP), it is critical to have a graded scale of its severity as a guide for appropriate treatment. In 2002 we introduced the Pregnancy-Unique Quantification of Emesis (PUQE) scoring system, which assessed the severity of nausea and vomiting in pregnancy (NVP) based on three physical symptoms: nausea, vomiting, and retching over the previous 12 hours. We present here validation of an extension of the original PUQE, by assessing NVP over 24 hours. This extension is deemed more clinically relevant, because assessment of symptoms over only 12 hours may encompass sleeping hours and hence may not adequately capture the length and severity of the symptoms. In this study we assessed the external validity of the new PUQE-24 by examining its ability to evaluate several characteristics associated with NVP: (a) ability to take multivitamin supplements; (b) rates of hospitalization and emergency room visits for severe symptoms; (c) sleep patterns; (d) liquid intake; and (e) the woman's self-rated well-being scores. Data collected prospectively from 315 women counselled via the Motherisk NVP line were used for the validation. PUQE-24 showed strong correlation with all parameters examined except for sleep patterns and hydration status. The well-being score, however, correlated significantly with hydration status. Capturing 24 hours rather than 12 hours of symptoms may better direct management of NVP and predict its outcome.

Résumé

Puisque jusqu'à 80 % des femmes enceintes connaissent des nausées et des vomissements gravidiques (NVG), il s'avère crucial de disposer d'une échelle graduée de la gravité de ce phénomène afin de guider le traitement. En 2002, nous avons lancé le système de notation *Pregnancy-Unique Quantification of Emesis* (PUQE), lequel évalue la gravité des nausées et des vomissements gravidiques (NVG) en fonction de trois symptômes physiques : les nausées, les vomissements et les haut-le-cœur connus au cours des 12 heures précédentes. Nous présentons ici la validation d'une extension du PUQE d'origine, soit l'évaluation des NVG sur 24 heures. Cette extension est considérée comme étant plus pertinente sur le plan clinique, puisque l'évaluation des symptômes sur une période de seulement 12 heures pourrait couvrir les heures de sommeil et donc ne pas refléter adéquatement la durée et la gravité des symptômes. Dans le cadre de cette étude, nous avons évalué la validité externe du nouveau PUQE-24 en examinant la capacité de ce dernier à évaluer plusieurs caractéristiques associées aux NVG : (a) la capacité de prendre des suppléments multivitaminiques; (b) les taux d'hospitalisation et de visite au service des urgences motivées par des symptômes graves; (c) les structures du sommeil; (d) l'apport en liquides; et (e) les scores de bien-être autodéterminés par la patiente. Les données recueillies prospectivement auprès de 315 patientes desservies par l'intermédiaire du service téléphonique *Motherisk NVP* ont été utilisées pour la validation. Le PUQE-24 a démontré une forte corrélation avec tous les paramètres examinés, exception faite des structures du sommeil et de l'état quant à l'hydratation. Le score de bien-être présentait, cependant, une corrélation significative avec l'état quant à l'hydratation. Le fait d'évaluer les symptômes sur 24 heures plutôt que sur 12 pourrait mieux orienter la prise en charge des NVG et mieux en prédire l'issue.

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INTRODUCTION

Nausea and vomiting of pregnancy is a clinical condition affecting between 50% and 80% of all pregnancies with variable severity.[1] It is most commonly encountered between four and nine weeks of gestation, and tends to diminish by the 16th week of pregnancy.[1–3] In its extreme form NVP may manifest itself as hyperemesis gravidarum, a potentially life threatening condition affecting 0.5% to 2% of pregnancies, which is characterized by protracted vomiting, retching, severe dehydration, and weight loss requiring hospitalization.[4] Attempts to quantify NVP symptoms originated with the Rhodes scale, which was designed for the assessment of nausea and vomiting in patients receiving chemotherapy for cancer.[5] In 2002 the Pregnancy-Unique Quantification of Emesis scoring system was adapted by us from the Rhodes scale and was the first scale of its kind to focus on the nausea and vomiting specific to pregnancy.[4]

Table 1. Motherisk PUQE-24 scoring system

In the last 24 hours, for how long have you felt nauseated or sick to your stomach?	Not at all (1)	1 hour or less (2)	2-3 hours (3)	4-6 hours (4)	More than 6 hours (5)
In the last 24 hours have you vomited or thrown up?	7 or more times (5)	5–6 times (4)	3–4 times (3)	1–2 times (2)	I did not throw up (1)
In the last 24 hours how many times have you had retching or dry heaves without bringing anything up?	No time (1)	1–2 times (2)	3–4 times (3)	5–6 times (4)	7 or more times (5)

PUQE-24 Score: Mild ≤ 6; Moderate = 7–12; Severe = 13–15

How many hours have you slept out of 24 hours? Why?_____

On a scale of 0 to 10, how would you rate your well-being?_____

0 (worst possible) 10 (The best you felt before pregnancy)

Can you tell me what causes you to feel that way?_____

The 12-hour PUQE score was validated by us in 2005.[6] As in the Rhodes scale, the original PUQE scale assessed the severity of NVP by focusing on the number of hours of nausea and the number of episodes of retching and vomiting, as well as overall well-being scores in the 12 hours immediately before assessment. We subsequently revised the PUQE scale to a 24-hour scale in order to account for the time spent sleeping. The objective of the present study was to validate this new 24-hour version of PUQE.

METHODS

The Motherisk NVP Healthline is a helpline developed to provide evidence-based counselling to pregnant woman experiencing nausea and vomiting of pregnancy, to counsel women on strategies such as lifestyle changes, and to provide advice about medication in the management of NVP symptoms. The NVP counsellors also collect data from women as part of evaluation and follow-up of those managed for NVP.

For the purpose of the present study, we selected 311 women who contacted our NVP Healthline between January 2005 and December 2008. Their mean gestational age at the time of their call was 8.6 weeks, and 96% of women were in the first trimester of pregnancy. The mean gestational age at which NVP symptoms began was 5.6 weeks (range 2–9.5 weeks). The following data were collected at the time of the call: daily liquid intake per kilogram of body weight; number of hours of sleep; quality of sleep (broken vs. good); use of multivitamin supplements; hospitalization or emergency room visits for NVP symptoms; and well-being scored on a visual analogue scale. The PUQE score for each patient was calculated using the original three criteria to assess the severity of NVP (the number of hours of nausea, the number of episodes of retching, and the number of episodes of vomiting in the preceding 24 hours). The PUQE score is calculated by adding the values from each category, and can range from a minimum of 1 to a maximum of 15 (Table 1). The well-being score is a general self-perception score of physical and psychological health that the woman provides when asked to rate her overall well-being in the 24 hours prior to the call. The score ranges from 0 to 10, with 0 being the worst possible well-being and 10 being the best well-being when compared with the woman's healthy pre-pregnancy state; callers were also asked to provide reasons for their well-being scores. Both the PUQE score and the well-being scores were used in the present study.

Information on sleep was obtained by asking the women to estimate the number of hours they had slept the night before and the naps taken during the last 24 hours. Women were also asked to comment on the quality of sleep by stating whether they had continuous or broken sleep; "good" sleep was described as undisturbed continuous sleep, whereas "broken" was anything otherwise.

Information on use of multivitamin supplements was obtained by asking callers to state if they were using prenatal multivitamins, as well as when they began and stopped taking them. This yielded three categories of usage pattern: (1) taking multivitamins, (2) not taking multivitamins, and

ABBREVIATIONS

HG	hyperemesis gravidarum
NVP	nausea and vomiting of pregnancy
PUQE	Pregnancy-Unique Quantification of Emesis

(3) stopped taking multivitamins. Patients were identified as "stopped taking" if they had discontinued use within the two weeks preceding the call, and were identified as "not taking" if they had never taken multivitamins or if they had discontinued their use more than two weeks prior to making the call. The rationale for this distinction was that if a woman had discontinued use of multivitamins more than two weeks before calling, this discontinuation could not necessarily be related to the severity of her NVP symptoms at the time of the call.

Callers were also asked if they had been hospitalized at all since the beginning of their pregnancy. The reason for their hospitalization, the length of stay in hospital, and the type of treatment received were recorded.

Information about liquid intake was provided by reports of the number of cups of water and beverages drunk in the preceding 24 hours. We used 200 mL as the estimated average volume of liquid per cup, multiplied this by the number of cups reported, and divided by the patient's weight; this yielded a volume of liquid intake expressed as millilitres per kilogram. Although in cooking measures a full cup is 250 mL, most people do not fill cups for drinking above 200 mL.

Since English is a secondary language for many pregnant patients, communication can be difficult when discussing their symptoms. We therefore sought to validate the use of PUQE in Spanish, a language widely used by many immigrants in Toronto. We translated the PUQE questionnaire into Spanish and administered it to 10 women in the reproductive age group. After the women answered all the questions, an extensive open-ended questionnaire was administered in detail to assess the women's understanding of each of the PUQE questions. Comprehension was rated as "excellent" if the understanding was judged complete, "very good" if there was minor misunderstanding not affecting the scores, and "less than optimal" if the lack of comprehension affected the scores.

Linear regression analysis was first performed between well-being and PUQE-24 scores and between individual well-being, PUQE-24 scores, the number of hours of sleep, and liquid intake. Chi-square analysis was performed to compare the severity of PUQE-24 (mild, moderate, severe) and quality of sleep, use of multivitamin supplements, and rates of hospitalization.

RESULTS

Of the 311 patients evaluated, a total of 39 patients were not taking multivitamins. Chi-square analysis showed a significant concordance between severity of NVP (as defined by PUQE-24) and the propensity for not taking multivitamins (Table 2).

Table 2. Inability to take multivitamin supplements in relation to PUQE-24 severity

PUQE severity	n (%) not taking
Mild (3–6)	0/32 (0.0)*
Moderate (7–12)	24/219 (11.0)†
Severe (> 13)	15/60 (25.0)*

*P = 0.002

†P = 0.001

Table 3. Rate of emergency room visits in relation to PUQE-24 severity

PUQE severity	n (%) visited ER
Mild (3-6)	3/32 (9.4)
Moderate (7-12)	21/219 (9.6)*
Severe (> 13)	16/63 (25.4)*

*P = 0.002

Of the 40 women who reported hospitalization and emergency visits, three had mild NVP (9.4%), 21 had moderate NVP (9.6%), and 16 had severe NVP (25%). Chi-square testing showed a significant difference between hospitalization rates in moderate cases and severe cases as categorized by PUQE-24 (P = 0.002). There was no significant difference in hospitalization rates between mild and severe cases, most probably because of the smaller sample size of the "mild" subgroup (Table 3).

Fourteen of 32 mild cases (43.8%), 112 of 217 moderate cases (51.6%), and 32 of 63 severe cases (50.8%) reported broken or poor sleep. This trend was not significant among the three groups. Similarly, linear regression analysis revealed no significant correlation between quality of sleep and PUQE-24 and well-being scores.

Callers were asked to rate on a 1–10 scale their overall physical and mental well-being in the 24 hours preceding the call. Linear regression analysis between well-being scores and the PUQE scores revealed a highly significant correlation ($P < 0.001$).

Information regarding liquid intake was provided by 134 callers (4 mild, 111 moderate, and 19 severe). Women with severe NVP by PUQE-24 score consumed an average of 17.3 mL of fluid/kg/24 hours, those with moderate NVP consumed 17.34 mL/kg/24 hours, and those with mild NVP consumed 19.96 mL/kg/24 hours. After standardizing the volume of liquid consumed for the women's body weight, linear regression revealed a significant correlation between well-being scores and the amount of liquid intake

(r = 0.189; $P = 0.031$). However, PUQE-24 scores and the amount of liquid intake did not show a significant correlation.

For the validation of PUQE in Spanish, 10 women of reproductive age (5 Mexican and 5 Argentinian) were interviewed. All participants stated that they had understood the questions, that the questions were straightforward, and that further clarification was not needed. They also stated that the questions were reasonable and they felt comfortable answering them.

After the questionnaire was completed, the participants were asked in detail what they understood from each of the questions in PUQE. Responses from all participants were satisfactory from the interviewer's perspective. Comprehension of the score questions was rated as "excellent" in 8 out of 10 of the participants, and "very good" in 2 out of 10, when they were asked to explain what they had understood and what they thought the questions meant.

A follow-up interview was conducted with 163 of the 311 women two weeks after the initial assessment. At follow-up, the PUQE score improved significantly (from 9.41+/-2.91 to 7.1+/-2.44), the well-being score improved from 4.18+/1.96 to 6.06+/-1.93, and liquid intake from 17.28+/- 10 to 21.95 +/-9.3 mL/kg/24 hours ($P < 0.001$ in all cases). Multiple regression analysis showed that the changes in PUQE correlated significantly with the changes in well-being ($P = 0.002$). The follow-up PUQE scores correlated with liquid intake ($P = 0.05$).

DISCUSSION

The original 12-hour PUQE score, developed from the original Rhodes scale, assessed nausea, vomiting, and retching in the 12 hours immediately preceding patients' calls. With wide clinical use of PUQE, it became apparent that callers may have been mostly sleeping during the 12 hours prior to calling us, and that using this interval for assessment of NVP might not allow an adequate evaluation of symptoms. In order to capture the extent of NVP in an entire day, we modified the originally validated 12-hour scale to the 24-hour PUQE, so that we would be able to account for the time spent sleeping. This can yield a more accurate reflection of the severity of symptoms in one day while capturing all aspects of daily life, but without compromising the quality of data due to recall errors because the captured period is still a short one.

In order to validate the modified PUQE scale, we used external parameters that reflect clinically the severity of the woman's symptoms. One of these parameters, multivitamin use, is indicative of the severity of NVP, since women tend to discontinue use of prenatal vitamin supplements when experiencing severe nausea or gastrointestinal symptoms related to the iron content of the multivitamin preparations.[6] This discontinuation occurs despite women's awareness of the importance of multivitamin supplementation in pregnancy and their attempts to take them regularly. As shown in our results, PUQE-24 scores were highly predictive of the inability to take multivitamins in cases of severe nausea; women attempted to avoid foods and nutritional supplements that might worsen their already severe NVP.

A second parameter examined by us was the rate of hospitalization or visits to an emergency room that could be attributed to NVP. This endpoint was also highly correlated with PUQE-24 scores. High PUQE-24 scores were not only associated with higher hospitalization rates, but were also able to distinguish between cases of severe NVP, most likely due to HG, and mild and moderate cases. This increases the power of this new tool not only to predict hospitalization but also to identify the more vulnerable group of women who are at risk of developing HG, and it can thereby provide women and their health-care providers with an opportunity to intervene prior to worsening of symptoms.

Well-being is a subjective parameter developed by us to capture women's overall mental and emotional health, reflecting their quality of life at the time of questioning. NVP symptoms, especially retching, tend to cause great distress in pregnancy,[1] and well-being scores are primarily reflective of the extent of distress when women call our NVP line. Our results show that PUQE-24 scores correlate strongly with this self-rated measure, and PUQE-24 can therefore be used in assessing the degree of distress experienced by pregnant women. We further found that the amount of liquid intake significantly correlates with women's well-being scores. Because well-being scores strongly correlate with PUQE-24 scores, PUQE-24 is also presumably predictive of the level of hydration in these women.

With respect to sleep, it is intuitive that women who achieve sufficient quality sleep feel better during the day. In our counselling, women are asked to state the number of hours they slept in the preceding 24 hours including naps, and whether that sleep was broken or good, to assess the quality of their sleep. The top reasons reported by women for broken sleep were frequent urination, young children waking up, anxiety, and lastly NVP. Hence one cannot expect the quality of sleep to correlate with the PUQE-24 score. Women with NVP will frequently lie down when feeling nauseated and they may take frequent naps rather than have a period of unbroken sleep. It should be noted that the most-prescribed anti-emetic therapy for NVP in Canada is Diclectin,[1–3] which contains the sedative antihistamine doxylamine. Use of a sedative will tend to distort the

correlation between the severity of NVP and sleep; in fact, better control of NVP with increasing use of Diclectin may be associated with more sleepiness.[7]

A major strength of our study is that the majority of women who call our NVP line are highly motivated to relieve their NVP symptoms. We are confident therefore about the accuracy of the personal information they provide for our counsellors, especially since the information is collected in real time and recall bias is not a confounding factor.[8] The validity of the PUQE scoring system has also been corroborated recently by other groups using it in clinical and research settings.[9,10]

CONCLUSION

The PUQE-24 appears to be a reliable tool for assessing the severity of NVP symptoms. The simplicity of its use and its specificity to NVP symptoms make it a valuable tool for health-care providers and researchers alike.

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