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## Development of a Tool to Assess Bladder *Health* Knowledge, Attitudes, and Beliefs (BH-KAB)

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In June 2007 the ICMJE adopted the WHO's definition of clinical trial: "any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects on health outcomes." No components of this work contained interventions and we did not assess any intervention's impact on health outcomes. Participant were included to assess the salience of items, question stems and responses during the survey development process. As such this was not a clinical trial and did not require registering as such.

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## Abstract

**Introduction:** Few instruments measure knowledge, attitudes, and beliefs (KAB) related to bladder health. Existing questionnaires have predominantly focused on KAB related to specific conditions such as urinary incontinence, overactive bladder, and other pelvic floor disorders. To address this literature gap, The Prevention of Lower Urinary Tract Symptoms Research Consortium (PLUS) developed an instrument that is being administered in the baseline assessment of the PLUS RISE FOR HEALTH longitudinal study.

**Methods:** The Bladder Health Knowledge, Attitudes, and Beliefs (BH-KAB) instrument development process consisted of two phases, item development and evaluation. Item development was guided by a conceptual framework, review of existing KAB instruments, and a review of qualitative data from the PLUS Consortium Study of Habits, Attitudes, Realities, and Experiences (SHARE). Evaluation comprised three methods to assess content validity and reduce and refine items: q-sort, e-panel survey, and cognitive interviews.

**Results:** The final 18-item BH-KAB instrument assesses self-reported bladder knowledge; perceptions of bladder function, anatomy, and related medical conditions; attitudes towards different patterns of fluid intake, voiding, and nocturia; the potential to prevent or treat urinary tract infections and incontinence; and the impact of pregnancy and pelvic muscle exercises on bladder health.

**Conclusion:** The PLUS BH-KAB instrument may be used independently or in conjunction with other KAB instruments for a more comprehensive assessment of women's KAB related to bladder health. The BH-KAB instrument can inform clinical conversations, health education programming, and research examining potential determinants of bladder health, LUTS, and related

behavioral habits (e.g., toileting, fluid intake, pelvic muscle exercises). Key words: Bladder Health, Survey Methodology, Women's Health, Lower Urinary Tract Symptoms, Primary Prevention

## INTRODUCTION

The Prevention of Lower Urinary Tract Symptoms Research Consortium (PLUS) was established to create the evidence base for bladder health promotion and lower urinary tract symptoms (LUTS) prevention in girls and women.<sup>1</sup> The PLUS Consortium defines bladder health as “a complete state of physical, mental, and social well-being related to bladder function and not merely the absence of LUTS,” with bladder function that “permits daily activities, adapts to short-term physical or environmental stressors, and allows optimal well-being (e.g., travel, exercise, social, occupational, or other activities).”<sup>2</sup>

Theory and evidence across decades of research support the importance of knowledge, attitudes, and beliefs (KAB) in shaping a variety of health behaviors, including eating, physical activity, sexual health behaviors, refraining from substance use or using substances in moderation, and injury-prevention behaviors.<sup>3,4</sup> Thus one hypothesizes that an individual's KAB around bladder health and lower urinary tract function may influence daily choices about toileting, activities, diet, and fluid intake, and therefore have significant impact on long-term bladder health. KAB may also shape perceptions of what is normal and influence when and how one changes behaviors such as self-management and treatment-seeking for early LUTS. A small body of literature suggests that knowledge deficits exist with respect to bladder health, as well as attitudes and beliefs that may lead to less than optimal bladder health behaviors (e.g., thinking it is normal to leak urine and not seeking treatment for symptoms).<sup>5–8</sup> Among its research aims, PLUS prioritized the assessment of women's bladder health and related KAB in planning their RISE FOR HEALTH (RISE) longitudinal study.<sup>9,10</sup> Understanding what women from varied backgrounds at different ages know, think, and believe about overall bladder health and not only LUTS will inform the development of bladder health promotion strategies and LUTS prevention interventions.

There are a limited number of validated instruments that measure KAB related to bladder health. Existing tools have predominantly focused on KAB related to LUTS such as urinary incontinence (UI) and overactive bladder, as well as other pelvic floor disorders. These instruments include the Urinary Incontinence Knowledge Scale (UIKS),<sup>11</sup> the Incontinence Quiz,<sup>12</sup> the Prolapse and Incontinence Knowledge Questionnaire (PIKQ),<sup>13</sup> and the Adolescent Bladder and Pelvic Health Questionnaire (ABPHQ).<sup>8</sup> Other KAB instruments were designed by researchers to meet specific study objectives and did not undergo a rigorous development process.<sup>14–18</sup> Collectively, these KAB instruments are limited by their focus on UI (e.g., etiology, relationship to aging, symptoms, impacts, prevention, treatment, and management); perceived bladder function norms and attitudes towards UI and treatment-seeking for urinary symptoms; toileting behaviors; and KAB and/or practices of pelvic muscle exercises in women with UI or who are pregnant or postpartum.<sup>5, 12–19</sup> Few instruments measure knowledge of pelvic anatomy and function,<sup>5</sup> or KAB about factors that influence overall bladder health such as dietary, hygiene, and voiding behaviors as opposed to only symptoms. Current KAB instruments are also limited by their focus on UI, populations studied, lack of a conceptual framework and operational definition of bladder

health guiding instrument design, and limited items measuring beliefs related to bladder health and factors that may influence bladder health.

To address limitations of prior instruments, PLUS developed an instrument that assessed KAB related to bladder health and function among women. This paper describes the process used to develop the KAB instrument and assess its face and content validity in women from varied backgrounds.

## METHODS

### 2.1 Overview

The Bladder Health Knowledge, Attitudes, and Beliefs (BH-KAB) instrument development process consisted of two phases, item development and evaluation (Figure 1). The item development phase was guided by a review of existing bladder- or pelvic floor-related KAB instruments, a review of qualitative data from the PLUS Consortium Study of Habits, Attitudes, Realities, and Experiences (SHARE),<sup>20</sup> and expert opinion. The evaluative phase comprised three methods to establish face and content validity and refine and reduce items: q-sort,<sup>21,22</sup> e-panel survey,<sup>23</sup> and cognitive interviews.<sup>24</sup> The transdisciplinary KAB workgroup conducting the development process contained members from medicine, nursing, midwifery, public health, psychology, women's studies, and psychometrics, including clinicians with expertise in LUTS care.

### 2.2 Item Development Phase

PLUS developed a conceptual framework to guide the development of items related to women's bladder health. This framework places individuals within an ecosystem of risk and protective factors, including interpersonal relationships (e.g., family influence), institutions (e.g., school and workplace environments), community (e.g., cultural norms), and societal structures that facilitate or constrain health. Within this framework, KAB are conceptualized as key individual-level determinants of health behaviors.<sup>25–27</sup> The KAB workgroup focused on KAB that may influence general knowledge about the bladder and related behaviors. The KAB instrument described in this article is intended to measure variation in KAB across women and inform future bladder health education efforts. It contains items to assess general knowledge about the bladder and selected KAB in relation to toileting behaviors, fluid intake, pregnancy, childbirth, and the pelvic floor.

**2.2.1 Literature Review and Expert Review of Initial Item Bank**—Initially, the KAB working group conducted a literature review to identify an existing bladder health KAB instrument or items that addressed four PLUS prioritized research topics (Table 1). This review identified 268 unique items from questionnaires derived from 32 papers on bladder related KAB. Most items focused on urinary incontinence and not bladder health. Existing questions from the literature were categorized based on the Consortium's research topics and questions relevant to KAB (Table 1) and KAB relative to bladder health function domains (storage, emptying, bioregulatory).<sup>2,28</sup> Among the items identified through the literature review, almost half were related to the prioritized research questions (n=131, 45%). Overall, nearly half assessed knowledge/beliefs (n=164, 49%), some described attitudes

(n=27, 10%), and the majority assessed one of the three bladder function domains (n=208, 78%). Once the items were compiled and categorized, non-KAB items and redundancies were eliminated and gaps in the item bank were identified. The KAB workgroup used an iterative process to develop new items and subsequently prioritized a revised set (n=133).

**2.2.2 Review of Codes from PLUS Focus Groups (SHARE)**—As foundational work for measuring bladder health and bladder health-related KAB, PLUS previously conducted the SHARE study.<sup>20,29</sup> Forty-four focus groups were held with 360 adolescent and adult women ages 11–93 years who were diverse with respect to age, race, ethnicity, geography, and socio-economic status. SHARE study methods are detailed elsewhere.<sup>20,30</sup> The review of SHARE codes aimed to identify common terminology and topics that were not previously captured by the literature review or working group augmentation of the item bank. Working group members who participated in the SHARE study, reviewed and identified codes related to KAB. Assessment of the following SHARE codes were conducted by two-person teams for each code: “Bladder Knowledge Acquisition,” “Bladder Knowledge,” “Bladder Assumptions and Beliefs,” “Fluid Intake,” and “I don’t know.” Review by each team prompted changes to language of existing KAB items and development of new items. After addition of items based on SHARE transcript review, the KAB item bank contained 154 unique items. The workgroup advanced items that were present in SHARE focus groups, had evidence for association with LUTS (e.g., weight gain or loss) based on working group knowledge of the literature, and/or were deemed a priority by expert clinician review. A resulting 112 items were forwarded to the evaluative phase.

### 2.3 Evaluative Phase

A three-stage approach assessed the relevance and content validity of the KAB items: q-sort, e-panel survey, and cognitive interviews. Institutional Review Board (IRB) approval for the q-sort and e-panel survey was obtained by the Scientific and Data Coordinating Center. Approval for the cognitive interviews was obtained from the IRBs at all four participating sites. The following sections detail the methodology for each approach.

**2.3.1 Q-sort Method via E-panel**—Q-methodology is way of extracting subjective opinions.<sup>31</sup> The primary technique of q-methodology is the q-sort, which involves rank-ordering a set of items from very strongly agree to very strongly disagree.<sup>32</sup> The item bank was quite large at the conclusion of the item development phase. Thus, the goal of the KAB q-sort was to narrow the large array of items to those bladder related topics that most resonated with participants, while also being judged to be meaningful by clinicians in the working group. Q-sort participants were recruited by Dynata (Shelton, CT), a marketing data service firm. Dynata invites potential respondents from an enrolled panel of members to complete a survey using a private and secure portal. We aimed to include respondents in each of four age groups: 18–25 years, 26–45 years, 46–64 years and >65 years. Respondents received a small incentive for completing e-panel surveys. One hundred and twelve participants formed this e-panel and completed the q-sort survey online using a specialized sorting program, QSortTouch ([www.qsorttouch.com](http://www.qsorttouch.com)).<sup>33</sup> Informed consent was obtained through Dynata, and demographic data of participants were collected. The q-sort technique was performed in two steps. First, participants followed a survey link where they

were asked to provide their level of agreement with items in a set of statements. Then, they sorted these statements into a grid based on level of agreement with the item according to specific prompts (e.g., Do you disagree or agree with the following statements about your bladder?). Although the number of grid boxes can vary in the q-sort technique, 9 grid boxes were chosen due to the number of items being sorted. In a q-sort, it is ideal to have only a small number of items in each grid box and to have approximately the same number of items in each box. Participants could not put more than 4 or 5 statements into any one of 9 grid boxes ranging from -4 (Very strongly disagree) to +4 (Very strongly agree) with respect to overall level of agreement. If participants neither agreed nor disagreed, they could sort items into a “Neutral or Unsure” box. In addition to the q-sort items, participants completed a small subset of e-panel survey questions that would be tested more fully during the survey stage.

Ninety-four statements were generated for the q-sort from the 112 items advanced to the evaluative phase. Several of the items were excluded because they did not convert well to statement form or were merged with another item. Three separate q-sets and corresponding prompts were constructed: (1) Do you agree or disagree with the following statements about your bladder? (52 items) (2) Which of the following things are good for your bladder and which are bad for your bladder? (25 items) (3) Which of the following are signs that your bladder is working well and which are signs your bladder is not working well? (17 items). Collectively, sets included topics on bladder function, medical conditions associated with bladder health, pelvic muscle function, pregnancy and bladder health, fluid consumption, voiding with urge, delayed voiding, and characteristics of urine. To decrease participant burden, q-sorting was divided between two groups of participants (n=60 and n=52); each group completed a subset of q-sort questions. Data from the sorting program were exported as a .csv file and analyzed using Ken-Q Analysis v. 1.0.6.<sup>34</sup>

**2.3.2 Survey Method via e-panel**—Items were reviewed by the working group after the q-sort. Thirty-eight prioritized items were advanced to a second evaluation method, a survey via e-panel that aimed to assure sufficient variation in responses. In addition, items assessing pelvic anatomy were introduced. Another Dynata e-panel with 1535 participants was recruited to receive a separate set of survey items that assessed variation in item response when using varying stems (i.e., questions) and response options. The workgroup recognized that the number of q-sort participants in the 18–25 year old group was insufficient. Sampling targets of equal distribution of all four age categories was set for the Survey e-panel. Additionally, we aimed to have half of the participants completing high school or less. Informed consent was obtained through Dynata, and demographic data of participants were collected. The e-panel process allowed for randomization of alternative stem and response options and efficient presentation of items. The distribution of responses was evaluated. The KAB working group selected items to advance to the cognitive interviewing stage for further assessment of language and concept understanding.

**2.3.3 Cognitive Interview Method**—Lastly, cognitive interviewing, an iterative process aimed to evaluate the survey items using a think-aloud method and verbal probing, was conducted to assure participants interpreted remaining items in the pool as

intended.<sup>35–37</sup> The working group reviewed the e-panel survey items and prioritized those that were advanced to interviews. Thirty-one women aged 18 and above were recruited from the four PLUS sites where IRB approval was obtained. Individuals were included who had female sex assigned at birth, fluent in written and spoken English (may be bilingual), age 18 years old, available for a virtual 2 hour interview and questionnaire completion, able to read and provide verbal or written consent, and access to a computer with internet, audio and video capabilities for participants completing their interviews virtually. Those who had physical or mental conditions that would impede participation in interviews or completion of questionnaires were excluded. Each site recruited women primarily from the community, but also from clinical settings. Throughout recruitment, strategies were adjusted to ensure a sample with a range of LUTS experiences and variation in age, race, ethnicity, and education.

Consent was obtained prior to one-on-one interviews, which were conducted using a secure virtual meeting platform. Interviewers presented items individually to participants and followed a standardized interview structure, including common probes to assess understanding of each item and unique probes to elicit feedback on specific items. Cognitive interviews were conducted using multiple rounds over 6 weeks to assess 69 items. The KAB working group reviewed item performance and each interviewee's comments weekly. This review informed edits and subsequent sets of items advanced to the following week's interviews. Saturation was reached on the 6<sup>th</sup> round after 31 interviews.

## RESULTS

As a result of the evaluative phase, the BH-KAB instrument was developed. The number of items considered at different stages of the process were as follows: q-sort (94 items), survey (38 items), and cognitive interview (69 items). Below, key findings from each stage of the evaluative phase are presented. Selective findings describe how specific items of the final Bladder Health Knowledge, Attitudes, and Beliefs (BH-KAB) instrument were influenced by evaluation data.

Table 2 contains distributions of sociodemographic variables across different stages of evaluation. The two older age groups (46–64, 65+) were overrepresented in q-sort samples. Age groups were more evenly distributed in survey and cognitive interview samples. Roughly 20% of q-sort and cognitive interview samples and 45% of the survey sample were comprised of women whose highest level of education was a high school degree or less. Remaining women were predominantly distributed across the associate's degree, bachelor's degree, or master's degree categories, with fewer women reporting a doctoral or professional degree or vocational or technical degree. While samples were predominantly White across all evaluation stages (58%–92%), greater racial/ethnic diversity was observed for the survey and cognitive interview samples. Twelve percent of the survey sample reported being Black or African American, and 13% reported being Hispanic. Thirteen percent of the cognitive interview sample reported being Asian, and 22% reported being Black or African American. Table 3 demonstrates that our participants represent the spectrum of LUTS.

### 3.1 Q-sort Key Findings

Examples of highest ranked factors included “Kegel exercises make your pelvic muscles stronger,” “My bladder holds urine,” and “My bladder releases urine.” In contrast, lowest ranked factors included “Pelvic muscles have no effect on sex,” “Having a baby can improve bladder control,” and “My bladder digests food.”

The q-sort informed response options for different questions on the BH-KAB, including the bladder function question, “*From what you understand, which of the following things does the bladder do?*” (Appendix, Item 2). To assess variance in knowledge about bladder function, q-sort participants were asked, “Do you agree or disagree with the following statements about your bladder?” Responses were included in Item 2 if they elicited very high agreement (e.g., my bladder holds urine) or very low agreement (e.g., my bladder digests food.) These rankings assisted the workgroup in identifying items that were clearly correct and incorrect to many participants.

Q-sort results assisted in excluding response options for specific BH-KAB questions. For example, participants were asked, “Which of the following things are good for your bladder and which are bad for your bladder?” Lowest ranked items for practices considered “good” or “bad” were excluded from a BH-KAB question assessing knowledge about prevention of UTIs (Appendix, Item 9), including wiping the genital region prior to sex and wiping the genital region from back to front after voiding. Highly ranked items were retained, including “peeing after sex” and “wiping from front to back.” Additionally, entire items were excluded upon review of the Q-sort results. Items assessing characteristics of urine (e.g., color of urine, force of urine stream) were not viewed as salient by q-sort participants with respect to whether the bladder was working and were subsequently excluded from the item pool.

### 3.2 Survey via E-panel Key Findings

A survey via e-panel assessed three characteristics of female pelvic anatomic diagrams. The distribution of responses was compared across front versus side views, color versus black and white images, and inclusion versus exclusion of pelvic muscles. Greater variation in responses (utilization of all response options) and accuracy of responses was elicited when the front view was provided. Less variation and accuracy were noted when pelvic muscles were included. The KAB workgroup selected a front-facing anatomic diagram without pelvic muscles as the final BH-KAB item. There was no difference between the color and black and white images; as such, the color diagram was not selected given the associated expense.

Additionally, e-panel findings assisted in the selection of terminology. Disparate results were elicited when the phrase, “pelvic muscle exercises” was compared to “Kegel exercise.” There was lower endorsement of items using the terminology “Kegel,” suggesting that many women were less aware of the term “Kegel” than “pelvic muscle” in relation to pelvic muscle exercises. Separate items using the terminology “pelvic muscle exercise” and “Kegel exercise” were advanced to cognitive interviewing for additional item refinement.



### 3.3 Cognitive Interview Key Findings

While most participants understood and interpreted the items as intended, cognitive interviewing revealed issues with some items that required alterations across multiple rounds. Two key examples were pelvic muscle exercise terminology and the concepts of LUTS prevention, treatment, and cure.

Whereas the e-panel was designed to elicit the distribution of responses when the terms “Kegel” and “pelvic muscle” exercise were varied, cognitive interviews were designed to determine if women understood items when either term was used. The terminology of “pelvic muscle exercises” compared to “Kegel exercises” was probed. Some women thought each term referred to distinctly different activities. This feedback prompted a redesign and retesting of items through cognitive interviews. Participants were first asked whether they were familiar with each term and then asked a set of questions using the term(s) with which they were familiar. Subsequent interviewees endorsed excellent understanding of questions after this modification. In the final BH-KAB instrument, KAB related to “pelvic muscle exercises” and “Kegel exercises” are assessed separately for familiarity with terms, perceived benefits of exercises, and the timing and source of learning about exercises.

The concepts of prevention, treatment, and cure were deemed problematic by participants. Some described prevention and treatment as the same concept. Others distinguished between the public health concepts of primary and secondary prevention, noting that prevention meant that a disease never happens, or that a disease or symptom ever happens “again.” One participant stated she had “no idea what prevention means.” Others noted that treatment and cure were the same if the treatment was successful. One participant interpreted cure to imply “world-wide” cure. These comments highlighted the ambiguous wording of our items. Revised items were assessed in a subsequent cognitive interviewing round. Feedback resulted in inclusion of only the terms “prevent” and “treat” (Appendix, items 12 and 13).

### 3.4 Final BH-KAB Items

The final BH-KAB instrument contains 18 items (Appendix). By design, all items are related to PLUS research topics and questions relevant to KAB (Table 1). The items assess self-reported bladder knowledge; perceptions of bladder function, anatomy, and related medical conditions; attitudes towards different patterns of fluid intake, voiding, and nocturia; the potential to prevent or treat urinary tract infections (UTI) and incontinence; and the impact of pregnancy and pelvic muscle exercises on bladder health (Table 4). Questions were written to be understood by women with varying degrees of educational attainment. The Flesch-Kinkaid Reading Grade Level for the final items was 6.7.

## DISCUSSION

The PLUS Consortium conceptualized KAB as important individual-level determinants of bladder health behaviors in women. This paper focuses on the development and face and content validation of questions to assess bladder health-related KAB in women. In contrast to established KAB instruments,<sup>5, 11–13</sup> which focus on specific urinary symptoms, the PLUS Bladder Health Knowledge, Attitudes, and Beliefs (BH-KAB) instrument concisely

assesses multiple domains that participants and investigators determined were of the greatest importance to inform strategies to promote bladder health among women. Unique topics assessed in the B-KAB compared to prior instruments used in adult women include knowledge about urinary tract anatomy, healthy bladder function, and medical conditions that affect bladder health, as well as perceived effects of different types of fluid intake, including water consumption, on bladder health, and perceived effects of different voiding patterns in response to urge. Our instrument may be used by practitioners and researchers to identify gaps in knowledge and health-compromising attitudes and beliefs that should be addressed through prevention and intervention strategies tailored to individuals and communities.

A variety of methods were employed in the development of the BH-KAB and evaluation of its face and content validity, including published literature, expert opinion, qualitative data review, surveys, and cognitive interviews of women from varied communities. In contrast to the majority of prior research,<sup>11–19</sup> our methodology incorporated women with and without LUTS from various age, education, racial, and ethnic groups, which allowed for a range of lived experiences to guide refinement of the BH-KAB. This approach was necessary to develop an instrument that is likely to be relevant and valid for the assessment of bladder-related KAB across the lifespan of adult women. The three evaluation techniques provided varying levels of information. Data from the cognitive interviews seemed to more strongly inform the content and edits of items ultimately included in the instrument. Our experience aligns with literature highlighting the utility of cognitive interviews.<sup>38</sup> The e-panel survey did, however, identify variations in responses; this led to greater confidence that items would elicit adequate variability when administered in future research. The least informative method was the e-panel q-sort, although it had good utility in directing the BH-KAB working group toward items that were salient to participants.

Administration of the BH-KAB instrument in the RISE study, a large national longitudinal study, will enable PLUS investigators to determine how KAB factors align with other assessed constructs, including self-reported behaviors and social determinants of health (SDOH), to broadly inform future strategies to promote bladder health in women. PLUS investigators will examine individual BH-KAB items in relation to self-reported behaviors and SDOH. The RISE study will poise investigators to examine how individual-level factors interact with social and systemic factors to inform prevention approaches that can be tailored to the needs of individuals and communities. In addition, the large sample planned in RISE will allow examination of how individual items are distributed, with consideration of creating a scoring algorithm for specific subscales that can then undergo psychometric evaluation.

Compared to other bladder-related KAB instruments that also used a multimethod approach in establishing content validity (e.g., literature review, expert opinion, cognitive interviews, and/or pilot testing),<sup>5, 11–13</sup> our development process involved multiple evaluation stages (q-sort, survey, cognitive interviewing) with a total of 1678 women. The present validation included a larger number of women in comparison to other KAB instrument validation studies. Attempts were made to recruit a sample that varied with respect to race, ethnicity, and education. Within the e-panel sample, which involved over 1,500 women, over 12% of

women identified as Black or African American, and 13% identified as Hispanic. Roughly 20% or more of participants at each stage of evaluation reported that their highest level of education was a high school degree or less; this assisted our team in developing questions that are likely to be understood by women with different levels of education. Limitations must also be acknowledged. While BH-KAB development and evaluation phases attempted to engage a diverse sample of women, samples were predominantly White. Future research should examine whether KAB varies across women of different racial and ethnic groups, and whether associations between KAB and bladder behaviors vary across groups. Such research would inform culturally tailored prevention and intervention approaches. Another limitation was the use of online panels, which limited participation in this portion of the process to women with internet access. It is also important to note that the PLUS BH-KAB instrument was developed for adult women aged 18 years and over. Central to the PLUS Consortium research agenda is the concept that bladder health KAB should be evaluated across the lifespan. The development of a similar instrument for adolescent girls is planned in the future.

## 1. CONCLUSION

The PLUS BH-KAB instrument can inform clinical conversations, health education programming, and research examining potential determinants of bladder health, LUTS, and related behavioral habits (e.g., toileting, fluid intake, pelvic muscle exercises). The BH-KAB instrument will also be useful for research examining how variations in social and community context and systemic factors such as racism, economic privilege, and deprivation can influence KAB about bladder health. Inclusion of the BH-KAB instrument in the RISE study provides a unique opportunity to inform the future of women's bladder health promotion and LUTS prevention interventions.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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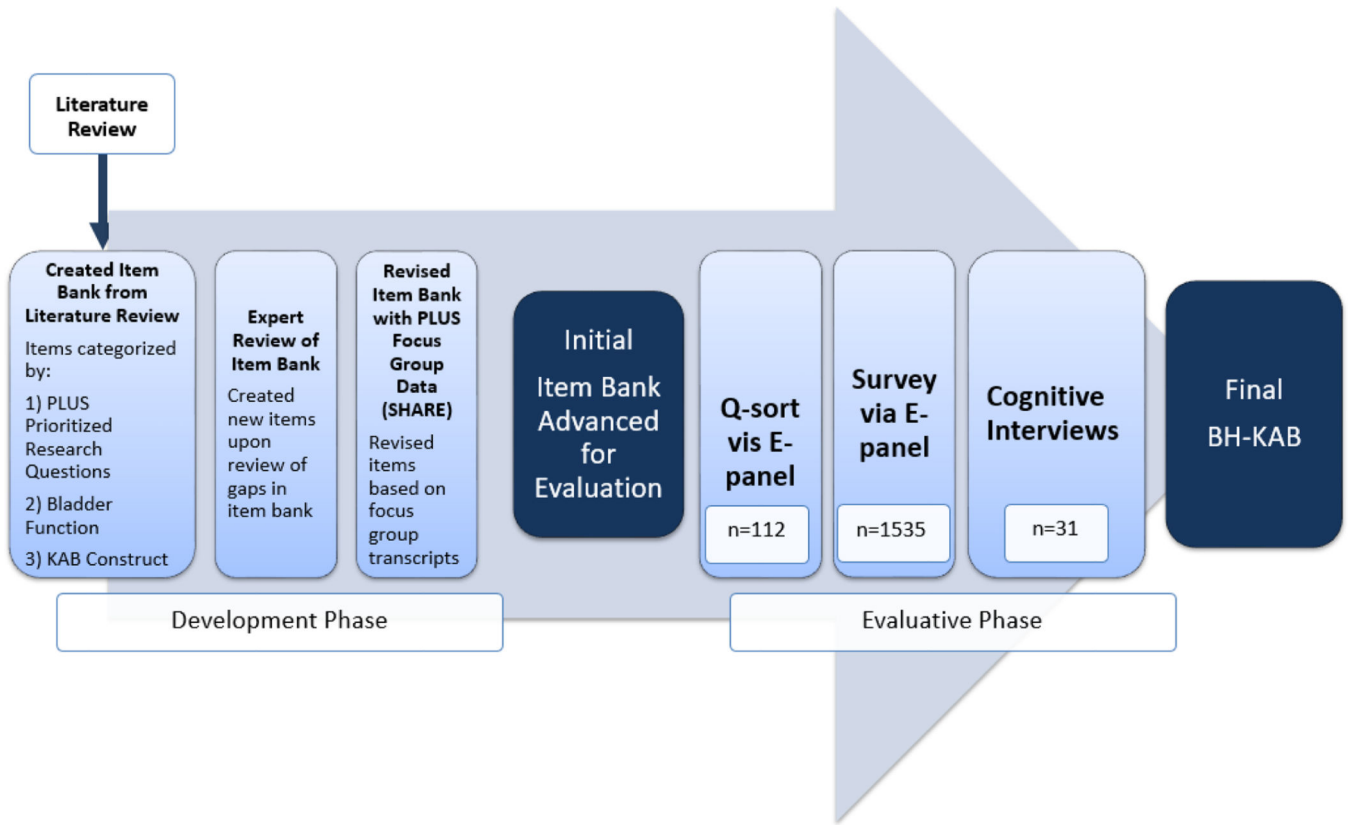
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**Figure 1.** Development and Evaluative Phases of Item Development for the Bladder Knowledge, Attitudes, and Beliefs (BH-KAB) instrument.

**Table 1.**

## PLUS Research Topics and Questions Relevant to BH-KAB

<b>PLUS Topic</b>	<b>KAB-Related Question</b>
Influence of one's own and others' bladder-related KAB on behavior	How are women's bladder-related behaviors influenced by their own bladder-related KAB,
Pelvic floor muscles	When and how do women learn about their pelvic floor muscles?
Pregnancy	How do KAB about pregnancy and postpartum influence bladder health?

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**Table 2.**

Demographic Characteristics of Q-sort, e-panel survey, and cognitive interview participants.

	Q-sort 1 <sup>a</sup> (N=60)	Q-sort 2 <sup>a</sup> (N=52)	E-Panel Survey (N=1535)	Cognitive Interviews (N=31)
	n (%)	n (%)	n (%)	n (%)
<b>Age Group</b>				
18–25	1 (1.7%)	0 (0%)	256 (16.7%)	8 (25.8%)
26–45	14 (23.3%)	1 (1.9%)	314 (20.5%)	5 (16.1%)
46–64	24 (40.0%)	22 (42.3%)	417 (27.2%)	11 (35.5%)
65+	19 (31.7%)	26 (50.0%)	469 (30.6%)	4 (12.9%)
Missing	2 (3.3%)	3 (5.8%)	79 (5.1%)	3 (9.7%)
<b>Education</b>				
Completed HS or less	14 (23.3%)	11 (21.2%)	691 (45.0%)	6 (19.4%)
Associate's degree or some college	13 (21.7%)	13 (25.0%)	322 (21.0%)	4 (12.9%)
Bachelor's degree	19 (31.7%)	17 (32.7%)	297 (19.3%)	14 (45.2%)
Master's degree	9 (15.0%)	11 (21.2%)	150 (9.8%)	6 (19.4%)
Doctoral or Professional degree	3 (5.0%)	0 (0%)	33 (2.1%)	0 (0%)
Vocational or technical degree	2 (3.3%)	0 (0%)	42 (2.7%)	0 (0%)
Missing	0 (0%)	0 (0%)	0 (0%)	1 (3.2%)
<b>Race and Ethnicity</b>				
Asian	4 (6.7%)	3 (5.8%)	73 (4.8%)	4 (12.9%)
Black or African American	4 (6.7%)	0 (0%)	190 (12.4%)	7 (22.6%)
Top Eastern or North African	0 (0%)	0 (0%)	0 (0%)	1 (3.2%)
Hispanic	4 (6.7%)	0 (0%)	199 (13.0%)	0 (0%)
White or Caucasian	47 (78.3%)	48 (92.3%)	1029 (67.0%)	18 (58.1%)
Another Race, Ethnicity, or Origin	1 (1.7%)	1 (1.9%)	43 (2.8%)	1 (3.2%)
Missing	0 (0%)	0 (0%)	3 (0.2%)	0 (0%)

<sup>a</sup>In addition to completing the q-sort, participants in Q-Sort 1 and Q-Sort 2 completed a small subset of e-panel survey questions. To avoid “double-counting” participants in terms of considering the diversity of all participants, they are excluded from the demographic variable distributions for the e-panel survey column.

**Table 3.**

LUTS Characteristics of E-Panel Survey and Cognitive Interview Participants.

	<b>E-Panel Survey (N=1535)</b>	<b>Cognitive Interviews (N=31)</b>
In the past year have you been told by a health care provider that you had a urinary tract infection (UTI)?		
I have never had a UTI in my life	506 (33.0%)	9 (29.0%)
No, I haven't had a UTI in the past year	783 (51.0%)	17 (54.8%)
Yes	245 (16.0%)	5 (16.1%)
Missing	1 (0.1%)	0 (0%)
In the past year, have you ever accidentally leaked urine, even just a drop or two?		
No, not even once in the past year	447 (29.1%)	7 (22.6%)
Only once or twice over the entire year	373 (24.3%)	5 (16.1%)
Up to six times over the entire year	225 (14.7%)	10 (32.3%)
At least once a month every month	180 (11.7%)	4 (12.9%)
More often than that	305 (19.9%)	5 (16.1%)
Missing	5 (0.3%)	0 (0%)
In the past year, have you experienced any of the following? Please do NOT count or consider times when this was a result of having a UTI.		
Trouble or difficulty starting to pee		
Yes	247 (16.1%)	3 (9.7%)
No	1280 (83.4%)	28 (90.3%)
Missing	8 (0.5%)	0 (0%)
Feel you like are not completely emptying your bladder		
Yes	398 (25.9%)	12 (38.7%)
No	1125 (73.3%)	19 (61.3%)
Missing	12 (0.8%)	0 (0%)
Dribbling at least a few drops after you think you have finished peeing		
Yes	711 (46.3%)	13 (41.9%)
No	820 (53.4%)	18 (58.1%)
Missing	4 (0.3%)	0 (0%)

**Table 4.**

Topics in the Bladder Knowledge, Attitudes, and Beliefs (BH-KAB) Instrument by Item.

<b>Item</b>	<b>Topic</b>
1	Bladder knowledge self-assessment
2	Bladder function
3	Bladder anatomy
4	Related medical conditions
5	Water consumption and bladder health
6	Perception of fluid types
7	Voiding with urge
8	Nocturia
9	Prevention of UTIs
10	Aging and incontinence
11	Incontinence treatment
12	Prevention and treatment – provider
13	Prevention and treatment - woman
14	Pregnancy's impact on bladder function
15	Duration of pregnancy's impact on incontinence
16	Pelvic muscle exercises – function, knowledge acquisition
17	Kegel exercises – function, knowledge acquisition
18	Pelvic muscle exercises and pregnancy

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