Nursing Research • May/June 2011 • Vol 60, No 3, 158–164

Development and Validation of an Instrument to Assess Women's Toileting Behavior Related to Urinary Elimination

Preliminary Results

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- ***Background:*** Toileting behaviors have been implicated in women's bladder health; however, the lack of a standardized instrument to explore variations in women's toileting behaviors has contributed to an incomplete understanding about the effects of these behaviors on bladder health.
- ***Objectives:*** The aims of this study were to develop and initially validate an instrument, the Web-based Toileting Behavior (TB-WEB) scale, to assess behaviors women use when emptying their bladders.
- ***Methods:*** An initial 41-item instrument was developed after a comprehensive literature review and a concept analysis of women's toileting behavior related to urinary elimination. Seven experts with clinical or research experience in women's bladder health were selected to evaluate the content validity of each item and of the entire instrument. The psychometric properties of the TB-WEB scale were assessed using a Web-based survey with community-dwelling middle-aged women from June to August 2009. Construct validity and internal consistency were measured.
- ***Results:*** An 18-item scale was developed. Principal component analysis with varimax rotation revealed 5 underlying factors that explained 67% of the variance. Internal consistency reliabilities of the 5 subscales ranged from .70 to .88. The 5 subscales were premature voiding (5 items), straining voiding (4 items), place preference for voiding (4 items), delayed voiding (3 items), and position preference for voiding (2 items).
- ***Discussion:*** The TB-WEB scale shows reliability and initial validity to assess women's toileting behavior related to urinary elimination in community-dwelling middle-aged women. However, further testing is needed in other community-dwelling populations, as well as with hospitalized women, to strengthen its generalizability and to address areas for improvement.

- ***Key Words:*** bladder health · instrument development · toileting behavior · urinary elimination

Eliminating toxins and wastes from the body is the main function of the bladder. When the bladder fills with approximately 250 ml of urine, the need to void should be perceived (Boy et al., 2007; Wyndaele & De Wachter, 2002). This need causes people to seek a place to urinate. Under normal conditions, people voluntarily expel urine multiple times during the day. Voluntary emptying of urine is not only a physiological function but is also influenced by psychological and sociocultural factors (Palmer, 1994). Urinary continence helps to maintain physical and social integrity in most cultures.

A chain of behaviors occur with toilet use. These toileting behaviors may include seeking and accessing the toilet to empty the bladder, adopting a proper position, and emptying urine into the toilet or toilet receptacle (Mahoney, Wagenen, & Meyerson, 1971). Children are taught to urinate at a proper time and place when they are very young. Methods of toilet training, however, differ throughout the world (Bakker & Wyndaele, 2000; deVries & deVries, 1977; Michel, 1999; Schum et al., 2001), and because adults live and work in a variety of physical and sociocultural environments, they may develop different toileting behaviors.

Some toileting behaviors have been implicated in bladder dysfunctions, especially for women. Some women repress their desire to micturate until they feel they cannot hold their urine any longer (Bendtsen, Andersen, & Andersen, 1991; Wall, Norton, & DeLancey, 1993). Overdistension of the bladder may occur as a result (van Gool, 1995; Webster, Koefoot, & Sihelnik, 1984), which may contribute to voiding dysfunction (Saito & Miyagawa, 2001) or infection (Wall et al., 1993). On the other hand, some women develop a habit of voiding very frequently to reduce the potential for an incontinent event (Naoemova, De Wachter, & Wyndaele, 2008). Too frequent voiding makes the bladder sensitive to smaller volumes of urine (Sampselle, 2003), which could exacerbate bladder dysfunction (Barker & Mitteness, 1988). Voiding when crouching or hovering over the toilet to avoid sitting down does not allow the pelvic floor to relax, sometimes resulting in poor bladder emptying with residual urine

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DOI: 10.1097/NNR.0b013e3182159cc7

(Moore, Richmond, Sutherst, Imrie, & Hutton, 1991). Research with 32 healthy women (age, $M \pm SD = 49 \pm 6$ years) revealed that 42% used abdominal straining to void on cystometry, and straining was their usual voiding style even when they voided in the privacy of their homes (Pauwels, De Laet, De Wachter, & Wyndaele, 2006). Straining has been regarded as a risk factor of incontinence surgery failure (Iglesia, Shott, Fenner, & Brubaker, 1998). Thus, toileting behaviors play a role in bladder and lower urinary tract dysfunctions in women.

Urinary continence helps to maintain physical and social integrity in most cultures.

Studies from the United States, United Kingdom, Canada, Sweden, Japan, and China have shown that urinary incontinence and other lower urinary tract symptoms are prevalent in women, and prevalence tends to increases with age (Coyne et al., 2009; Homma, Yamaguchi, & Hayashi, 2006; Irwin et al., 2006; Zhu et al., 2009). Other studies have shown that behavioral treatments are effective for treating incontinence, including bladder training (Roe, Ostaszkiewicz, Milne, & Wallace, 2007; Wyman, Fantl, McClish, & Bump, 1998), timed voiding (Ostaszkiewicz, Roe, & Johnston, 2005), and habit training (Colling, Owen, McCreedy, & Newman, 2003; Eustice, Roe, & Paterson, 2000).

Given the potential impact of toileting behaviors on bladder health, clinicians need to assess these behaviors to provide education and interventions that promote bladder health. Voiding diaries, also called bladder records or frequency volume charts, are used widely as an objective and inexpensive method of recording lower urinary tract symptoms, measuring fluid intake and urinary output. Voiding diaries can range from relatively simple frequency records of the number of voiding and incontinence episodes to more detailed records in which additional information, such as the voided volume, the number of voiding and type of fluids taken in, is collected (Abrams & Klevmark, 1996). Although several researchers have investigated the reliability of diaries (Groutz et al. 2000; Tincello, Williams, Joshi, Assassa, & Abrams, 2007; Wyman et al., 1998), and voiding diaries provide clinically meaningful information, completion of these records can be time-consuming and burdensome (Tincello et al., 2007). Furthermore, voiding diaries focus only on the fluids taken in, toilet times and voided volumes, and number and volume of leakage. Diaries fail to capture the critical aspects of toileting behavior related to urinary elimination. The lack of standardized instruments to explore variations in women's toileting behaviors has contributed to an incomplete understanding of the effect of these behaviors on bladder health.

The aims of this preliminary study were to (a) develop a standardized instrument to assess toileting behaviors women used to empty their bladders (Web-based Toileting Behavior [TB-WEB] scale) and (b) preliminarily validate the TB-WEB scale in a sample of middle-aged women. The purpose of the study was to facilitate further study about the relationship between toileting behavior and bladder health and to aid in the development and evaluation of interventions designed to modify toileting behaviors to improve women's bladder health.

Methods

This study was conducted in four phases: (a) conceptual framework construction, (b) instrument item development, (c) content validity evaluation, and (d) psychometric evaluation of the instrument with middle-aged women living in the community.

Conceptual Framework Generation

To capture the multiple dimensions of women's toileting behavior related to urinary elimination, the content domains were delineated through concept analysis. Four conceptual domains of TB-WEB scale were identified: behaviors related to voiding place, voiding time, voiding position, and voiding style. The concept analysis details and results are reported elsewhere (Wang & Palmer, 2010).

The following five conceptual domains of the TB-WEB scale were identified for item development. Voiding place preference behavior was defined as the behaviors women use regarding their preference of place to urinate. Voiding time was divided into premature and delayed voiding. Premature voiding behavior was defined as women's behaviors that lead them to void often, including before the sensation of the need to void. Delayed voiding behavior refers to behaviors women use to inhibit the voiding urge and to put off voiding. Voiding position preference behavior refers to the posture women use to urinate. Voiding style refers to the manner in which women empty their bladders.

Instrument Generation

Based on the previously mentioned conceptual framework and review of the available literature, a pool of 41 items was drafted. Multi-item scales for each domain were used to reduce measurement error. The responses to each item were graded on a 5-point scale indicating how often women use the behavior (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *always*). To reduce the potential response bias of women agreeing with a statement, the direction of each item wording was varied. Ten items were worded positively, and 31 items were worded negatively. The higher the score, the more negative behavior women engaged in emptying their bladders.

Content Validity Evaluation

To evaluate individual items as well as the entire instrument, seven research and clinical practice experts from three countries (Australia, United Kingdom, and United States) were selected as panel members based on the following criteria: (a) expert with relevant research experience in women's bladder health, (b) clinical expertise in women's bladder health, (c) expertise with developing or using conceptual frameworks, and (d) research or clinical expertise in women's bladder health from different geographic locations.

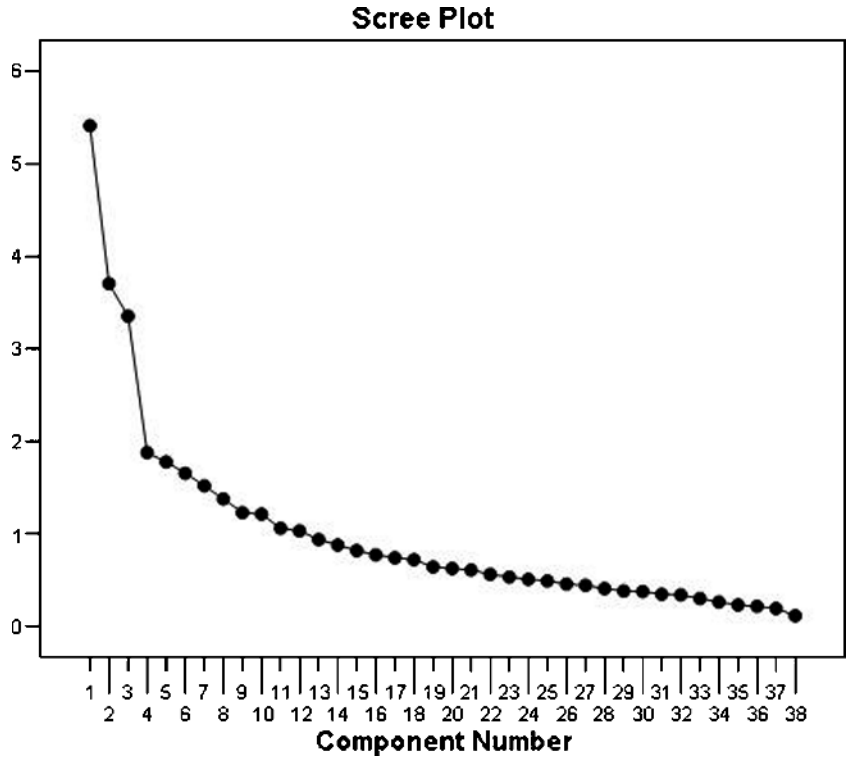

FIGURE 1. Scree plot of factors putatively comprising the Web-based Toileting Behavior scale.

These expert panel members were asked to rate the clarity, relevance, and representativeness of each item in terms of the underlying conceptual framework on a 4-point scale (4 = *very relevant and succinct*, 3 = *relevant but needs minor revision*, 2 = *unable to assess relevance*, and 1 = *not relevant*; Lynn, 1986). The content validity index (CVI) for relevance and representativeness was calculated for each item (item-level CVI, the proportion of experts who score the item as content valid defined as a rating of 3 or 4) and for the entire scale (scale CVI, the proportion of items on an instrument that achieved a rating of 3 or 4 by all experts). The experts were asked if any items or areas had been omitted from the instrument.

Based on the feedback from all of the expert panel members, seven items were revised for clarity, five items were deleted based on an item-level CVI lower than .78 (Polit, Beck, & Owen, 2007), and two items were added. The scale CVI was .93. No area was identified by the experts as being missing from the instrument. As a result, a draft of the TB-WEB scale containing 38 items with five domains underwent subsequent psychometric evaluation.

Preliminary Psychometric Properties Evaluation

Participants and Procedure A Web-based survey was conducted during the month of June to August 2009 with a convenience sample of community-dwelling middle-aged women who were employees of a large university and academic medical center system. The inclusion criteria for the study were as follows: (a) women aged 40 to 64 years, (b) women who had at least an elementary school education and could read English, (c) women who were able to complete the online questionnaire independently, and (d) women who were not pregnant. Survey design software (Qualtrics.com) was used to develop the Web survey. Fifty items (demographic information, health history, and the 38 TB-WEB scale items) were used in this Web-based survey. An advertisement calling for participation in the study was sent via e-mail through the university mass mail system,

TABLE 1. Eigenvalues and Variance Explained by the 18-Item Web-Based Toileting Behavior Scale

Subscale	Factor loading	Eigenvalues	% of Variance	Cumulative %
Premature voiding	.78–.85	3.46	19	19
Straining voiding	.74–.91	2.87	16	35
Place preference for voiding	.66–.79	2.18	12	47
Delay voiding	.75–.81	1.93	11	58
Position preference for voiding	.86	1.66	9	67

and the Web-based address for the survey was inserted into the advertisement. Women who were eligible and willing to participate in the Web-based survey were asked to complete and return it within 8 weeks.

Data Analysis The SPSS software (Version 12) was used for data analysis. Descriptive statistics were used to display the distributions of participants' individual characteristics. Reliability was assessed using the Cronbach's alpha coefficient to measure internal consistency. Content validity was evaluated using the standard proposed by Lynn (1986) for CVI >.78. Structure validity was tested by conducting principal components analysis with varimax rotation to obtain evidence regarding the internal structure of the survey items related to toileting behavior. Criterion-related validity was examined by exploring differences in the global and factor scores between continent and incontinent women; independent group statistical analysis was used.

The findings suggest that the instrument captures multiple important domains of women's toileting behaviors.

Ethical Considerations

The study was approved by the university's institutional review board. Receipt of returned Web-based questionnaires was taken as informed consent. The participants were assured that their responses would be confidential and anonymous.

Results

Participant Characteristics

A total of 297 middle-aged women completed the Web-based survey; 47 were excluded from the analysis because they had omitted three or more items in the survey. The age of the 250 remaining participants ranged from 40 to 64 years ($M \pm SD$ = 51.2 ± 6.8 years). Most (87.2%) were Caucasian, and 75% reported that they experienced involuntary urinary leakage at least once during the past month.

Structure Validity of the Instrument

Principal components analysis with varimax rotation was performed to determine underlying factor structure and whether items should be removed. The Kaiser–Meyer–Olkin measure of sampling adequacy was .75, which would be considered middling by Kaiser (1974). However, the results of Bartlett's test indicated that there were significant correlations among the 38 items (χ^2 = 3,371.20, df = 703, p < .001) and supporting the factorability of the correlation matrix. Criteria for inclusion of an item on a factor were a minimum loading of .40 and at least .10 difference from other loadings. Alpha values and item–total correlation were determined to evaluate the effects of item deletion.

The initial principal components analysis yielded 12 factors with eigenvalues >1. All 12 components accounted for 66% of the entire variance. Upon examining the Scree plot (Figure 1), a clear "elbow" was seen at four factors, and that directed the subsequent analysis: Solutions between three and five factors were examined. After examination of the three solutions, the five-factor solution was determined to be the best solution because most of the loadings on factors were high (>.40), there were fewer double loadings than the other solutions, and it was conceptually consistent with the initial theoretical framework.

Of the 38 TB-WEB items, 18 items comprised the five factors, which explained 67% of the total variance (Table 1). The first factor, premature voiding, accounted for 19% of the variance and consisted of five items, such as "I empty my bladder without feeling a need to urinate, but do so just in case." The second factor, straining voiding, accounted for 16% of the variance and consisted of four

TABLE 2. Subscale Comparison Between Continent and Incontinent Women

Subscales	Group (n)	$M \pm SD$	t	p
Premature voiding	Continent (62)	8.20 ± 3.10	1.39	>.05
	Incontinent (188)	8.86 ± 3.32		
Straining voiding	Continent (62)	6.87 ± 2.83	2.12	<.05
	Incontinent (188)	7.79 ± 3.31		
Place preference for voiding	Continent (62)	10.41 ± 3.05	2.24	<.05
	Incontinent (188)	11.37 ± 2.90		
Delay voiding	Continent (62)	7.76 ± 1.82	2.70	<.01
	Incontinent (188)	8.49 ± 1.92		
Position preference for voiding	Continent (62)	3.79 ± 1.39	2.07	<.05
	Incontinent (188)	4.23 ± 1.62		
Total scale	Continent (62)	37.02 ± 6.52	3.79	<.01
	Incontinent (188)	40.72 ± 7.03		

items, such as "I push down to keep the urine flowing during the urinating process." The third factor, place preference for voiding, accounted for 12% of the variance and consisted of four items, such as "I try to empty my bladder at my home." The fourth factor, delay voiding, accounted for 11% of the variance and consisted of three items, such as "I wait to empty my bladder until I cannot hold my urine any longer." The fifth and final factor, position preference for voiding, accounted for 9% of the variance and consisted of two items, such as "I crouch (hover) over the toilet when I empty my bladder."

The reliability of the instrument is supported by an acceptable internal consistency.

Criterion-Related Validity

The results of independent group statistical analysis of variance showed that the incontinent women had significantly higher mean scores in the global and four of the five factor scores compared with the continent women (Table 2).

Item Analysis and Reliability

All subscales had an interitem correlation above .30, with four subscales above .40. Within a subscale, most item-total correlations fell within the recommended .30 to .70 range (Ferketich, 1991), with two items having some item–total correlations greater than .75. The Cronbach's alpha values of the five subscales range from .70 to .88 (Table 3).

Discussion

The 18-item toileting behavior instrument described in this article showed good content validity, construct validity, and internal consistency. Items and hypothesized scales were selected based on a comprehensive literature review and a concept analysis of women's toileting behavior related to urinary elimination. The findings suggest that the instrument captures multiple important domains of women's toileting behaviors.

The results of factor analysis identified five dimensions of the TB-WEB scale, providing preliminary evidence in support of the conceptual framework. These factors accounted for 67% of the total variance, suggesting good construct validity. The subscale position preference for voiding contained only two items. This subscale was retained, however, because voiding position was found to be a component of toileting behavior in the concept analysis, and clinical research has shown that crouching or hovering over the toilet negatively influences bladder health (Moore et al., 1991). The five subscales reflect where, when, and how women empty their bladders of urine. The differences in the global and factor scores between continent and incontinent women showed that the TB-WEB instrument was able to discriminate toileting behavior between these groups.

The reliability of the instrument is supported by an acceptable internal consistency. The satisfactory levels of interitem and item–total correlations suggest that the items are sufficiently related. Internal consistency satisfied the minimum recommended level for reliability of Cronbach's coefficient alpha (>.70; Polit & Beck, 2004), with Cronbach's alpha values between .70 and .88.

There were several limitations to this study due to selection bias and the convenience sampling strategy used. Despite efforts to recruit a wide range of participants, continent women may have had less interest in completing the survey than did incontinent women; there was high self-reported prevalence of urinary incontinence among the respondents. Although the number of respondents was more than six times the number of items in the scale, a larger sample would have allowed for confirmatory factor analysis to explore the scale's structure. The instrument was developed and tested initially in a single sample of community-dwelling middle-aged women from a large academic and medical center system, and they may not reflect characteristics of the women in the general population with bladder control problems. Further testing is needed in other community-dwelling populations, as well as with hospitalized women. In addition, a pencil–paper version of this instrument is planned, including test–retest to examine the instrument stability over time in the same population. A pencil–paper version will allow nurses and other clinicians to use the instrument when assessing the impact of women's toileting behavior on lower urinary tract function.

Conclusions

In preliminary testing, the TB-WEB instrument showed reliability and initial validity as a measure of the toileting

TABLE 3. Descriptive Statistics, Item Analysis, and Reliability for the Five Subscales (n = 250)

Subscales	*M* ± *SD*	Interitem correlations (range)	Item–total correlations (range)	Cronbach's α
Premature voiding	1.75 ± 0.11	.53–.69	.69–.75	.88
Straining voiding	1.91 ± 0.06	.48–.84	.58–.82	.86
Place preference for voiding	2.81 ± 0.61	.34–.45	.47–.55	.71
Delay voiding	2.79 ± 0.25	.41–.46	.50–.54	.70
Position preference for voiding	2.01 ± 0.16	.58	.58	.73

behaviors women use to empty their bladder. After further study, this instrument will allow researchers and clinicians to assess women's toileting behavior objectively, analyze the relationship between toileting behavior and bladder health, and develop and evaluate the effects of an intervention designed to modify toileting behaviors that promote female bladder health. Readers interested in learning more about the TB-WEB should contact the first author. ▼

Accepted for publication January 5, 2011.

Thank you to Dr. Mary Lynn for her thoughtful suggestions in instrument content validation and her invaluable feedback on an earlier draft of this manuscript. Thank you also to Dr. Teresa Edwards and Dr. Cathy Zimmer for their consultation on survey development and data analysis and the University of North Carolina Odum Institute for providing Qualtrics.com software to develop our Web-based survey.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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