Development and Testing of the Urinary Incontinence Scales

Jane Schade Henderson
Maisie Schmidt Kashka

An estimated 13 million adults in the United States are incontinent at an annual cost of over $16 billion. At least 80% could be helped or cured if treated or referred appropriately (Fantl et al., 1996). Nurses have an obligation to know about and take action in the detection, treatment, and referral of urinary incontinent adults and to examine their own attitude and belief toward incontinence. No prior study has investigated these issues in professional nurses. Salient points to be addressed in this article include the role of nursing in incontinence care and research, the conceptual framework and research question addressed by this study, and methodological development, reliability, and validity of the newly developed Urinary Incontinence Scales. Finally, results are reviewed and perceived contributions of this study are considered.

Role of Nursing in Incontinence Care and Research

The phenomenon of interest in this study is urinary incontinence (UI) in adults defined as “involuntary loss of urine that is sufficient to be a problem” (Fantl et al., 1996, p. 8). Incontinence is a major clinical problem and a significant cause of disability and dependency (U.S. Department of Health and Human Services [USDHHS], 1988, 1990). Agency for Health Care Policy and Research (AHGPR) guidelines (Fantl et al., 1996; Urinary Incontinence Guideline Panel, 1992) identified UI in adults as a national priority in the United States and a target “all practitioners who encounter urinary incontinence, with the primary outcome of elimination or reduction” (Fantl et al., 1996, p. 8).

Incontinence is a presumed attribute of adulthood. Why, then, is UI in adults left untreated, under treated, or mistreated? Lay people report a poor understanding of the causes and/or the success of treatment (Ashworth & Hagan, 1993; Dolman, 1995; Goldstein, Hawthorne, Engeberg, McDowell, & Burgio, 1992; Mitteness, 1990; Norton, MacDonald, Sedgwick, & Stanton, 1988). Incontinent adults find the condition embarrassing (Norton et al., 1988; Rai, Kiniors, & Wientjes, 1994; Wyman, Harkins, & Fantl, 1990) and a cause of withdrawal from social activities (Grimby et al., 1993; Lee, Reid, Saltmarche, & Linton, 1995; Lukaz, 1995; Wyman, Mclish, Ory, & Fantl, 1992). The Urinary Incontinence Scales were developed to measure RNs’ attitude, belief, practice, and knowledge about urinary incontinence in adults. The purpose of this article is to introduce the scales and discuss their development and testing. These scales include the Urinary Incontinence Attitude Scale, the Urinary Incontinence Belief Scale, the Urinary Incontinence Practice Scale, and the Urinary Incontinence Knowledge Scale. Evaluation using confirmatory factor analysis showed the attitude, belief, and practice scales to be reliable and valid. Reliability of the knowledge scale was slightly lower than desired using both Cronbach’s alpha coefficient and squared multiple correlation. While the hypothesized measurement model demonstrated acceptable goodness-of-fit, further testing is needed for generalizability of findings.

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Notes: The authors wish to thank Carol A. Brink, MPH, RN; Molly Dougherty, PhD, RN; Therese Dowd, PhD, RN; Katherine F. Jeter, EdD; Linda S. Mitteness, PhD; and Jean F. Wyman, PhD, RN, for serving as content experts for this project. This article is a report of part of the dissertation of the first author who wishes to acknowledge the assistance of the other members of her dissertation committee, Margaret Beard, PhD, RN, and Patti Hamilton, PhD, RN. The second author was the dissertation chair.
1992) and decreased self-esteem (Dowd, 1991). Incontinence status is often not addressed by health care professionals (McFall, Yerkes, Belzer, & Cowan, 1994) or is perceived by the client as being of little interest when reported (Rosenzweig, Hischke, Thomas, Nelson, & Bhatia, 1991).

Most urinary incontinence can be helped by strategies within the realm of nursing practice, such as bladder training and pelvic muscle exercise, or through appropriate referral for medication or surgery. “A critical component of the [AHCPR] guideline is the acknowledgment of the importance of nurses in the management of urinary incontinence” (Jacobs, 1994, p.7). Formal and continuing education for nurses is reportedly lacking, with content regarding urine control problems emphasizing containment rather than treatment and cure and often being presented only vicariously as related to other subjects such as aging (Cheater, 1992; Morishita, Uman, & Pierson, 1994; Wilce, 1987). Cheater (1992) states, “In spite of considerable advances in the management of urinary incontinence, in recent years, pre- and post-registration education is still focused predominantly upon palliative rather than therapeutic or rehabilitative nursing strategies” (p. 328). Nursing research emphasis is on early detection and treatment (Brooks, 1995; Engberg, McDowell, Burgio, Watson & Belle, 1995; Pearson & Kelber, 1996; Ravalli & Bettschneider, 1996). Results reflect an ongoing interest and success in the role of nursing in the care of adults with UI.

The following questions influenced conceptualization of this project: (a) What is the role played by nurses in evaluation, treatment, and referral of adults with urinary incontinence? and (b) What part do attitude, belief, and knowledge about incontinence play in defining that role? These questions led to conceptualization of nurses’ attitude, belief, practice, and knowledge regarding UI in adults. An eclectic conceptual framework grew from a shared belief among many disciplines, including nursing, that you feel about something (attitude and belief) and what you learn (knowledge) ultimately influence what you do (practice) (see Figure 1).

**Research Questions**

The need for developing four new instruments initiated the research question addressed by this article: Are the newly developed instruments reliable and valid measures of nurses’ attitude, belief, practice, and knowledge related to UI in adults? Attitude was seen as a predisposed perspective which influences nurses’ thoughts, feelings, perceptions, and behaviors toward care of adults with UI. Belief was understood as a theoretically conceptualized conviction or expectation regarding UI in general. Practice was seen as actions identified in the AHCPR guideline (Urinary Incontinence Panel, 1992; Fantl et al., 1996) as being within the capability and scope of RNs of all educational levels. Knowledge was conceptualized as the comprehension and understanding of acquired facts or information about UI in adults. Review of literature and personal communication with experts yielded no existing measures of the constructs as conceptualized. The Urinary Incontinence Scales were, therefore, operationalized as four investigatively developed measures: the Urinary Incontinence Attitude Scale, the Urinary Incontinence Belief Scale, the Urinary Incontinence Practice Scale, and the Urinary Incontinence Knowledge Scale.

To furnish support for validity and reliability of the four newly developed instruments, a nonexperimental descriptive
design with causal inference was employed. Confirmatory factor analysis examined a hypothesized measurement model of relationships of latent variables to each other and to their indicators and error variance of the observed variables.

**Population and Sample**

The population from which the sample was drawn was 1,309 nurses residing in Denton County, Texas, and registered with the Board of Nurse Examiners for the State of Texas. A random sample of 700 was drawn with 126 usable surveys returned and used for data analysis.

Respondents ranged in age from 28 to 64 years (mean, 43.5 years). Ninety-four percent were white with the remaining 6% being African American, Asian, and Hispanic. Nurses in the sample were similar to Texas nurses as a whole in age and race/ethnicity (Texas Nurses’ Association, 1994). Work setting differed between sample nurses and Texas nurses in general in these ways: hospital (sample, 57%; Texas nurses, 67%); home health (sample, 11%; Texas nurses, 0.6%), and long-term care (sample, 10%; Texas nurses, 3%). Forty-nine percent of sample nurses practiced at a staff nurse level as compared to 60% of Texas nurses. More than twice as many sample nurses (58%) than Texas nurses (28%) held managerial positions. Some nurses in both groups held both staff nurse and supervisory positions. Twice as many respondents (8%) than Texas nurses (4%) identified themselves as “advanced practice nurses.”

**Methods**

Four pencil-and-paper instruments were developed: the Urinary Incontinence Attitude Scale, the Urinary Incontinence Belief Scale, the Urinary Incontinence Practice Scale, and the Urinary Incontinence Knowledge Scale. Demographic information was gathered to describe the study sample and to allow future comparison across studies. Collectively, the measures were known as the Urinary Incontinence Scales. Item development was based on information gathered over a 15-year period during which the first author had been active in assimilating and contributing to the body of knowledge regarding urinary incontinence through literature review, clinical practice, research, publication (Henderson, 1980, 1983, 1988, 1989; Henderson & Taylor, 1987; Taylor & Henderson, 1986), formal presentation, formal education, and collegial exchange. Item development was followed by face and content validation.

**Face validity.** Generation of items, formatting of the measure, etc. took approximately 9 months. Before undertaking a formal content validation process, feedback from 11 nurses was solicited to further evaluate items and format. Both verbal and written feedback was sought. Each instrument was revised based on this feedback.

**Content validity.** Evidence of content validity “...is obtained from three sources: the literature, representatives of the relevant populations, and content experts” (Burns & Grove, 1993, p. 343). Prior discussion emphasized ongoing review of literature spanning a decade and a half. Invaluable pragmatic input into content of the instruments was gleaned from 10 years of clinical practice, accumulated clinical notes, both anecdotal and formal, and interviews with potential respondents during the process of instrument development.

**Content experts.** Content experts were chosen for their overall expertise and research experience in the area of UI in adults. Additionally, proficiency and a record of publication in either clinical research in UI or the study of attitude regarding UI in adults was sought. Seven experts agreed to evaluate the instruments for content validity. Six returned usable packets.

**Evaluation criteria.** The item pool within each domain was sent to content experts. Study variables and their relationships were delineated. Experts were asked to evaluate each item as it related to the construct of interest using the following four-point scale: 1 = not relevant, 2 = unable to assess, 3 = needs minor revision, and 4 = very relevant (Lynn, 1986). They were also asked to make suggestions for minor revisions, assess all items in each domain which were considered “needing minor revision” or “very relevant” as to whether or not they adequately represented the domain of interest, suggest additional questions or needed content areas, and assess instructions for readability and clarity.

Items which five of the six experts judged as 3 (needing minor revision) or 4 (very relevant) were considered content valid items within the domain of interest (Lynn, 1986). The content validity index (CVI) was used to quantify the extent of agreement between the experts regarding content validity of each instrument as a whole (Lynn, 1986; Waltz, Strickland, & Lenz, 1991). Changes in format and in individual items were made in accordance with suggestions of experts. Twenty items were accepted as the Urinary Incontinence Attitude Scale, 23 items as the Urinary Incontinence Belief Scale, 25 items as the Urinary Incontinence Practice Scale, and
24 items as the Urinary Incontinence Knowledge Scale. Thus, in response to suggestions and comments by experts, 92 items and 22 demographic questions were retained. Placement of the 114 items was carefully considered and the Urinary Incontinence Scales in their final format were sent to the six experts who then approved the final measures. Selected items from the Urinary Incontinence Scales appear in Table 1.

**Setting** Data were gathered via a mail survey from a random sampling of RNs who resided in Denton County, Texas. According to the 1990 census, the county had a population of 212,792 with 67,473 and 47,846 people residing in the two largest cities. It is part of a southwestern metropolitan area of over 3,000,000 and is identified as a county in which low-income, indigent, or underinsured families are poorly served by the health care community.

<table>
<thead>
<tr>
<th>Table 1. Selected Items From the Urinary Incontinence Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urinary Incontinence Attitude Scale</strong></td>
</tr>
<tr>
<td>• Nurses should be knowledgeable enough to care for clients with urinary incontinence.</td>
</tr>
<tr>
<td>• Compared with other health conditions, a client’s urinary incontinence is a low priority.</td>
</tr>
<tr>
<td>• Nurses should ask patients if they have urinary incontinence.</td>
</tr>
<tr>
<td><strong>Urinary Incontinence Belief Scale</strong></td>
</tr>
<tr>
<td>• Urinary incontinence is a heavy burden for men who have it.</td>
</tr>
<tr>
<td>• With urinary incontinence it is hard to be sociable.</td>
</tr>
<tr>
<td>• Having urinary incontinence does not decrease self-esteem in women.</td>
</tr>
<tr>
<td><strong>Urinary Incontinence Knowledge Scale</strong></td>
</tr>
<tr>
<td>• Medication can help treat some urinary incontinence.</td>
</tr>
<tr>
<td>• Obesity can contribute to urinary incontinence.</td>
</tr>
<tr>
<td>• About one-third of older Americans living in the community have urinary incontinence.</td>
</tr>
<tr>
<td><strong>Urinary Incontinence Practice Scale</strong></td>
</tr>
<tr>
<td>In my practice setting I, personally:</td>
</tr>
<tr>
<td>• Explore the amount of continent voids (a tablespoon, a cup, etc.).</td>
</tr>
<tr>
<td>• Inquire as to alterations in bowel habit.</td>
</tr>
<tr>
<td>• Ask about use of pads, briefs, or other protective devices.</td>
</tr>
</tbody>
</table>

Nurses residing in the county practice nursing throughout the metropolitan area; however, 65% of respondents practiced in their county of residence.

**Data Collection and Analysis**

After approval of the proposed study by the university human subjects review committee, data were collected via an anonymous mail survey. Packets contained a letter of introduction, the Urinary Incontinence Scales, a resource booklet used as an incentive, and a stamped, addressed return envelope in which to mail the survey. Two weeks after the first mailing a followup letter was sent as a reminder to all nurses to whom the survey was mailed.

**Pilot study.** Fifty-five of 200 nurses returned pilot surveys. Twenty-one (38%) were usable. Nurses were asked to return survey forms whether or not they met participant criteria. Two criteria decreased respondent eligibility. The first, that respondents practice nursing in their county of residence, was a holdover from a previous design and was unnecessary to the present study. The other criterion directed nurses to complete the survey only if they cared for people 65 years and older. “Adult” was redefined as anyone 18 or older and an item dealing with older clientele was added in the demographics section. While UI may be more problematic for older persons, recent studies indicate in younger women the prevalence is similar to that of their older counterparts (Kulpa, 1996; Scowen, 1996; Turan, Zorlu, Ekin, Hancerlioullari, & Saracoğlu, 1996; Wilson, Herbison, & Herbison, 1996). Thus, current research supports this expanded definition which increased respondent eligibility and added an important dimension to data collected.

**Full study.** From a mailing of 700, 126 usable surveys were returned and used for data analysis. When computing a covariance matrix, Jöreskog (1993) recommends the following formula for determining adequate sample size for confirmatory factor analysis using LISREL: \( k(k+1)/2 \) where \( k \) is the number of indicator variables. The tested model had eight indicators (see Figure 2); therefore, a sample of 126 would be considered adequate using this criterion.

**Data Analysis**

Employing listwise deletion for missing data, exploratory data analysis using PRELIS 2.12 (Jöreskog & Sörbom, 1993b) for the personal computer included item and scale means, standard deviations, skew, kurtosis, and item frequencies. PRELIS 2.12 was also used to estimate correlated relationships item-to-scale,
item-to-item, and subscale-to-subscale. SPSS 6.1 (SPSS, Inc., 1994) executed Cronbach’s alpha and exploratory factor analysis on each scale. The subscale-to-subscale correlation matrix was entered into the program and LISREL 8.12a (Jöreskog & Sörbom, 1993a) for the personal computer, executed confirmatory factor analysis.

To facilitate discussion of the findings, results of exploratory factor analysis, method for formulation of summative indicators, and reliability determination using Cronbach’s alpha coefficient and squared multiple correlation will be described. Reliability and exploratory data analysis will be considered for each scale separately. Confirmatory factor analysis for validity, multicollinearity, and goodness-of-fit will be discussed.

Exploratory factor analysis. Exploratory factor analysis employed both principal components and maximum likelihood extractions, each with oblique and varimax rotation. Analyses failed to delineate extractable, theoretically logical, or unique factors on any of the instruments. This is not unexpected in item pools developed as summative measures for a single construct (Nunnally, 1978). Following a single-factor maximum likelihood extraction, deletion of items with item-to-scale correlations of below 0.3 and 0.7 and above (Nunnally, 1978), each scale was treated as summative affording each item equal weight in the summed total of its respective scale as no item was considered more important than another.

Summative indicators. Each scale was designed as summative; however, in confirmatory factor analysis, model identification necessitates more than one indicator for each construct. To satisfy identification require-

ments, two nearly parallel summative indicators were developed for each scale from items within the respective scale. The method used is reported by Brooke, Russell, and Price (1988), Mathieu (1991), and Mathieu and Farr (1991). Items with highest and lowest item-to-scale correlations were assigned to the first indicator; items with the second highest and second lowest item-to-scale correlations were assigned to the second indicator. This procedure continued alternately assigning the high and low correlations to one indicator and then the other until all items were distributed. Odd numbers of items in the attitude and practice scales left one remaining item designated by coin toss. Following the division process, each scale had two nearly parallel, summative indicators: The Urinary Incontinence Attitude Scale had ATTITUDEA and ATTITUDEB, the Urinary Incontinence Belief Scale had BELIEFA and BELIEFB, the Urinary Incontinence Practice Scale had ACTIONSA and ACTIONSB, and the Urinary Incontinence Knowledge Scale had FACTSA and FACTSB (see Figure 2).
Table 2. Cronbach’s Alpha Coefficients for All Measures and Subscales and Squared Multiple Correlations for Subscales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Alpha</th>
<th>Subscale</th>
<th>Alpha</th>
<th>Multiple $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary Incontinence</td>
<td>0.8425</td>
<td>ATTITUDEA</td>
<td>0.7224</td>
<td>0.96</td>
</tr>
<tr>
<td>Attitude Scale</td>
<td></td>
<td>ATTITUDEB</td>
<td>0.7325</td>
<td>0.85</td>
</tr>
<tr>
<td>Urinary Incontinence</td>
<td>0.8002</td>
<td>BELIEFA</td>
<td>0.7948</td>
<td>0.85</td>
</tr>
<tr>
<td>Belief Scale</td>
<td></td>
<td>BELIEFB</td>
<td>0.7873</td>
<td>0.98</td>
</tr>
<tr>
<td>Urinary Incontinence</td>
<td>0.9039</td>
<td>PRACTICEA</td>
<td>0.7794</td>
<td>0.72</td>
</tr>
<tr>
<td>Practice Scale</td>
<td></td>
<td>PRACTICEB</td>
<td>0.8486</td>
<td>0.97</td>
</tr>
<tr>
<td>Urinary Incontinence</td>
<td>0.6409</td>
<td>FACTSA</td>
<td>0.4296</td>
<td>0.50</td>
</tr>
<tr>
<td>Knowledge Scale</td>
<td></td>
<td>FACTSB</td>
<td>0.5202</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Reliability: Cronbach’s alpha and squared multiple correlations. Although Cronbach’s alpha coefficient is the most commonly used reliability coefficient, a drawback is it makes no allowances for correlated errors of similar measures or the effects of more than one latent variable on any observed variable (Bollen, 1989). An advantage of squared multiple correlation over Cronbach’s alpha coefficient is it measures all influences on observed variables including effects of multiple latent or observed causes and/or correlated error (Bollen, 1989). Data analysis of reliability estimates in this study included both Cronbach’s coefficient alpha and squared multiple correlation. The closer coefficient alpha and squared multiple correlation approach 1.00, the higher the reliability of the measure (Bollen, 1989; Jöreskog & Sörbom, 1989; Nunnally, 1978).

Urinary Incontinence Attitude Scale

Items on the Urinary Incontinence Attitude Scale concerned nurses’ attitude toward care of the incontinent adult. Negatively stated items were recoded for scoring. Possible answers on the six-point Likert scale ranged from “strongly agree” to “strongly disagree.” As the scale was summative, the item-to-scale correlations were examined and all items falling below the recommended 0.3 were eliminated (Nunnally, 1978). Three items were excluded based on this criterion. Remaining item-to-scale correlations ranged from 0.4245 to 0.6990. Seventeen items remained in the Urinary Incontinence Attitude Scale affording a possible score range from 17, indicating the most negative attitude, to 102 for the most positive. The scale provided data to evaluate nurses’ attitude toward care of incontinent adults. Two subscales, ATTITUDEA and ATTITUDEB, were formed using Brooke et al.’s (1988), Mathieu’s (1991), and Mathieu and Farr’s (1991) method of defining nearly parallel measures.

Reliability: Alpha for the Urinary Incontinence Attitude Scale was 0.8425. Subscale ATTITUDEA had an alpha coefficient of 0.7224 and ATTITUDEB, 0.7325. All were above 0.7 recommended by Nunnally (1978) for newly developed instruments. Squared multiple correlations of subscales of the Urinary Incontinence Attitude Scale were 0.96 (ATTITUDEA) and 0.85 (ATTITUDEB). Table 2 relates all alpha coefficients of reliability and squared multiple correlations of subscales for all measures.

Frequencies, mean, standard deviation, skew, and kurtosis. The highest obtainable score for the Urinary Incontinence Attitude Scale was 102 with a mean of 78.34, standard deviation of 9.28, and a range of 57 to 102. Scores were significantly negatively skewed ($z = -0.358; p < .01$) indicating a more positive than negative attitude of nurses in the study toward care of the client with UI. Nonsignificant kurtosis ($z = 0.170; p < .01$) indicated variance of scores in this sample did not differ significantly from a normal distribution.

Urinary Incontinence Belief Scale

Twenty-three items composed the original Urinary Incontinence Belief Scale. Item-to-scale correlations below 0.3 (Nunnally, 1978) eliminated six items with remaining correlations ranging from 0.3124 to 0.6917. While using the same six-point Likert scale scoring as for the Urinary Incontinence Attitude Scale, scoring for the Urinary Incontinence Belief Scale was conceptually different. The higher the score the
stronger the belief that UI in general carries with it undesirable consequences. Score range on the 18 remaining items was 18 to 108. Items on this scale were also recoded so a highest score on each item and the total were indicative of a strong belief that UI in general has undesirable consequences for those who have it. The scale provided data to evaluate nurses’ belief about UI in general. Two nearly-parallel subscales of the Urinary Incontinence Belief Scale were formulated (BELIEFA and BELIEFB) using the method previously described.

**Reliability:** Alpha for the Urinary Incontinence Belief Scale with this sample was 0.8002. Subscale alpha co-efficient for BELIEFA was 0.7948 and 0.7873 for BELIEFB. All were above 0.7 as recommended by Nunnally (1978) for newly developed instruments. Squared multiple correlations of subscales of the Urinary Incontinence Belief Scale were 0.85 (BELIEFA) and 0.98 (BELIEFB).

**Frequencies, mean, standard deviation, skew, and kurtosis:** The highest obtainable score on the Urinary Incontinence Belief Scale was 108 and the lowest, 18. The mean for this sample was 77.6, standard deviation was 9.79, and scores ranged from 27 to 108. Scores revealed a significant negative skew ($z = -0.612; p \leq .01$) indicating nurses in this sample shared the belief that UI in general is undesirable. Significant kurtosis ($z = 1.081; p \leq .01$) indicated a leptokurtic (more peaked than normal) distribution of scores.

**Urinary Incontinence Practice Scale**

Instructions read, “In the ACTIONS section, I will be asking you how frequently (always, usually, sometimes, never) you would actually do specific things in your practice setting.” The responses formulated a four-point format with three points for a response of “always,” two points for “usually,” one point for “sometimes,” and zero points for “never.” A total of 25 items composed the original scale. Item-to-scale correlations for the 19 remaining items ranged from 0.3774 to 0.6987. The highest obtainable score was 57 and the lowest was 0. The scale provided data to evaluate self-reported practice of nurses with regard to UI in adults. Two nearly parallel subscales, ACTIONSA and ACTIONSB, were formulated for the Urinary Incontinence Practice Scale using Brooke et al.’s, (1988), Mathieu’s (1991), and Mathieu and Farr’s (1991) method described previously.

**Reliability:** Alpha for the scale was 0.9039. Subscale ACTIONSA had an alpha of 0.7794 and ACTIONSB, 0.8446. All were above 0.7 as recommended by Nunnally (1978) for newly developed instruments. Squared multiple correlations of subscales of the Urinary Incontinence Practice Scale were 0.72 (ACTIONSA) and 0.97 (ACTIONSB).

**Frequencies, mean, standard deviation, skew, and kurtosis:** The highest possible score on the Urinary Incontinence Practice Scale was 57, indicating the respondent always did each of the actions, to zero, meaning she/he never did any of them. The sample mean was 33.85, standard deviation was 11.39, and scores ranged from 3 to 55. A significant negative skew ($z = -0.455; p \leq .05$) indicated nurses sampled performed more of the actions than would be expected in a normally distributed population. Nonsignificant kurtosis ($z = -0.228; p \leq .05$) indicated a normal peak to the distribution of scores.

**Urinary Incontinence Knowledge Scale**

The Urinary Incontinence Knowledge Scale contained factually stated items addressed by respondents as “true,” “false,” or “uncertain.” This scale was the most psychometrically problematic. Of the original 24 items, 16 had item-to-scale correlations below 0.3. Correlations for eight remaining items ranged from 0.3002 to 0.4080. These eight items were then used for further analysis. With one point afforded each correctly answered item, the highest obtainable score for the revised scale was 8 and the lowest was 0. Two nearly parallel summative indicators, FACTSA and FACTSB, were formed using the previously described method.

**Reliability:** Internal consistency was determined using Cronbach’s alpha coefficient of reliability. Although respondents had a choice of three answers — true, false, and uncertain — only correct responses were scored as “1.” Incorrect and uncertain were scored as “0.” Thus, items on the Urinary Incontinence Knowledge Scale were analyzed as dichotomous using the Kuder-Richardson formula, the K-R 20, a special case of Cronbach’s alpha coefficient for dichotomous data. Subscale squared multiple correlations also served as a reliability estimate. Alpha for the scale was 0.6409, below the 0.7 recommended by Nunnally (1978). Alpha coefficients for the two subscales, FACTSA and FACTSB, were 0.4296 and 0.5202 respectively. Squared multiple correlations of subscales of the Urinary Incontinence Knowledge Scale were 0.50 (FACTSA) and 0.41 (FACTSB). Table 2 relates all alpha coefficients of reliability and squared multiple correlations of subscales. Lower reliability of this scale than for the
other three is reflected in both the coefficients alpha and the squared multiple correlations.

**Frequencies, mean, standard deviation, skew, and kurtosis.** The total possible score for the Urinary Incontinence Knowledge Scale was eight points. The mean was 5.83 points or 72.9% correct, standard deviation was 1.71, and scores ranged from no correct answers to all eight correct. The skew was significant and negative ($z = -.552; p \leq .01$) indicating scores of nurses in the sample were higher than expected in a normally distributed population. Significant negative kurtosis ($z = -0.609; p \leq .01$) indicated a platykurtic (flatter than normal) distribution of scores.

**Demographic Information**

Twenty-two items were used to demographically describe the respondents. Three items addressed the AHCP guideline (Fantl et al., 1996). Eleven nurses (9%) were aware of its existence; six (5%) indicated the guideline was available in his/her practice setting, and only three nurses (2%) said they used the publication. The remaining 19 items requested personal characteristics used to describe the sample and allow future comparison of research results.

**Confirmatory Factor Analysis**

The research question asked, “Are the instruments contained in the Urinary Incontinence Scales reliable and valid measures of nurses’ attitude, belief, practice, and knowledge related to urinary incontinence in adults?” Reliability was discussed in the previous section and was adequate for the attitude, belief, and practice scales. The knowledge scale fell somewhat short of desired reliability. Confirmatory factor analysis was applied to analyze two measurement models. The first model included all four constructs. As “reliability is a necessary but not sufficient condition for validity” (Nunnally, 1978, p. 192), a second model analyzed only attitude, belief, and practice. Discussion of results of confirmatory factor analysis will include validity of the measures, multicollinearity among the latent variables, and goodness-of-fit of the measurement models.

**Validity.** Inferred causal relationships were significant between all latent variables and the indicators designed to measure them (see Figure 2). This is the relative structural relation between the latent variables and their measures. Based on Bollen’s (1989) definition, these findings support validity of the observed variables. “For a measure to be valid, the latent and observed variable must have a direct link” (Bollen, 1989, p. 197). All latent variables had a significant direct link to their hypothesized indicators.

**Multicollinearity among latent variables.** Attitude was significantly related to the other three constructs and belief was significantly related to knowledge. Nonsignificant relationships existed between practice and knowledge and practice and belief.

**Goodness-of-fit statistics.** Goodness-of-fit (GOF) statistics indicate fit of the hypothesized models to the data (see Table 3). The GOF statistics for the measurement models indicate an acceptable fit of both models to the sample data. For the four-construct model, GOF statistics were as follows: chi-square, 22.82 ($p = 0.12; df = 17$); goodness-of-fit index (GFI), 0.95; adjusted goodness-of-fit index (AGFI), 0.89; a difference of 0.06 from the GFI; root-mean-

**Discussion**

The research question addressed in this article was: “Are the newly developed instruments reliable and valid measures of nurses’ attitude, belief, practice and knowledge related to urinary incontinence in adults?” Reliability was adequate for three scales: The Urinary Incontinence Attitude Scale, the Urinary Incontinence Belief Scale, and the Urinary Incontinence Practice Scale. The Urinary Incontinence Knowledge Scale was somewhat deficient. Validity, using Bollen’s (1989) definition, was supported for both the four-construct and the three-construct models. Multicollinearity among the latent constructs indicated a significant correlation between attitude and the other three constructs and between belief and knowledge. Model fit is an important evaluation and communication tool; however, model modification must consider theoretical soundness. Goodness-of-fit statistics were within acceptable ranges for both models indicating adequate fit of the models to the data. The three-construct model was more statistically sound than the four-construct model; however, elimination of the knowledge construct due to questionable reliability brings the theoretical soundness of the three-construct model into question.
### Table 3.
Summary of Goodness-of-Fit (GOF) Statistics for the Measurement Model

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
<th>Desired Value</th>
<th>Description</th>
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</thead>
</table>
| Chi-square (X^2)                 | 4-Construct Model: 22.82  
                               | 3-Construct Model: 10.99  
                               | p = 0.12  
                               | p = 0.20  
                               | df = 17  
                               | df = 9  
                               | Nonsignificant                  | Test of goodness-of-fit of the model to the data.  
                               | Nonsignificant                  | Nonsignificant X^2 GOF is desired indicating fit of the model to the sample data does not differ significantly from the population as a whole (Schumacker & Lomax, 1996). |
| Goodness-of-fit index (GFI)      | 0.95   | 0.96          | ≥ 0.90                        | Indicates good fit of model to data.  
                               |        |               |                               | Not affected by sample size.  
                               |        |               |                               | Robust against departure from normality (Lavee, 1988). |
| Adjusted goodness-of-fit index (AGFI) | 0.89   | 0.90          | ≥ 0.80                        | Adjusts GFI for degrees of freedom.  
                               |        |               |                               | Independent of sample size.  
                               |        |               |                               | Small differences in GFI & AGFI are desirable (Diamantopoulos, 1994). |
| Root-mean-square residual (RMR) | 0.056  | 0.065         | ≤ 0.10                        | Useful in comparing two different models for the same data (Diamantopoulos, 1994; Lavee, 1988). |
| Normed-fit index (NFI)           | 0.97   | 0.96          | ≥ 0.90                        | Computed by comparing X^2 for a null model that hypothesizes complete independence among measured variables.  
                               |        |               |                               | Not affected by sample size.  
                               |        |               |                               | Not affected by number of degrees of freedom (Brooke et al., 1988). |

*table continued on next page*
Table 3. (continued)

<table>
<thead>
<tr>
<th>Statistic</th>
<th>4-Construct Model</th>
<th>3-Construct Model</th>
<th>Desired Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum - modification index</td>
<td>5.00</td>
<td>4.78</td>
<td>≤ 5.0</td>
<td>Indicate which parameter specifications can be modified to improve fit of model to data (Jöreskog, &amp; Sörbom, 1989; Lavee, 1988).</td>
</tr>
<tr>
<td>Standardized residuals</td>
<td>-1.96 to 2.04</td>
<td>-1.96 to 1.65</td>
<td>≤ 2.58</td>
<td>Provide approximate correction for sample size effects and scaling differences (Bollen, 1989).</td>
</tr>
</tbody>
</table>

Unlike the other scales, responses on the Urinary Incontinence Knowledge Scale were either right or wrong; therefore, it is much different conceptually and empirically than the respondent-discre- tionary Urinary Incontinence Attitude, Belief, and Practice Scales. Further thought will be given to whether or not knowledge should be measured differently than the other three constructs, perhaps as a domain requiring mastery, if its effect is to be accurately evaluated. Contribution of the study to the theoretical development of the body of nursing knowledge about urinary incontinent adults includes providing a mechanism by which nurses can evaluate their attitude toward care, belief about incontinence in general, incontinence-related practice, and knowledge of acquired facts. While the knowledge scale requires further study, we believe the attitude, belief, and practice scales are ready for use with other population samples.

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