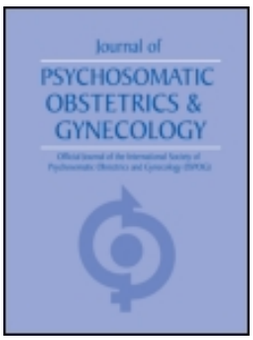

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ORIGINAL ARTICLE

Reliability and validity of three shortened versions of the State Anxiety Inventory scale during the perinatal period

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Abstract

The screening for anxiety in obstetric settings has been challenging due to time and knowledge constraints. Brief, valid, and reliable instruments can provide health care professionals with a quick and easy method to assess anxiety. Three six-item forms of the State Anxiety Inventory scale have been constructed. The purpose of this study was to evaluate and compare the psychometric properties of these short versions in the perinatal period. Data were drawn from a longitudinal pregnancy cohort in Alberta, Canada. Internal consistency of the shortened versions was assessed. Confirmatory factor analysis was conducted to estimate and compare indicators of fit during pregnancy and at 4 and 12 months postpartum. All shortened scales demonstrated high internal consistency and reliability, with alphas ranging from 0.81 to 0.85. All fit indices were greater than 0.93, implying a good fit between each model and our data. In the model comparisons, the Marteau and Bekker scale provided a more robust fit to data obtained during pregnancy and the early postpartum period. At 12 months postpartum, the Chlan et al. form demonstrated the best fit of the three versions. The shortened scales appear to have acceptable psychometric properties. Brief scales have the potential to provide an economical means of assessing perinatal anxiety and can be considered as equivalent alternatives to the full-scale version.

Keywords

Factor analysis, perintatal anxiety, screening, State–Trait Anxiety Inventory scale

History

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Background

Anxiety is a common mental health problem during the perinatal period, with estimated rates ranging from 6% to 36% [1,2]. Antenatal anxiety is linked to several adverse maternal and child outcomes with long-term consequences. Elevated levels of anxiety during pregnancy are associated with preterm birth and low birth weight [3–5]. Anxiety during pregnancy is also a powerful predictor of postpartum depression [6–8] as well as subsequent cognitive, behavioral, and psychomotor development and mental health problems in children [9–12]. Considering these associations, identifying and managing antenatal anxiety may improve maternal and child outcomes, particularly because non-pharmacologic options, such as cognitive-behavioral therapy, are effective in managing anxiety in the perinatal period.

The American College of Obstetricians and Gynecologists (ACOG) recommends that pregnant women be routinely screened for psychosocial problems at each trimester [13]. The implementation of such recommendations in practice, however, remains a challenge. In 2008, Coleman et al. conducted a study among active members of the ACOG to determine the screening patterns for and knowledge of antenatal anxiety. They found that although the majority of the respondents had moderate to high interest in screening for anxiety, only one-fifth of the practitioners screened pregnant women for anxiety by using a clinical intake form or asking their own questions about anxiety [14]. In this study, the lack of time and resources and inadequate training about mental health problems were identified as the primary obstacles hindering anxiety assessment in obstetric settings [14]. A recent systematic review of the barriers to the screening and treatment of perinatal depression has revealed similar findings [15]. To promote the screening of perinatal mental health issues, time and training barriers to screening anxiety in obstetric settings should be addressed. Brief, valid, and reliable instruments that can be administered in a few minutes and do not require specialized training for interpretation provide health care professionals with a quick and easy method to assess anxiety.

The development of an anxiety screening tool specific to the pregnant population requires further research. Results of a

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recent review of measures of pregnancy-specific stress that included anxiety measures suggested that current tools are more suitable to identify the source of anxiety during pregnancy than screening for anxiety [16]. There are a number of general anxiety instruments that have been evaluated and validated for use during the perinatal period. Meads and Ayers conducted a systematic review to evaluate self-report measures that have been validated with perinatal women. They conclude that the State–Trait Anxiety Inventory (STAI) shows discriminant and predictive validity and is a robust tool to assess anxiety in perinatal samples [17]. The STAI is a measure of anxiety that has been used extensively in the health field. The scale (STAI Form X) was developed by Spielberger et al. in 1970 and was revised in 1983 (STAI Form Y) [18]. Since then, STAI Form Y has been used worldwide and translated into more than 50 languages [19]. The scale is a reliable measure of anxiety as it covers several domains of generalized anxiety disorder, as defined in the DSM-IV [20]. The STAI has been validated against clinical interviews during both pregnancy and the postpartum period and has been found to have acceptable sensitivity, specificity, and predictive values to identify cases of anxiety among the perinatal population [17,21]. Grant et al. validated the STAI against a clinical interview using the Mini-Plus International Neuropsychiatric Interview. They reported that a cut-off >40 on both state and trait scales yield a sensitivity of 80.95%, a specificity of 79.75%, a positive predictive value of 51.5%, and negative predictive value of 94.00% to detect cases of anxiety in the third trimester of pregnancy.

The STAI consists of two subscales: state anxiety and trait anxiety. The STAI-State anxiety scale assesses how an individual feels at the present time, whereas the STAI-Trait anxiety scale evaluates a person's general state of calmness. Spielberger has defined state anxiety as ''a temporal cross-section in the emotional stream-of-life of a person, consisting of subjective feelings of tension, apprehension, nervousness, and worry, and activation or arousal of the autonomic nervous system'' [22, p.10]. The STAI-Trait anxiety scale and the STAI-State anxiety scale (STAI-S) each consist of 20 items, including 10 anxiety-present items and 10 anxiety-absent items. Each item is rated on a 4-point Likert scale from 1 (not at all) to 4 (very much so).

Various shortened versions of the STAI-S using 4, 6, 8 or 10 items from the original scale have been constructed using explanatory factor analysis. In the literature, six-item versions appear to have better validity and reliability than 4-item scales and to be comparable with 8- or 10-item scales [23]. Three different six-item forms of the STAI-S have been constructed. Marteau and Bekker developed the first six-item STAI-S using anxiety-present items 3, 6, and 17 and anxiety-absent items 1, 15, and 16, retaining the original scale's two-factor model [23]. Chlan et al. created another six-item scale using anxiety-present items 9, 12, and 17 and anxiety-absent items 5, 10, and 20 [24]. More recently, Abed et al. created a different six-item scale using items 5, 6, 9, 12, 15, and 16 of the STAI-S [25].

If any of these shortened versions is proven to be as valid and reliable as the original scale for use in the perinatal population, the shortened scale could be considered a viable alternative to the full-length scale. Few studies, with relatively small sample sizes, have been conducted to evaluate the reliability and validity of the shortened scales developed by Marteau and Bekker and Chlan et al. Their findings support the shortened 6-item versions being valid instruments to use in intensive care patients, general medical practice patients, and parent samples [26–28]. No study has evaluated the psychometric properties of the shortened form developed by Abed et al. in different populations, and only one study has compared the psychometric properties of the other two shortened versions [28]. Although Marteau and Bekker's version was developed using a sample of pregnant women, to the best of our knowledge, no additional studies have examined and compared the validity and reliability of these three shortened scales during pregnancy to determine their suitability for use in different samples. Therefore, the purpose of this study is to evaluate and compare the psychometric properties of these three short versions of the STAI-S anxiety scale during the perinatal period among a large representative sample of women in Calgary.

Methods

Data for this methodological study are drawn from the All Our Babies (AOB) study, a longitudinal pregnancy cohort in Alberta, Canada. The AOB study includes questionnaire data on maternal mental health, health care utilization, birth outcomes, and postpartum experiences. Recruitment for the AOB study started in 2008 and ended in 2010, and participants completed questionnaires during pregnancy and twice after delivery at 4 and 12 months postpartum. The cohort has been followed at yearly intervals. Participants provided informed consent that included the consent for data to be linked to medical records at the time of recruitment. The study was approved by the Conjoint Health Research Ethics Board of the University of Calgary. Detailed information about the cohort can be found in previous reports [29,30]. For the purpose of this study, we used data collected during the second trimester of pregnancy (<25 weeks) and at 4 and 12 months postpartum for women with singleton pregnancies. There were 3021 women who completed questionnaires during pregnancy and at 4 months postpartum. At 12 months postpartum, data were only secured from 1573 women due to funding and ethics timelines.

Data analysis

Descriptive statistics were used to describe the characteristics of the sample. Internal consistency was assessed for the full version and the three shortened versions using Cronbach's alpha coefficient for each data collection point. In addition, the item statistics (i.e. means and standard deviations), inter-item correlations, and item-total statistics (i.e. corrected item-total correlation and Cronbach's alpha if the item was deleted) were calculated for each shortened version at different time points. Correlations between the total score of each shortened version and the total score of the full version were examined for each time point. Descriptive analysis, item statistics and item-total statistics, Cronbach's alpha coefficient, and correlation analyses were conducted using IBM SPSS Statistics version 19.0.0.1 (Chicago, IL).

Given that depression has been shown to correlate with anxiety in previous studies, we assessed concurrent validity by examining the correlation of the total score of each shortened scale with depression as measured by the Edinburgh Postnatal Depression Scale (EPDS). The Edinburgh Postnatal Depression Scale (EDPS) is a 10-item self-reported questionnaire that measures postpartum depression. A score of 13 or greater is recommended for the identification of women with symptoms of major depression. The scale has good validity and reliability, with an internal consistency of 0.87 [31].

The validity of the three shortened versions was assessed using confirmatory factor analysis. Nine confirmatory factor analyses using the maximum likelihood (ML) estimation technique were performed in LISREL, version 9.1 (Skokie, IL) to estimate and compare indicators of fit for the three shortened forms of the STAI-S during pregnancy and at 4 and 12 months postpartum. At each assessment point, three hypothesized models were tested to determine which shortened version fit our data better. Consistent with the two-factor structure of the original scale, each model consisted of two factors: anxiety absent and anxiety present. In the 20-item version, each factor contained 10 items, and in the three shortened versions, each factor contained three items. Factor loading matrices were generated for each model at each of the three time points. The proportion of participants with missing values was low in our sample (4%). Thus, a listwise deletion approach was used to address the missing data.

Both model fit and model comparison indices were reported. As the chi-square model-fit criterion is sensitive to a large sample size and to departures from multivariate normality of the observed variables [32], we used Goodness-of-Fit (GFI) and Adjusted-Goodness-of-Fit (AGFI) indices to examine the fit of each of the three shortened versions with our data.

No ideal index to evaluate model fit exists yet as each index has its own limitations. To overcome this problem, it has been recommended not to rely on a single index in model evaluations and to report various indices to assess model fit or compare models [33]. Therefore, we also reported the Root-Mean-Square Residual Index (RMR) and the Root-Mean-Square Error of Approximation (RMSEA) to examine model fit. The RMR evaluates the closeness of the population covariance matrix to the sample covariance. RMR values closer to zero are desirable and indicate a better fit. As this index has no defined acceptable level, it is considered an appropriate index to compare the fit of the different models using the same data. For the RMSEA, values less than 0.08 indicate a good model fit. To compare models, the Non-Normed Fit index (NNFI), also known as the Tucker-Lewis index, and the Comparative Fit Index (CFI) were examined.

Results

Sample characteristics

The majority of participants were Caucasian, married or in a common-law relationship, and had some or completed post-secondary education. Approximately half of the participants had previously given birth to a child, and 36% were pregnant for the first time. The sample characteristics are summarized in Table 1 and represent the pregnant and parenting population of an urban center in Canada [30].

Table 1. Sample characteristics $N = 3021$.

Variable	*n* (%)
Maternal age	
• ≤24	183 (6.2)
• 25–34	2095 (71.1)
• ≥35	670 (22.7)
Ethnicity	
• Non-Caucasian	610 (20.4)
• Caucasian	2385 (79.6)
Income	
• $39,999 or less	223 (7.7)
• $40,000 – 79,999	619 (21.3)
• $80,000 or more	2063 (71.0)
Education	
• High school or less	295 (9.8)
• Some or completed post-secondary	2702 (90.2)
Marital status	
• Not married	141 (4.7)
• Married/Common-law	2855 (95.3)
Gravida	
• No previous pregnancy	1067 (35.6)
• Previous pregnancy (at least once)	1931 (64.4)
Parity	
• No previous births	1458 (48.9)
• Previous birth to a fetus (at least once)	1524 (51.1)
Gestational age	
• <37 weeks	211 (7.0)
• 37–40 weeks	2192 (73.2)
• >40 weeks	592 (19.8)

Reliability

Table 2 presents measures of internal consistency and item statistics for the full version and for each shortened version at each data point. The Cronbach's alpha coefficients of the original scale at all assessment points were very high, ranging from 0.91 to 0.93. All shortened forms demonstrated high internal consistency reliability, with alphas ranging from 0.81 to 0.85. The correlations between the total score of each shortened version and the total score of the original scale are presented in Table 2. All correlation coefficients were greater than 0.93 at the three time points.

For each shortened scale, the correlations between each item and overall score (corrected item-total scale correlation coefficients) were examined to check for homogeneity of the scale and item discrimination. In a homogenous scale, if respondents score high on one item, they are expected to have higher total scores. All corrected item-total scale correlation coefficients for the shortened scales were positive and above the acceptable level of 0.20, ranging from 0.48 to 0.74 (Table 3). These findings indicate that all items contributed to the overall score of the scale. Cronbach's alpha coefficients of the shortened versions were also assessed after removing each item from the scale. The deletion of the items from the scales did not increase the Cronbach's alpha of the scale at any time point.

Validity

All three shortened scales had strong, positive, significant correlations with a related construct, the EPDS score

(Pearson r ranging from 0.67 to 0.77), at each time point, providing evidence of their concurrent validity (Table 2). The standardized loadings for each of the shortened versions across the data points are presented in Table 4. In the Marteau and Bekker shortened form, the standardized factor loadings ranged from 0.74 to 0.88 for the anxiety-absent factors and from 0.58 to 0.76 for the anxiety-present factors. The standardized factor loadings for the Chlan et al. form ranged from 0.70 to 0.83 for the anxiety-absent factors and from 0.72 to 0.79 for the anxiety-present factors. These values for the Abed et al. version were 0.77 to 0.88 and 0.54 to 0.83, respectively. Interestingly, in the Marteau and Abed version, the anxiety-absent items had slightly higher factor loading values than the anxiety-present items. This difference was less evident for the Chlan scale, which might be due to the different item compositions of each shortened scale. The highest loading item for the anxiety-absent factors in both the Marteau and Bekker and Abed et al. versions was ''being relaxed'' at all data points. In the Chlan et al. version, ''feeling pleasant'' had the highest factor loading, both during pregnancy and at 12 months postpartum, and ''feeling comfortable'' had the highest loading at 4 months postpartum. ''Feeling anxious'' had the highest factor loading among the anxiety-present factors for both the Abed et al. and Chlan et al. versions, and ''being tense'' had the highest loading for the Marteau and Bekker version at all data points. The factor loadings appear to be homogeneous across the three time points for each of the shortened scale and this lends reassurance to the validity of the findings.

Table 2. Reliability statistics.

	Pregnancy	4 Months postpartum	12 Months postpartum
Cronbach's Alpha			
20-Item SAI	0.91	0.93	0.93
Marteau and Bekker Version	0.84	0.84	0.85
Chlan et al. Version	0.81	0.85	0.84
Abed et al. Version	0.83	0.84	0.84
Items Mean			
20-Item SAI	1.54	1.52	1.55
Marteau and Bekker Version	1.56	1.55	1.57
Chlan et al. Version	1.58	1.49	1.55
Abed et al. Version	1.53	1.50	1.53
Correlations with Full-Version			
Marteau and Bekker Version	0.944	0.944	0.950
Chlan et al. Version	0.937	0.953	0.952
Abed et al. Version	0.937	0.951	0.950
Correlations with EPDS[a]			
20-Item SAI	0.718	0.769	0.758
Marteau and Bekker Version	0.665	0.713	0.705
Chlan et al. Version	0.665	0.733	0.718
Abed et al. Version	0.665	0.723	0.707

All associations were significant (p value < 0.001).

The fit of each brief scale with our data was determined and compared on the basis of several indices: GFI, AGFI, RMR, RMSEA, NNFI, and CFI. GFI, AGFI, NNFI, and CFI values greater than 0.90 to 0.95 indicate a good model fit [32]. The fit indices from the confirmatory factor analyses are presented in Table 5. All fit indices were greater than 0.93, implying a good fit between each model and our data. In the model comparisons, during pregnancy and at 4 months postpartum, all fit index values were consistently higher for the Marteau and Bekker scale than for the other two versions. In contrast, at 12 months postpartum, the Chlan et al. version demonstrated the best fit of the three versions.

Discussion

This study was conducted to describe and compare the psychometric properties of three shortened versions of the STAI-State anxiety scale during pregnancy and the postpartum period in a community sample of women in Alberta,

Table 3. Item and item-total statistics.

	Pregnancy			4 Months postpartum			12 Months postpartum		
Item	M (SD)	Cronbach's alpha if item deleted	Corrected item-total correlation	M (SD)	Cronbach's alpha if item deleted	Corrected item-total correlation	M (SD)	Cronbach's alpha if item deleted	Corrected item-total correlation
Marteau and Bekker									
SAI1-calm	1.59 (.71)	0.80	0.653	1.59 (0.73)	0.813	0.652	1.61 (0.73)	0.811	0.691
SAI15-relaxed	1.83 (.81)	0.79	0.712	1.85 (0.83)	0.798	0.721	1.92 (0.86)	0.803	0.732
SAI16-content	1.61 (.77)	0.80	0.645	1.61 (0.77)	0.810	0.666	1.72 (0.82)	0.809	0.702
SAI3-tense	1.52 (.72)	0.81	0.594	1.51 (0.74)	0.816	0.636	1.47 (0.70)	0.825	0.618
SAI6-upset	1.23 (56)	0.82	0.550	1.25 (0.58)	0.838	0.521	1.20 (0.52)	0.847	0.497
SAI17-worried	1.60 (.75)	0.83	0.526	1.51 (0.74)	0.832	0.556	1.51 (0.72)	0.836	0.563
Chlan et al.									
SAI5-ease	1.65 (0.77)	0.767	0.621	1.66 (0.81)	0.813	0.670	1.72 (0.82)	0.802	0.662
SAI10-comfortable	1.69 (0.76)	0.784	0.549	1.56 (0.73)	0.814	0.665	1.69 (0.77)	0.802	0.661
SAI20-pleasant	1.69 (0.78)	0.774	0.590	1.61 (0.76)	0.816	0.655	1.75 (0.82)	0.802	0.661
SAI9-anxious	1.46 (0.70)	0.782	0.555	1.38 (0.67)	0.824	0.614	1.37 (0.64)	0.816	0.597
SAI12-nervous	1.40 (0.66)	0.791	0.511	1.24 (0.56)	0.832	0.577	1.25 (0.54)	0.827	0.541
SAI17-worried	1.60 (0.75)	0.776	0.583	1.51 (0.74)	0.826	0.603	1.51 (0.72)	0.817	0.587
Abed et al.									
SAI5-ease	1.65 (0.77)	0.783	0.663	1.66 (0.81)	0.799	0.689	1.72 (0.82)	0.796	0.679
SAI15-relaxed	1.82 (0.80)	0.777	0.688	1.85 (0.83)	0.800	0.688	1.93 (0.86)	0.783	0.735
SAI16-content	1.61 (0.77)	0.788	0.640	1.61 (0.77)	0.799	0.687	1.72 (0.82)	0.788	0.712
SAI6-upset	1.23 (0.56)	0.810	0.546	1.25 (0.58)	0.833	0.510	1.20 (0.52)	0.834	0.482
SAI9-anxious	1.47 (0.70)	0.807	0.551	1.38 (0.67)	0.818	0.597	1.37 (0.64)	0.816	0.583
SAI12-nervous	1.40 (0.67)	0.818	0.492	1.24 (0.56)	0.827	0.556	1.25 (0.54)	0.829	0.511

Table 4. Factor loadings for each of the shortened versions across the data points.

	Pregnancy		4 Months postpartum		12 Months postpartum	
Item	Anxiety absent	Anxiety present	Anxiety absent	Anxiety present	Anxiety absent	Anxiety present
Marteau and Bekker						
SAI1-calm	0.747		0.744		0.754	
SAI15-relaxed	0.860		0.860		0.876	
SAI16-content	0.749		0.764		0.814	
SAI3:tense		0.714		0.759		0.736
SAI6-upset		0.653		0.616		0.581
SAI17-worried		0.630		0.655		0.681
Chlan et al.						
SAI5-ease	0.761		0.778		0.780	
SAI10-comfortable	0.700		0.803		0.799	
SAI20-pleasant	0.777		0.792		0.825	
SAI9-anxious		0.726		0.767		0.794
SAI12-nervous		0.727		0.739		0.741
SAI17-worried		0.719		0.727		0.728
Abed et al.						
SAI5-ease	0.784		0.783		0.774	
SAI15-relaxed	0.832		0.812		0.879	
SAI16-content	0.779		0.804		0.828	
SAI6-upset		0.610		0.580		0.535
SAI9-anxious		0.750		0.769		0.826
SAI12-nervous		0.688		0.724		0.718

Table 5. Model fit and model comparison indices.

	Pregnancy	4 Months postpartum	12 Months postpartum
GFI			
Marteau and Bekker Version	0.987	0.994	0.981
Chlan et al. Version	0.984	0.991	0.991
Abed et al. Version	0.975	0.990	0.987
AGFI			
Marteau and Bekker Version	0.967	0.985	0.951
Chlan et al. Version	0.959	0.976	0.976
Abed et al. Version	0.935	0.975	0.965
RMR			
Marteau and Bekker Version	0.0215	0.0152	0.0277
Chlan et al. Version	0.0346	0.0222	0.0251
Abed et al. Version	0.0451	0.0273	0.0377
RMSEA			
Marteau and Bekker Version	0.0668	0.0428	0.0802
Chlan et al. Version	0.0749	0.0545	0.0534
Abed et al. Version	0.0930	0.0547	0.0660
NNFI			
Marteau and Bekker Version	0.980	0.992	0.973
Chlan et al. Version	0.969	0.988	0.988
Abed et al. Version	0.958	0.986	0.981
CFI			
Marteau and Bekker Version	0.989	0.996	0.986
Chlan et al. Version	0.984	0.993	0.993
Abed et al. Version	0.978	0.992	0.990

Canada. All six-item scales demonstrated good internal consistency and reliability across the data points. Our findings are consistent with those of studies conducted in different populations. Court et al. examined the psychometric properties of the six-item scale developed by Marteau and Bekker in 297 general medical clinic patients and reported good psychometric properties for this short-version. More recently, Perpina-Galvan et al. examined the reliability and validity of the six-item version developed by Chlan et al. in 80 patients receiving invasive mechanical ventilation [34]. Similarly, they reported satisfactory reliability and validity for this brief scale. In our sample, the Cronbach's alpha coefficients for the Marteau and Bekker version were comparable with those values obtained in the original study by Marteau and Bekker and were slightly higher than those reported in later studies by Tluczek et al. and by Court et al. For the scale developed by Chlan et al., our Cronbach's alpha coefficients were slightly higher than those of previous studies [27,28]. The overall scores of the 6-item scales were highly correlated with the scores obtained from the 20-item STAI-S. These findings were consistent across pregnancy and postpartum periods.

Evidence of strong correlations between the score of each shortened scale and the concurrent values of depression were shown for all assessment points. The confirmatory factor analyses provided evidence of construct validity in the shortened versions in the perinatal population, in which all shortened scales demonstrated a good fit for our study data. These results may reflect the excellent content validity of the original STAI-S for measuring anxiety symptoms, with all items making a substantial contribution to the measurement of the concept. According to Spielberger, each item in the State-S anxiety scale has been selected based on demonstrated construct validity by producing higher scores during stressful situations and lower scores after relaxation training [34].

Although all brief scales demonstrated acceptable levels for fit indices in our study, the results of confirmatory factor analyses showed that the scale constructed by Marteau and Bekker best fit our STAI-S data in the pregnancy and early postpartum periods compared with the shortened versions constructed by Abed et al. and by Chlan et al. These results were expected, as this brief scale was developed using a sample of pregnant women. At 12 months postpartum, however, the scale developed by Chlan et al. provided a better fitting model than the other two brief scales. These results may be explained by the fact that each shortened scale may assess different aspects of anxiety. As noted by Tluczek et al., the Marteau and Bekker scale evaluates cognitive, future-oriented and anticipatory aspects of anxiety that might be more evident during pregnancy and the early postpartum period. The Chlan et al. version evaluates anxiety symptoms related to immediate and ongoing circumstances, such as those related to parenting and raising a toddler.

Tluczek et al. compared the reliability and validity of the Marteau and Bekker scale with the Chlan et al. shortened scale in 228 parents at 2, 6 and 12 months after the birth of their infant. Similar to our study, they found that Marteau and Bekker's version in the early postpartum period had better indices of validity, internal consistency and reliability than Chlan's version. In contrast to our findings, they reported better validity for the Marteau and Bekker version compared with Chlan's version at 12 months postpartum. This discrepancy might be attributed to differences in the sample compositions as the sample in Tluczek's study was composed of both male and female participants whereas our sample included only women.

The strengths of the current study include a large community-based sample and measurement of anxiety at three time points across the perinatal period. A limitation of this study is the decrease in the sample size to almost half of the population at 12 months due to study process issues,

which raises the possibility of a selection bias for this time point. However, there were no differences in the sample characteristics between the sample at 12 months postpartum and the women who participated during pregnancy (data not shown), which provides us with increased confidence against this type of bias. The majority of women in our sample had high incomes and education levels, which may limit the generalizability of the findings to other demographic subgroups. However, our sample is representative of the pregnant and parenting population in urban Canada [30].

Based on these findings, we recommend the Marteau and Bekker shortened scale as an alternative brief measure of anxiety during both pregnancy and the early postpartum periods. Our findings also suggest that the scale created by Chlan et al. might be a slightly more accurate scale to use in women one year after delivery. Future studies are warranted to determine the most robust brief measure of anxiety during that time.

Conclusion

Anxiety is common during the perinatal period and is associated with adverse maternal and child outcomes, including postpartum depression, negative child temperament, and impaired executive functioning during childhood [6–12]. Given these impacts, the early detection of anxiety will provide key opportunities for interventions to improve pregnancy outcomes, postpartum mental health, and early childhood development. Most health professionals who work with pregnant women recognize its importance, yet the screening for anxiety in obstetric settings has been challenging due to time and knowledge constraints [14]. As a result, anxiety is an underdiagnosed mental health problem among the perinatal population. Spielberger's STAI scale is a valid and reliable tool to use in the perinatal population. The full STAI scale requires approximately 10 minutes to administer among adults [19]. Based on the findings of this study and those from previous research, the shortened versions appear to have acceptable psychometric properties. A six-item scale can be administered and scored in less than 5 minutes and requires minimal knowledge about mental health problems. Taken together, such brief versions have the potential to provide an economical means of assessing perinatal anxiety and can be considered as equivalent alternatives to the full-scale version. These advantages, in turn, may improve the feasibility of screening for anxiety among the perinatal population. In research, the use of shortened versions may decrease the research burden for potential participants and improve the participation rate. In conclusion, in our study, the Marteau and Bekker 6-item scale provided a more robust fit to data obtained during pregnancy and the early postpartum period compared with the other two shortened scales. Thus, it can be considered a concise alternative to the full version to use in this population. The recommendation for the specific STAI-S shortened scale to use during the late postpartum period calls for future research.

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Declaration of interest

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