Self-Perceived Improvement in Bladder Health After Viewing a Novel Tutorial on Knack Use: A Randomized Controlled Trial Pilot Study

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Abstract

Purpose: To test a novel bladder health tutorial on use of the Knack for overcoming bladder control challenges. The Knack-tutorial is a self-administered vignette-based instructional program on preempting bladder challenges in daily life (urgency, stress-leakage, or urge-leakage) through anticipatory, well-timed pelvic floor muscle contraction at the moment of challenge.

Materials and Methods: This is a randomized controlled trial pilot test of 108 women with stress or mixed urinary incontinence. The Knack-tutorial group saw a 15-minute slide show with 10 vignettes portraying use of the Knack in daily life. The slide show format used inserted narrated videos, dubbed and animation enhanced pictures and cartoons, and automatic slide advancement. A control group saw a similarly constructed slide show on incorporating good diet/exercise habits. Outcomes were self-perceived improvement (yes/no, and as 0%–100%) 1 month after viewing the tutorial.

Results: We enrolled 123 women, randomizing 64 to Knack-tutorial group and 59 to diet/exercise tutorial group. Eleven and one participant, respectively, did not return. Three did not fill out the self-perceived improvement report. Significant improvement was reported by 71% in the Knack-tutorial group compared to 25% in the diet/exercise group ($p < 0.001$). Self-perceived improvement was 21%–22% higher (Model I Est: 21.01, SE: 4.25, $p < 0.001$) in the Knack-tutorial group.

Conclusions: An electronic tutorial viewed independent of a health care provider with vignettes showing Knack application to manage the everyday bladder challenges women face shows benefit of a magnitude that warrants more widespread use and rigorous testing. A professional remake of the intervention is now available (www.myconfidentbladder.com).

Keywords: levator ani, Kegel, pelvic floor muscle training, mixed incontinence, patient satisfaction, virtual education efficacy

Introduction

COMMON BLADDER CONTROL challenges can occur during a cough or sneeze, when a voiding opportunity is not imminent, or when the degree of urgency threatens leakage.^{1,2} Kegel, in 1948, popularized repetitive pelvic floor muscle contractions to increase strength of the pelvic floor muscles.³ However, women's learned ability to use these

same muscles to perform a single or just a couple skilled, well-timed pelvic floor muscle contractions to manage a bladder control challenge, regardless of existing strength level, is lesser recognized in its effectiveness.⁴ Many women with bladder control challenges already have adequate strength to engage the muscles. Their need is rather to learn conscious use of those muscles to manage bladder control challenges in everyday life.

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While long recognized, the first data-based publication showing efficacy of this in-the-moment conscious use was a 1998 study by Miller et al.⁴ They used the succinct English word “Knack” to describe this put-into operation contraction as a talent, clever body trick, or applied skill. Historical literature reveals many different names for the same concept (Table 1).^{5–9} We use the term Knack in this article for brevity and consistency.

Logically, practicing the Knack in real-life situations until it becomes a habit is important. There is beginning evidence

TABLE 1. COMPONENTS TO LEARNING THE KNACK
(PER AUTHOR JANIS M. MILLER)

Awareness

- Identify situations that typically cause you bladder problems. Common situations are listed here.
- Urgency or fear of urge-related leakage on arriving home, getting out of bed, or hearing running water.
- Leakage or fear of leakage with coughing or sneezing or getting up from a chair.
- Leakage with exercise.
- Feeling as though you need to return to the toilet right after having urinated.

Practice: Urge suppression

- Take a few days to focus on getting ahead of the urgency sensation of your bladder by consciously sending it a calming message with gentle pelvic floor muscle contractions (just a few, 3–5) when you anticipate an upcoming event that has caused you urgency sensations in the past.
- This is not the time to practice big powerful pelvic floor muscle contractions. Rather you are just sending a “calming” message to the bladder that now is not the time to overtrigger.
- The urgency should be controlled. Continue your prior activities and delay at least a few minutes until you can walk calmly and slowly to the bathroom.

Practice: Support during physical stress on the bladder

- Practice timing a voluntary, single well-controlled pelvic floor muscle contraction with blowing your nose or a fake cough or sneeze, attempting to hold through the event. You should be able to feel the postural support, and with practice will be more prepared to quickly support with a pelvic floor muscle contraction at the moment of a surprise cough or sneeze.
- Slide to the edge of a chair or the edge of your bed, contract your pelvic floor muscles a couple of times to calm the bladder, stand up with your pelvic floor muscle engaged, and try not to bend forward over your bladder.
- During running, jogging, or other exercise, stop for a brief moment and reset the pelvic floor muscles with a couple of gentle pelvic floor muscle contractions. With practice, you may be able to do a couple of pelvic floor muscle contractions occasionally, while also continuing jogging or other exercise.

Other names for the Knack (from the scientific and lay literature)

Kegel when you cough, squeeze when you sneeze, the squeeze trick, precontraction, co-contraction, stress strategy, counterbracing, pelvic clutch, muscle clenching, perineal lock, blockage, bladder control strategy, voluntary urinary inhibition reflex.

of success in cognitive rehabilitation for developing this dual tasking performance (*e.g.*, the Knack while coughing).¹⁰ Despite the potential efficacy of the Knack for use in daily life, instructional content on the Knack is nonstandardized in the literature, poorly delineated, and remains obscure in application to most women. While some discover the maneuver on their own, for others it is an “Aha!” moment, with specific instruction necessary (Table 1).

Two seminal studies showed immediate reduction in volume of urine leaked on cough using the Knack to suppress leakage volume on coughing in the clinic.^{4,11} However, efficacy data are absent in the array of bladder control challenges women encounter in a real-world environment. The studies that do exist are contaminated from concurrently applied intervention of Kegel’s exercises.^{10,12,13}

Outside of the clinic, Knack use to overcome bladder control challenges arguably relies on operant conditioning with disruption to Pavlovian patterned responses to environmental stimuli. How the Knack works biologically for stress-type leakage (*e.g.*, with a cough) is by enhancing urethral closure pressure^{14,15} and improving bladder stabilization,¹⁶ to suppress urgency or urge urinary incontinence by also inhibiting a detrusor contraction.^{6,17,18}

The purpose of this study was to build and test a vanguard self-administered Knack-tutorial, using vignette-based portrayals of its use in real-life settings to see if results warrant the cost of a full professional build of a tutorial website for public dissemination. A secondary purpose was to establish data for use in the future should a power analysis for more rigorous testing beyond this pilot be warranted. The long-term goal is heightened awareness of the Knack’s potential for optimizing bladder health, a public health message that can be relayed without the need for high contact with health care professionals and lengthy commitment to Kegel’s exercises.

Materials and Methods

In this pilot, we used a randomized controlled superiority trial with two parallel groups (a Knack-tutorial group and a diet/exercise tutorial group). The data collector was blinded to group assignment. Primary endpoints were self-perceived improvement at 1 month (“any” as indicated by yes/no and “percentage improvement” as indicated on a scale of “0–100”). The study was registered on clinicaltrials.gov (NCT00125177). The Institutional Review Board (IRBMED) approved the protocol, HUM00050898. All participants signed a written, informed consent.

Interventions

The vanguard Knack-tutorial and diet/exercise tutorial (for the control group) were both constructed as automated and narrated slideshows viewable by computer. Each was ~15-minutes long. The research team themselves filmed, added clip art, animations, voice-over, and acted in the videoclips to build the Knack-tutorial (the script is in Supplementary Data S2). The parallel control group diet/exercise tutorial was created by the same research team that created the Knack-tutorial. We chose this content for the control group as a positive and logically plausible intervention because of evidence that relatively minor weight loss is shown to reduce bladder problems.^{13,19}

Building the Knack-Tutorial. The principal investigator of the study (author J.M.M.) was responsible for the content that depicted common bladder health challenges for which the Knack would be appropriate. She drew from her clinical experience of greater than 25 years of specialized practice in behavioral training programs for women with urinary incontinence and from the classic social learning theory of Bandura, which emphasizes observation, imitation, and modeling.²⁰

The educational vignettes included Knack use to suppress or preempt onset of urgency on arriving home in the driveway, standing at your home's entry door, getting out of bed, hearing running water, and while outdoors jogging by briefly either stopping exercise or stepping in place, while using the Knack to retain a sense of bladder control. These situations were shown by small narrated videos scripted by the first author (J.M.M.), created by project staff (authors L.P., M.T., K.B. C.G., and R.M.), and with amateur actresses (project staff and friends of the principal investigator) portraying the scenes.

These videos were embedded into a slide show and were supplemented with dubbed animated clip-art demonstrations of Knack use during sudden cough and sneeze, and for support to the bladder when getting up from a chair, and use of the Knack at end of micturition before leaving the toilet. The latter represented Knack use to prevent postvoid dribble and the need to return to the toilet. The actresses were women of a variety of ages and races, consistent with social learning theory emphasis that if models' traits are similar to the observer's, then individuals are more likely to adopt the modeled behavior.

To offer improved understanding of the underlying anatomy involved in using the Knack, dynamic sagittal view magnetic resonance imaging clips and ultrasound imaging were shown. Voice-over was used for pointing out the lift under the bladder from a moment of pelvic floor muscle contraction and how timing that lift with a cough stabilizes the bladder and supports the urethra. The entirety of the Knack-tutorial was compiled into a narrated/dubbed slide show that automatically advanced through slides, inserted videos, and animations. It was designed to be watched on a desktop or laptop computer, but without any clicking required by the participant.

Building the diet/exercise tutorial for the control group. The same team developed the diet/wellness tutorial in similar manner to the Knack-tutorial. Although authors were not expert in diet/exercise, basic content (although not style of presentation) was drawn from the U.S. Food and Drug Administration recommendations generally available on various websites at the time of production. Attention to style match with the Knack-tutorial was of main concern, and included that the diet/exercise tutorial be of approximately same length, same subtle humor, clip art animation, and amateur voice-over as used for the Knack-tutorial. Actress portrayals of diet/exercise behaviors were not feasible on our limited budget, so this tutorial relied solely on animated clip art.

Sample

Participants. A convenience sample of 123 participants was recruited. The vast majority of participants were recruited through local advertising in the community newspa-

pers, fliers around town, through a participant engagement research website local to our university, or word of mouth from participants or research staff. A small handful of participants were referred from clinical practices by clinicians (non-authors) who became aware of the study. Telephone screening was conducted for inclusion criteria: female sex, 18 years of age or older, English-language proficiency, and self-reported leakage instigated by coughing, "Do you sometimes leak urine on a hard cough?" and "Would you say that you would leak urine nearly every day if you coughed hard every day?"

A simplified 3-day voiding diary (counts of voids and urinary incontinence episodes per day) was used to screen for at least one leakage event in the 3 days. This diary included instructions to cough intentionally once per day with a full bladder and mark any leakage on a tick box. Although the participant was not excluded if no leakage occurred with the intentional coughs across the 3 days, a final inclusion criterion was that at least one leakage event must occur somewhere on the 3-day diary and could include leakage related to the intentional cough.

Final inclusion criterion was willingness to participate in a physical examination, including measures of genital hiatus and urethral pressures, variables we needed as covariates for stratified randomization purposes.

Exclusion criteria were as follows: chronic urinary tract infection(s), surgery for prior incontinence or prolapse, pregnant or childbirth within the past 12 months, discomfort with pelvic examinations, certain neurological conditions that may affect bladder control, and uncontrolled diabetes. Participants received financial compensation (\$100 at baseline and \$40 at follow-up) for the burden of diary recording and in-person visits.

All baseline data were collected before randomization. Earlier pilot work (see Supplementary Methods section in Supplementary Data S1) suggested probability of response to the Knack may be influenced by age, urethral closure pressure, genital hiatus, and response to questionnaire item on a 0%–100% scale: "How confident are you that you can do things that will avoid urine loss?" Since we wanted these potential covariates to be distributed evenly across the Knack-tutorial group and the diet/exercise control group, we obtained these data within the clinic examination portion of the study.

Instruments

To characterize the sample at baseline and collect covariate information, the voiding diary from screening was used. Demographic information such as age, race, education, income, and parity were collected, as well as the Sandvik Score²¹ for grading urinary incontinence (0–8 points, which account for frequency and amount of leakage), and an investigator-designed single self-efficacy question: "How confident are you that you can do things that will avoid urine loss?" on a 0%–100% scale.

Clinical examination data included height, weight, a ruler measure of genital hiatus, and urodynamics measure of urethral pressure at rest and with pelvic floor muscles contracted. To distinguish stress-type leakage from mixed or urge urinary incontinence, a quantified standing stress paper towel test was performed at baseline.⁴ In this test, the bladder is filled to 250 cc. The woman in standing position holds a brown trifold paper towel lightly to the perineum, and coughs hard three times. The first set of coughs is without any directive to

contract her pelvic floor muscles. On the second set of three coughs, she is directed with a single phrase to intentionally contract her pelvic floor muscles simultaneously with coughing. Differences in paper towel wetted area without and with the pelvic floor contracted are visible against the background of the brown paper towel.

A sagittal 2D dynamic ultrasound was performed with the woman in standing position, and with images taken at rest, during Valsalva effort, during coughing, during volitional effort to contract the pelvic floor muscles, and during cough, while also contracting the pelvic floor muscles. These images were visible to each participant during her examination. The anatomy was pointed out to the participants throughout the imaging procedure, but other instruction was limited to simple phrases, “now push or strain down,” “now cough,” “now contract your pelvic floor muscles,” and “now try coughing and contracting your pelvic floor muscles at the same time.”

Main outcomes

At ~1 month, all participants, regardless of which tutorial seen, were surveyed with these questions: “In general, do you feel your situation has significantly improved since beginning the research study?” with response options “yes” or “no” and “What percent improvement are you experiencing since beginning the research study? Place an X on the scale 0–100 perceived percentage of improvement.”

These questions were chosen over instruments such as a bladder diary or survey instruments on urinary incontinence, which have a limited ability to capture expected immediacy of Knack effect, to capture decreased volume of leakage regardless of number of leakage events, or to show a women’s sense of control over her urgency sensation. We did not use a previously validated measure of these more global outcomes, and chose to emphasize the practical relevance to a woman from her own viewpoint.

Procedures

Throughout the baseline assessments, done before randomization, the examiner could provide simple corrective feedback, such as “On that attempt at pelvic floor muscle contraction you strained down. Can you try again to contract your pelvic floor muscles without straining down?” Any indication on the ultrasound of straining down on ultrasound preemptive to a cough, rather than lifting motion preemptive/with the cough, was pointed out to the patient with the visual feedback from the ultrasound and they were asked to attempt to correct the maneuver. The clinician was strictly prohibited from mentioning the Knack application to scenarios outside of the clinical examination room. No one was excluded from the study for either poor contraction ability or likelihood of levator ani muscle (Kegel muscle) tear (known to occur with childbirth in a percentage of women).²²

Randomization. The clinician left the room and participants were randomized by the project manager, 1:1 to the Knack-tutorial group or the diet/exercise control group based on a computer-generated stratified randomization schedule provided by a biostatistician. Randomization was stratified by probability of response, which was determined by incorporating the composite of the factors listed above into the predictive equation derived from the prior small study

(Supplementary Data S1). The randomization schedule, in the form of a spreadsheet, was concealed to all except the project manager, who used it for assignment to the correct intervention as per randomization allocation.

Immediately after being randomized, the project manager provided computer access to the participant to view one of the allocated tutorial slide shows (either the Knack-tutorial or the similarly constructed diet/exercise tutorial). Each participant viewed the entirety of the slide show one time on the monitor of the examination room computer. The project manager was present when the participant was viewing the tutorial and was instructed not to answer questions on content. At visit end, the project manager scheduled the 1-month follow-up and advised all participants that they would be invited to view the parallel slide show at the follow-up visit.

Statistical analysis

As no data were available for a definitive sample size analysis, and due to the pilot nature of this study, we estimated that a sample size of ~100 would be adequate to both test for basic worthiness of the tutorial (warranting a professional build), and for determining variance and effect size for sample size estimates needed for future testing.

Participants who did not complete the self-perceived improvement questions at 1-month follow-up were excluded from all analysis. Demographic information and results of baseline functional assessments are presented as medians and interquartile ranges (IQRs; Q1–Q3) or frequencies and percentages for the combined sample of women who saw the Knack-tutorial and diet/exercise tutorial. Comparisons between baseline characterizations and outcome measures between the two randomization groups were made using chi-square tests for categorical variables and Wilcoxon two-sample tests for continuous variables.

Logistic regression models for significant “yes/no” self-perceived improvement and linear regression models for percentage self-perceived improvement were used to compare primary outcomes by randomization group after adjusting for variables used in stratified randomization. Two models were tested for both logistic and linear regression approaches. Model I used covariates of age, highest resting and contracting urethral pressure, genital hiatus, and self-reported confidence in ability to do things that will avoid urine loss. Model II adjusted for predicted responder status drawn from the variables in Model Type I. For detail on choice of these variables and predictive responder versus nonresponder information, see Supplementary Methods section in Supplementary Data S1.

Additional sensitivity analysis was performed limited to women who leaked on the baseline paper towel test to test whether the effect of the intervention differed in women with predominant stress urinary incontinence. For all analysis, level of significance was set as <0.05.

Results

A CONSORT diagram is shown in Figure 1. Those noted as “nonresponsive” to study entry refer to women on the engagement research website who were contacted by our research staff because of their general interest in research on health habits, but who declined this particular study. Of the

FIG. 1. CONSORT diagram.

123 women enrolled in the study, randomization to the Knack-tutorial or diet/exercise tutorial resulted in 64 Knack participants and 59 diet/exercise participants. Of these, 12 women (11 Knack and one diet/exercise) did not return (dropped out) for the 1-month follow-up and an additional three women (one Knack and two diet/exercise) were excluded from the analysis because they were missing responses on self-perceived improvement at 1-month postintervention. Thus, the remaining 108 patients (52 Knack and 56 diet/exercise) were available for analysis.

Baseline measures are shown in Table 2. Women in the Knack-tutorial and diet/exercise tutorial groups did not differ significantly on any baseline characteristic (all $p > 0.09$), including whether or not there was any leakage on the paper towel test, or reduction of leakage at the baseline in-clinic visit when asked to cough first without and then with intentionally contracting the pelvic floor muscles.

To detail these baseline data, despite all participants reporting leakage with cough on the screening interview, 53% ($n = 57$) did not demonstrate leakage with cough on the no-Knack paper towel test at the baseline clinical assessment. Descriptively, in those who did leak at baseline, 31% ($n = 33$) had considerable leakage on the paper towel test ($>33 \text{ cm}^2$ wetted area). Percentage reduction in volume leaked on paper towel test between the no-Knack and with-Knack coughs at baseline was similar in both groups.

Among those with any leakage on the no-Knack cough test, at baseline, some degree of reduction in leakage was achieved by 64% (16/25) of women in the Knack-tutorial group and 66% (21/32) in the diet/exercise tutorial group, respectively. This indicates the groups were balanced at baseline in

physical ability to reduce leakage on cough when prompted verbally to contract the pelvic floor muscles ($p = 0.2$).

In terms of the outcome measures at 1-month postviewing of the randomly allocated tutorial, 71% (36/51) of women in the Knack-tutorial group reported that they had significant improvement compared to 25% (14/56) in the diet group. Median (IQR) percent self-perceived percentage point of improvement was 30% (23%–50%) in the Knack-tutorial group versus 10% (1%–23%) in the diet/exercise group (Fig. 2). Women in the Knack-tutorial group had seven times higher odds of reporting significant self-perceived improvement at 1 month compared to women in the diet/exercise tutorial group (Model I OR: 7.06 [95% CI: 2.86–17.42], $p < 0.001$, Table 3). On average, women in the Knack-tutorial group reported 21–22 more percentage points on a scale of 0–100 of self-perceived improvement compared to women in the diet/exercise group (Model I estimate: 21.01 [SE: 4.25], $p < 0.001$, Table 4).

The sensitivity analyses, which used only the subset of 51 women who demonstrated leakage on the baseline paper towel test, produced results concurring with results above for the full sample. Those in the Knack-tutorial group showed 5–7 times the odds of saying “yes” to self-perceived significant improvement (Model I OR: 7.13 [95% CI: 1.58–32.15], $p = 0.011$, Table 3) and 28–30 more percentage points of self-perceived improvement (Model I estimate: 30.32 [SE: 5.89], $p < 0.001$, Table 4), compared to the diet/exercise tutorial group at 1 month.

Discussion

This study provides proof of concept that a standardized Knack-tutorial using vignettes based on Bandura’s theory of

TABLE 2. BASELINE MEASURES FOR 108 RANDOMIZED CONTROLLED TRIAL PARTICIPANTS

Variable	<i>Knack-tutorial treatment group (N=52)</i>		<i>Diet/exercise control group (N=56)</i>	
	N	Median (IQR) or n (%)	N	Median (IQR) or n (%)
Age (years)	52	51.5 (44.0–62.5)	56	52.0 (46.0–60.5)
Race	52		56	
White		39 (75.0)		47 (83.9)
Black/African American		8 (15.4)		4 (7.1)
Asian		3 (5.8)		1 (1.8)
Other Race		2 (3.8)		4 (7.1)
Non-Hispanic/non-Latino	52	51 (98.1)	56	56 (100.0)
Body mass index	52	28.3 (23.8–32.6)	56	27.7 (23.5–32.6)
Education	52		55	
High school graduate or less		12 (23.1)		12 (21.8)
Some college		16 (30.8)		14 (25.5)
College/Technical school graduate		9 (17.3)		11 (20.0)
Graduate school		15 (28.8)		18 (32.7)
Income	52		52	
<20,000/year		10 (19.2)		11 (21.2)
\$20,000–\$40,999/year		13 (25.0)		9 (17.3)
\$41,000–\$60,000/year		13 (25.0)		10 (19.2)
>\$60,000/year		16 (30.8)		22 (42.3)
C-section births (No.)	47	0 (0–0)	51	0 (0–0)
Vaginal births (No.)	52	2 (0–3)	56	2 (1–3)
Paper towel test wetted area on no-Knack cough, cm ²	52		56	
None		29 (55.8)		28 (50.0)
Drops (<10 cm ²)		5 (9.6)		3 (5.4)
Some (10–33 cm ²)		6 (11.5)		4 (7.1)
A lot (>33 cm ²)		12 (23.1)		21 (37.5)
Leakage episodes (average No. of per 3-day diary)	48	2.6 (1.0–3.4)	54	2.7 (1.3–4.0)
Daily voids (per 3-day diary)	50	8.0 (6.0–9.0)	55	7.0 (6.0–9.0)
Sandvik score (optimal range 0–8 points)	50	4 (2–6)	55	4 (2–6)
Resting urethral closure pressure (average of two measurements) (cm H ₂ O)	52	40.8 (28.3–60.8)	55	39.0 (23.0–56.0)
Contracting urethral closure pressure (average of two measurements) (cm H ₂ O)	52	59.3 (35.5–81.8)	55	50.5 (30.0–71.5)
Highest UCP (highest of four measurements, two resting and two contracting) (cm H ₂ O)	52	63.5 (47.5–91.0)	55	54.0 (34.0–88.0)
Pelvic organ prolapse quantification (cm)				
Total vaginal length	52	11.0 (10.0–11.5)	56	11.0 (10.0–12.0)
Genital hiatus	51	4.0 (4.0–5.0)	56	4.5 (4.0–5.0)
Perineal body	51	2.5 (2.0–3.0)	56	2.5 (2.5–3.0)
Anterior wall	51	–2.5 (–2.5 to –2.0)	56	–2.0 (–2.5 to –2.0)
Posterior wall	51	–2.5 (–2.5 to –2.0)	56	–2.5 (–2.5 to –2.0)
Cervix ^a	33	–7.0 (–8.0 to –7.0)	41	–8.0 (–8.0 to –7.0)
Postvoid residual (ml)	51	15.0 (5.0–25.0)	56	15.0 (5.0–30.0)

Baseline characteristics were similar between the analytic sample and the 15 women without 1-month outcomes.

^aNineteen participants in the treatment group and 15 in the control group were, by study protocol, missing POP-Q cervix measure due to the patient self-reporting hysterectomy.

IQR, interquartile range; UCP, urethral closure pressure.

social learning viewed on a computer screen could be effective, while also reaching a broad audience of women. Significant improvement at short-term follow-up (1 month) shows immediacy of response for many women, even before fully establishing the Knack habit. Their results may improve over time.

The positive effect appears to be mostly from the vignette-based approach of the tutorial, since women in both the Knack-tutorial and the diet/exercise tutorial groups were equally exposed to a clinical examination where the physical aspect of the

Knack was visible to them. Of particular interest, the results of the sensitivity analysis on only those women who leaked on a paper towel test showed the same findings.

No one was taught in this study to perform repetitive pelvic floor muscle exercises, nor did the groups differ on any of the wide variety of baseline clinical measures or demographic variables obtained, including self-reported confidence (0%–100%) in ability to do things that prevent urine loss. We therefore surmise that the difference between groups in self-perceived improvement measures is attributable to learning

FIG. 2. Distribution of responses to survey item “What percent improvement are you experiencing since beginning the research study? Place an X on the scale 0–100 perceived percentage of improvement” by randomization group.

application of the Knack from observation, imitation, and modeling by the vignettes.

Burgio et al.⁶ reported that for women with urge-related symptoms, who only received a handout detailing multi-component intervention (including, but not exclusive to the Knack), 30.8% perceived their condition as “much better” at 2 months follow-up. Goode et al.⁷ reported the rating of “much better” at 15%, using the same handout intervention for women with stress or mixed symptoms. Another study

reported that the group receiving only a paper with instructions had from 37.2% to 54.3% of respondents answering “yes” across four questions on perceived improvement since baseline 6 months earlier.¹⁹ Our findings of the Knack-tutorial only (not a multicomponent intervention) compared favorably with 71% responding “yes” at 1-month follow-up to the question, “Do you feel your situation has significantly improved?”

Limitations of this study include a subjective outcome measure. However, there is no single existing validated outcome measure, subjective or objective, to capture the Knack’s quick effect on reducing bladder control challenges in everyday life across many different and individualized scenarios. We do not know if women who independently reviewed the Knack-tutorial without an examination would respond to the same degree. However, since both intervention and control group women received the same examinations done by a clinician blinded to intervention, this does lend strength to the conclusion that the difference in response by groups is from the difference in the tutorials viewed, not the examination.

We focused on whether high start-up costs of building a vignette-based, publicly available, standardized, and professionally created tutorial to teach the Knack without a health care professional involved would be worth the effort. With worthiness established, we did a professional remake of a caliber appropriate for widespread public dissemination, see www.myconfidentbladder.com (© 2019 The Regents of the University of Michigan, invention disclosure 2019-351, available by an Open Source Creative Commons license). This Knack-tutorial remake is expected to benefit over time from improvements made incrementally as women, researchers, and

TABLE 3. MODEL OF PROBABILITY OF PERCEIVED IMPROVEMENT AS YES OR NO (LOGISTIC REGRESSION)

<i>Sample set</i>	<i>Model type^a</i>	<i>Odds ratio Knack group vs. diet group</i>	<i>95% CI</i>	<i>p</i>
All women	I	7.06	2.86–17.42	<0.001
	II	7.16	3.04–16.90	<0.001
Women with any demonstrable leakage on quantified standing stress paper towel test at baseline (<i>N</i> =51)	I	7.13	1.58–32.15	0.011
	II	5.37	1.58–18.20	0.007

^aModel Type I covariate adjusted model: adjusted for age, highest resting and contracting urethral closure pressure, genital hiatus, and self-reported ability to do things that will avoid urine loss. Model Type II group adjusted model: adjusted for predicted responder status based on variables in Model Type I. For detail on predictive responder versus nonresponder, see Supplementary Methods section in Supplementary Data S1.

CI, confidence interval.

TABLE 4. MODEL OF PERCENTAGE OF PERCEIVED IMPROVEMENT AS 0%–100% (LINEAR REGRESSION)

<i>Sample set</i>	<i>Model type^a</i>	<i>Difference in percent improvement in Knack group vs. diet group</i>	<i>SE</i>	<i>p</i>
All women	I	21.01	4.25	<0.001
	II	21.65	3.99	<0.001
Women with any demonstrable leakage on quantified standing stress paper towel test at baseline (<i>N</i> =51)	I	30.32	5.89	<0.001
	II	28.24	4.98	<0.001

^aModel Type I covariate adjusted model: adjusted for age, highest resting and contracting urethral closure pressure, genital hiatus, and self-reported ability to do things that will avoid urine loss. Model Type II group adjusted model: adjusted for predicted responder status based on variables in Model Type I. For detail on predictive responder versus nonresponder, see Supplementary Methods section in Supplementary Data S1.

SE, standard error.

clinicians gain access to the information. Analysis of failure reasons and rates should also be evaluated with more widespread diverse dissemination.

A logical reason for failure of an effective Knack maneuver is the possibility of a detached (torn) levator ani muscle, as can occur with childbirth.²² Logically, a woman would be unable to contract a muscle torn from its origin at the pubic bone. Recommendations on when to seek health provider assistance, including lack of confidence in being able to contract the pelvic floor muscles, are offered in the professional remake of the Knack-tutorial (Supplementary Data S2), which used the vanguard version as the key content guide.

The remake is substantially improved by website as the platform. Instead of a slide show, the website benefits from a professional voice-over, the expertise of a graphics designer (author W.N.), the neutrality of cartoon character vignettes, which retain the humor, and a whimsical portrayal of the vanguard version. To mimic the original study's clinical examination component, instructions are given for doing a home version paper towel test and an animated cartoon of a real dynamic ultrasound is provided.

Conclusions

A Knack-tutorial to teach application of preemptive pelvic floor muscle contraction at a moment of bladder control challenge meets criteria as a simple low-risk intervention that can be made widely available to the public through internet. While the Knack-tutorial does not permanently change an individual's baseline physiology, it optimizes what a woman might achieve in bladder control on her own, without the expense or social barrier of having to seek help from a health care provider for bladder control challenges. This do-no-harm standardized Knack-tutorial rests with principles long substantiated by social learning theory and may prove to be an expedient approach to adoption by a broad spectrum of community women desiring to maximize bladder control.

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Supplementary Material

Supplementary Data S1
Supplementary Data S2

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