Published in final edited form as:

J Pediatr Health Care. 2017 ; 31(1): 16–28. doi:10.1016/j.pedhc.2016.01.001.

Provider training to screen and initiate evidence-based pediatric obesity treatment in routine practice settings: A randomized pilot trial

Rachel P. Kolko, PhD^{a,b}, Andrea E. Kass, PhD^{b,c}, Jacqueline F. Hayes, BA^b, Michele D. Levine, PhD^a, Jane M. Garbutt, MB, ChB^{d,e}, Enola K. Proctor, PhD^f, and Denise E. Wilfley, PhD^{b,g}

^aDepartment of Psychiatry, University of Pittsburgh

^bDepartment of Psychology, Washington University in St. Louis

^cDepartment of Medicine, The University of Chicago

^dDepartment of Medicine, Washington University School of Medicine

^eDepartment of Pediatrics, Washington University School of Medicine

^fBrown School of Social Work, Washington University in St. Louis

^gDepartment of Psychiatry, Washington University School of Medicine

Abstract

Introduction—This randomized pilot trial evaluated two training modalities for first-line, evidence-based pediatric obesity services (screening and goal-setting) among nursing students.

Method—Participants (N=63) were randomized to Live Interactive Training (Live) or Web-facilitated Self-study Training (Web). Pre-training, post-training, and one-month follow-up assessments evaluated training feasibility, acceptability, and impact (knowledge, and skill via simulation). Moderator (previous experience) and predictor (content engagement) analyses were conducted.

Results—Nearly-all (98%) participants completed assessments. Both trainings were acceptable, with higher ratings for Live and participants with previous experience (p 's<.05). Knowledge and skill improved from pre-training to post-training and follow-up in both conditions (p 's<.001). Live demonstrated greater content engagement (p 's<.01).

Conclusions—The training package was feasible, acceptable, and efficacious among nursing students. Given that Live had higher acceptability and engagement, and online training offers

Correspondence to be addressed to: Rachel P. Kolko, PhD, University of Pittsburgh, 3811 O'Hara Street, Pittsburgh, PA, USA, 15213; kolkor2@upmc.edu; Phone: 412-647-1827.

Author Disclosure Statement: No competing financial interests reported.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

greater scalability, integrating interactive Live components within Web-based training may optimize outcomes, which may enhance practitioners' delivery of pediatric obesity services.

Keywords

Childhood obesity; nursing curriculum; evidence-based guidelines; training; simulation

INTRODUCTION

Addressing obesity in children has the potential to reduce the burdensome medical and psychological complications of obesity and its associated healthcare costs (Halfon, Larson, & Slusser, 2013; Hammond & Levine, 2010). The United States Preventive Services Task Force (USPSTF) and American Academy of Pediatrics (AAP) recommend providers screen for and treat pediatric obesity using evidence-based intervention guidelines. Further, the National Association of Pediatric Nurse Practitioners (NAPNAP) encourages providers to prioritize early identification; provision of age-specific guidance on healthy behaviors for parents, families, and caregivers; and continuity of care for youth identified as overweight or obese (NAPNAP, 2009, 2015). Family-based behavioral treatment (FBT) addresses these recommendations and is the gold-standard intervention for overweight and obesity in children (Epstein, Paluch, Roemmich, & Beecher, 2007; Kalarchian et al., 2009). Importantly, behavioral interventions embedded within routine care settings may substantially increase access to care (Kolko, Campo, Kelleher, & Cheng, 2010; Quattrin et al., 2012). However, although pediatric primary care represents an ideal point of intervention (Quattrin et al., 2012; Small, Bonds-McClain, Melnyk, Vaughan, & Gannon, 2014; Wilfley, Kass, & Kolko, 2011), access to evidence-based obesity treatment is limited and few providers follow guideline recommendations (Barlow, Trowbridge, Klish, & Dietz, 2002; Holt et al., 2011; Klein et al., 2010; Tanda & Salsberry, 2014).

The gap between recommended and typically-delivered care may be due to inadequate training opportunities, lack of referral resources (Barlow et al., 2002; Holt et al., 2011; Klein et al., 2010), and poor fit between treatment intensity and resources available in primary care (Haemer et al., 2011; Kilbourne, Neumann, Pincus, Bauer, & Stall, 2007). Indeed, studies demonstrate limited efficacy of low-intensity obesity intervention in pediatric primary care (Haemer et al., 2011; McCallum et al., 2007; Schwartz et al., 2007; Taveras et al., 2011; Wake et al., 2009). Further, as obesity-related discrimination exists among providers (Phelan et al., 2015), and weight discrimination is associated with mortality (Puhl & Heuer, 2009; Sutin, Stephan, & Terracciano, 2015), training providers to address obesity without stigma is critical. Pediatric nurse practitioners have reported that parent-associated barriers, such as perceived lack of parent motivation to address obesity in their children, hinder their delivery of screening and intervention for pediatric obesity (Small, Anderson, Sidora-Arcoleo, & Gance-Cleveland, 2009). Thus, equipping providers with strategies to facilitate engagement in healthy behavior change with children and families in a non-stigmatizing manner may enhance provider use of pediatric obesity screening and intervention approaches. Accordingly, we aimed to determine aspects of guideline-based care and training methods that will increase providers' ability to identify patients with obesity in non-stigmatizing ways and help them access effective services. Two obesity guidelines that may be well-

suited for primary care delivery are: (1) screening to identify patients warranting obesity intervention; and (2) initiating goals for intervention. These guidelines align with USPSTF, AAP, and NAPNAP recommendations, can be readily implemented within primary care settings, and may facilitate weight loss. However, to date, no study has evaluated the impact of training providers in these first-line obesity strategies. Doing so may improve uptake and implementation of pediatric obesity screening and intervention, subsequently curbing the pediatric obesity trend.

Thus, this randomized pilot trial conducted the first evaluation of the feasibility and efficacy of two training methods that address screening and initial intervention goal-setting as first-line obesity services. Live Interactive Training (Live) and Web-facilitated Self-study Training (Web) were implemented in an existing nursing curriculum to increase knowledge and skill of obesity guideline delivery. Nursing students were selected, given that nurses are in prime position to address obesity among pediatric patients and families (Foundation, 2012, para. 1) and providers-in-training may have more adaptable attitudes toward obesity than established nurses (Poon & Tarrant, 2009). While research on nurse practitioners has documented post-training improvements in obesity knowledge as well as intent to use skills for behavior modification and counseling (Gance-Cleveland, Sidora-Arcoleo, Keesing, Gottesman, & Brady, 2009) and web-based training for nursing students yields greater learning than control conditions (Clifton & Mann, 2011; Gerdprasert, Pruksacheva, Panijpan, & Ruenwongsa, 2010), less is known about response to different training methods. Thus, use of two active training conditions in this study makes this an ideal investigation in this population. We hypothesized that Live (vs. Web) would lead to greater increases in acceptability, knowledge, and skill at post-training and one-month follow-up. Exploratory analyses evaluated moderators (i.e., previous experience with intervention) and variables that influence training outcomes (i.e., time spent thinking about or using learned strategies).

METHODS

Participants

Advanced nursing students were recruited and randomized to a training condition. Because students were already organized into groups of 7–8 students within their Nursing of Children and Families course, nine groups were available for randomization ($N=68$). Five groups ($n=36$) were randomized to Live and four groups ($n=27$) to Web. Participants completed consent forms approved by the nursing program and study site's Institutional Review Board.

Procedure

Study procedures were developed and embedded within a required course in partnership with the Dean of the nursing program and the faculty course instructor. To ensure fit within the program, we utilized components of the Replicating Effective Programs (REP) model (Kilbourne et al., 2007), which posits that training and treatment fidelity are determinants of implementation success. Specifically, we used REP implementation strategies for soliciting feedback on and providing core training in initial obesity intervention delivery (Kilbourne et al., 2007).

Participation was voluntary; students who did not wish to participate could complete alternative assignments for course credit. Assessments were completed pre-training, post-training, and at one-month follow-up (Figure 1). Participants were compensated with a pedometer after the follow-up assessment.

Training content—The content used for training in obesity screening and initial goal setting is presented in Table 1. Both Live and Web used weight management recommendations from the USPSTF, AAP, and NAPNAP (Barlow, 2007; Force, 2010; NAPNAP, 2009, 2015) through a FBT approach that incorporated socio-environmental targets (Family-based Behavioral Social Facilitation Treatment; FBSFT; Halberstadt et al., 2013; Sarwer & Dilks, 2012; Wilfley et al., 2007; Wilfley et al., 2010). Specifically, these sources recommend providers calculate and plot BMI among all children ages 2 years and older on an annual basis to screen for children's weight status. For assessment and intervention, providers are encouraged to conduct a thorough history including family history and eating and activity behaviors, while considering risk for obesity and associated comorbidities based on family history, height and weight gain pattern, comorbidities, and socioeconomic, racial/ethnic, cultural, and environmental factors (Barlow, 2007; NAPNAP, 2006). The intervention targets described in these guidelines and in FBSFT include the following: consuming recommended quantities of fruits and vegetables, limiting sugar-sweetened beverage consumption, limiting television and other screen time, eating breakfast daily, limiting eating at restaurants and fast food establishments, eating family meals, and limiting portion size. Additional intervention targets include engaging in moderate to vigorous physical activity and limiting consumption of energy-dense foods (Barlow, 2007; Wilfley et al., 2011).

Accordingly, all students in both training programs were provided with an overview of the guidelines and instructed in two fundamental guideline-based content modules: (1) obesity screening (e.g., BMI calculation, obesity diagnosis), and (2) initial intervention goal-setting (e.g., evaluation and targeting of eating/activity patterns and social/environmental support for weight-related behaviors). In addition to the techniques discussed, strategies for non-stigmatizing communication about weight status and related behavioral changes with children, parents, and caregivers were provided. In learning these first-line services, nurses can better identify patients for whom obesity care is warranted and connect patients with comprehensive evidence-based services (e.g., FBSFT) or refer to other providers (e.g., registered dietitians) (NAPNAP, 2009, 2015).

Training delivery—Live and Web were designed as two relevant and empirically-supported approaches (Herschell, Kolko, Baumann, & Davis, 2010) that could be implemented within the nursing curriculum. Training duration (1 hour) and content were the same across conditions. Web was delivered on study-provided computers. The same classrooms and study staff were used across trainings and assessments.

Live entailed an in-person program that provided: (1) a brief review of concepts, (2) concept demonstrations (e.g., how to use child BMI to identify obesity), and (3) informal, interactive role-plays to practice and receive feedback on specific techniques (e.g., competently discussing obesity with family members using sensitive and non-stigmatizing approaches).

The interactive format was designed to facilitate engagement with the trainer, interest in content, and peer learning, collaboration (Herschell et al., 2010), and support (Taylor et al., 2013).

Web used a computer-based program that provided: (1) a brief review of concepts, and (2) information for delivery. The web-based format was designed to facilitate students' independent and self-paced learning. Online and self-study trainings are common, effective, easily accessible for providers (Dimeff et al., 2009; Miller, Sorensen, Selzer, & Brigham, 2006; Worrall & Fruzzetti, 2009) and may be a cost-effective method to increase knowledge, given their disseminability (Sholomskas et al., 2005).

Measures

Demographics were collected at the pre-training assessment. Knowledge and skill were assessed at pre-training, post-training, and follow-up. Acceptability was measured at post-training and follow-up.

Demographics—Participants provided demographics and information on previous experience with obesity and/or non-weight related behavioral/counseling interventions.

Knowledge—Knowledge of obesity screening and goal-setting was evaluated through a 12-item assessment. Items measuring training content were derived from USPSTF, AAP, and NAPNAP guidelines and from core FBSFT strategies (Barlow, 2007; NAPNAP, 2006, 2015; U.S. Preventive Services Task Force, 2010; Wilfley et al., 2011).

Skills—Skills were evaluated through a novel simulation assessment. Simulation in medical training has been positively endorsed (Ewy et al., 1987; Gordon, Wilkerson, Shaffer, & Armstrong, 2001), effective (Alinier, Hunt, Gordon, & Harwood, 2006), and shown to teach skills that transfer to patient interactions (Issenberg et al., 1999). Nursing students across conditions role-played responses to one standardized patient scenario to gauge their use of the evidence-based strategies. Study staff members were trained to portray a female parent of a male child with obesity that included the provision of information related to identified individual, familial, social, and environmental factors associated with specific behaviors and attitudes. A female parent role was selected because mothers often present for obesity treatment with their children, mothers' baseline weight is associated with children's weight loss treatment outcomes, and mothers may play a leading role in targeted health behaviors and engineering the home and other environments (Golan, Kaufman, & Shahar, 2006; Sonnevile et al., 2012). Given that rates of obesity and levels of parental concern about this problem are similar for boys and girls (Lampard, Byrne, Zubrick, & Davis, 2008; Ogden, Carroll, Kit, & Flegal, 2014), a male child role was chosen to provide gender balance with the female parent role.

Simulations were audio-recorded and rated on a composite score of two dimensions: (1) adherence to screening and goal-setting components (assessed on a 3-point scale: 0=*non-occurrence*, 1=*semi-occurrence*, 2=*occurrence*), and (2) quality of delivered components (assessed on a 5-point scale using the following anchors: 0=*inadequate*, 2=*satisfactory*, 4=*expert*). Two undergraduate research assistants were trained to rate simulations and to

code and enter all data. The trainer (R.P.K.) met with each rater independently, then both raters together, to review assessments and rate audiorecordings. Feedback was provided until individual rating items matched the trainer's with 75% accuracy. The first 10 cases (i.e., 10 pairs of scores per timepoint) were used to evaluate interrater reliability, yielding intraclass correlation coefficients (Nichols, 1998) of 0.86, 0.96, and 0.92 at pre-training, post-training, and follow-up, respectively.

Acceptability—The questionnaire to assess acceptability of training content and methods was adapted from a measure of obesity treatment satisfaction and perceived helpfulness (Edwards et al., 2006) as well as from a measure assessing treatment acceptance when comparing interventions (Sidani, Epstein, Bootzin, Moritz, & Miranda, 2009). Six items assessed acceptability on a 5-point scale (1=*not at all*, 2=*a little*, 3=*sort-of*, 4=*somewhat or fairly*, 5=*very much*).

Content engagement—Engagement in training material was assessed in four items measuring how often participants thought about and used the discussed information and strategies, on a 5-point scale (1=*never*, 2=*rarely*, 3=*sometimes*, 4=*often*, 5=*very often*).

Statistical Analyses

Univariate analyses examined differences between training conditions at each timepoint. Hypotheses were tested with an alpha level of .05.

Participants' responses to acceptability, knowledge, and skill items were summed for each measure, divided by the possible total score for each, and multiplied by 100 to form a percentage of the total for acceptability, knowledge, and skill (each ranging between 0–100). Assessment timepoint was entered as a within-subjects repeated measure. Analyses were performed using linear mixed models in SPSS 21.0 [IBM Corporation, Armonk, NY]. Analyses were intent-to-treat, using restricted maximum likelihood estimation for missing data (Hollis & Campbell, 1999; Moher, Schulz, & Altman, 2001). Models included training condition, timepoint, and the training condition by timepoint interaction as fixed effects (with moderator or covariate terms as fixed effects). Models also included pre-defined contrasts to test the null hypothesis that one training group did not differ from another in outcomes from pre-training to post-training, post-training to follow-up, or pre-training to follow-up.

Data on participants' previous experience were merged into one variable, given the low percentage of participants who reported previous experience with weight-related ($n=10$) and non-weight-related intervention ($n=14$). This aggregate variable represented previous experience with any weight-related/behavioral/counseling intervention ($n=19$).

Moderator effects of previous experience were evaluated by including the previous experience by training condition term in mixed models. Previous experience and content engagement were also evaluated as predictors by including covariate terms.

RESULTS

Preliminary Analyses

All enrolled students ($N = 63$; 100%) completed pre- and post-training assessments. All but one ($n = 62$; 98%) completed follow-up assessments (Figure 1).

Table 2 provides demographic characteristics and demonstrates there were no significant differences between training conditions in terms of demographics, previous intervention experience, or pre-training knowledge or skill (p 's $> .49$). None of the demographics significantly related to pre-training knowledge or skill (p 's $> .22$).

Acceptability of Training

Acceptability was significantly higher in Live than Web across both timepoints ($F(1, 61) = 31.22, p < .001$; Table 3). Participants in Live reported average acceptability ratings of “very much” and participants in Web reported ratings of “somewhat or fairly.” Acceptability decreased from post-training to follow-up across both conditions ($F(1, 61) = 37.25, p < .001$), although each condition remained within their respective ranges (“very much” for Live and “somewhat or fairly” for Web; Figure 2). The condition by timepoint interaction was not significant, suggesting no group difference in acceptability change patterns.

Impact of Training

Across conditions, participants demonstrated changes in knowledge ($F(2, 122) = 99.43, p < .001$) and skill ($F(2, 122) = 17.46, p = .001$; Table 3) over time. Knowledge increased from pre-training to post-training and decreased from post-training to follow-up for both conditions (Figure 2). However, there was an overall increase in knowledge from pre-training to follow-up. Skill also significantly increased from pre-training to post-training (Table 3), and scores were maintained from post-training to follow-up (Figure 2), with higher skill scores at follow-up than pre-training. Training condition did not differentially impact knowledge or skill (p 's $> .09$). Effect sizes across timepoints were small, with one moderate effect for skill (favoring Web from pre-training to post-training).

Moderator and Predictor Analyses

Previous experience—Previous experience influenced the relation between acceptability and time ($F(1, 59) = 5.45, p = .02$). Participants with previous experience reported higher acceptability at follow-up (i.e., less reduction in acceptability over time). For knowledge and skill, no other main effects or interaction terms were significant.

Content engagement—Frequency of thinking about the information ($t(60) = -2.89, p = .005$) and about intervention strategies ($t(60) = -3.05, p = .002$) were significantly higher in Live versus Web (Table 4). Frequency of using the information and strategies did not differ by condition (p 's $< .13$).

For acceptability, the main effects for training condition and timepoint remained significant across all engagement items. Frequency of thinking about information ($F(1, 59) = 12.29, p = .001$) and strategies ($F(1, 59) = 15.30, p < .001$) were significant covariates, whereas using

information or strategies were not significant. None of the engagement items were significant covariates in the models for knowledge and skill outcomes.

DISCUSSION

This pilot trial evaluated the feasibility, knowledge, skill, and acceptability of two training methods for obesity screening and initial intervention goal-setting in nursing students. Training and simulation assessment were feasible, as nearly all of the available nursing students participated, and all but one of the participating students completed the follow-up assessment.

Both Live and Web increased knowledge and skill from pre-training to post-training, and both demonstrated overall improvements at follow-up compared to pre-training. For knowledge, there was a decrease across conditions from post-training to follow-up. This may warrant further exploration and indicate a need to augment training delivery to optimize knowledge maintenance. However, it is notable that participants maintained skill levels from post-training to follow-up, given the importance of skill competency in care delivery. Given that the two trainings yielded similarly positive outcomes and no condition effects were found for skill or knowledge, either training program may be beneficial for inclusion in nursing school curricula. The similar effect also corroborates extant research showing the comparability of web-based training to live lectures (McConville & Lane, 2006).

The low percentage of participants who reported previous experience is comparable to published rates among practicing providers (Adams, Kohlmeier, & Zeisel, 2010) and underscores the urgent need for increased training efforts. However, results indicate that Live was associated with greater frequency of thinking about training content. Such engagement may reflect future use or uptake of the screening and intervention strategies, among other important implementation outcomes. It is not unsurprising that use of content did not differ between groups, which may be related to not being actively involved in pediatric obesity service delivery during the study. Still, this novel finding would be important to investigate in relation to impact on patient delivery and clinical outcomes. Additionally, continued training or supervision may augment these effects and would be worth exploring in a trial of longer duration.

While Live was more acceptable than Web, both conditions demonstrated similar reductions in acceptability over time. This may be due to the time lapse since training rather than as a feature (or lack thereof) of a particular training approach. Of note, follow-up ratings for both conditions remained within the ranges endorsed at post-training (“very much” for Live, “somewhat or fairly” for Web), highlighting continued positive review of the training package. In addition, the finding that previous intervention experience was associated with greater acceptability suggests that increasing nursing students’ involvement with obesity intervention may foster greater interest in providing it for their patients (Proctor et al., 2011). While acceptability may be dynamic and reflects provider experience throughout a process (Proctor et al., 2011), few data exist as to how changes in acceptability relate to implementation processes or outcomes, warranting future research to assess repeated intervention exposure and acceptability over time.

Overall, results suggest potential advantages and disadvantages to each training approach. Live included more diverse evidence-based educational strategies and had higher acceptability ratings. Importantly, role-plays, real-time feedback, and discussions with trainers and other trainees are among in-person training methods whose incorporation may enhance impact when delivering a higher-intensity intervention (Herschell et al., 2010), which may be important considerations for future large-scale efforts to train providers in more comprehensive services. Further, some evidence in the child and family treatment arena indicates higher acceptability of an intervention may enhance treatment engagement and outcome (Demidovich, Kolko, Bukstein, & Hart, 2011; Karver, Handelsman, Fields, & Bickman, 2006), lending support to future implementation of Live. However, live delivery requires more resources to implement than web (e.g., in-person attendance, access to trainers, classroom space), which may not be available for all settings.

Advantages for Web include the inexpensive, accessible, and self-paced nature of the program, as well as freedom from reliance on a trainer. Given that acceptability ratings were still favorable, the Web-based approach may fit with settings that encourage self-directed online approaches. Furthermore, the Web method offers strong potential for dissemination to other nursing programs as well as other curricula across disciplines, and recent research on online obesity training for school-based providers indicated high satisfaction and acceptability (Gance-Cleveland, Aldrich, Dandreaux, Oetzel, & Schmiede, 2015).

Taken together, one or both of the trainings may be well-suited for implementation within nursing training programs and could be selected to match schools' curricula, preferences, and student population. It is possible that including interactive components from live training (e.g., feedback from trainers) within web-based training may augment outcomes while optimizing training accessibility and scalability. Also, the results suggest that these specific and focused content modules for obesity screening and initial intervention goal-setting can be successfully taught within an hour, which may facilitate their large-scale dissemination.

In addition to organizational-level implementation considerations (Proctor et al., 2009), individual differences may influence learning outcomes (Biggs, 1979; Naquin & Holton, 2002) or preferences for selecting a particular training modality. Providers have been shown to self-select formal training when learning a new skill (McClaran, Snell, & Franco, 1998). Evaluating nursing student self-selection may offer unique information about the types of students who may be most interested or successful in particular training modalities.

Positive features of this pilot trial include partnership with nursing program leadership and attention to stakeholder preferences for implementation, near-perfect retention over follow-up, use of a controlled setting (similar schedules and workloads across participants), randomization to increase the ability to focus on influences of training, and use of two active training interventions. An additional strength is the use of a representative sample of students in a nursing program that may generalize to other provider training programs (e.g., registered dietitians). Moreover, incorporation of components from REP, an implementation framework that has been evaluated in primary care and mental health settings, guided

customization of the training and assessment paradigms to increase fit with the setting, which likely contributed to the high participation rates (Kilbourne et al., 2007).

Several limitations warrant consideration. First, outcome measures and simulation scenarios were developed for the study, given the dearth of measures on pediatric obesity training benchmarks. Evaluation of the measures' psychometric properties and replication in a larger trial represents a critical next step. Second, participants were drawn from one nursing program, which may limit the generalizability of findings. Third, the sample size was small, although this enrollment number is similar to published literature on evidence-based practice training (Herschell, Kogan, Celedonia, Gavin, & Stein, 2009; Herschell et al., 2010). Fourth, the overall training and assessment package, particularly the knowledge questionnaires and simulations, may have increased engagement and subsequent learning across both conditions (Roediger & Butler, 2011). Effect sizes were small-to-moderate, and may increase with a larger and more diverse sample, longer training and assessment duration (Roediger & Butler, 2011), more intensive intervention content, and/or by including an additional assessment of competency in patient delivery to capture the real-world impact of training.

In summary, this pilot trial evaluated two training programs for first-line obesity services among a cohort of nursing students. Live and Web trainings demonstrated improved knowledge and skill, and Live was associated with greater acceptability and content engagement at follow-up. However, the finding that a web-based, self-paced training showed comparable improvements in knowledge and skill to an in-person, interactive training suggests that nursing students may benefit from either in-person or low-cost, accessible training programs, offering implications for scalability to other health professionals and future implementation initiatives. Accordingly, both training programs may inform larger-scale efforts to increase the number of providers trained in relevant, useful evidence-based intervention components. Moreover, this work may aid the development and organization of training content and assessments for obesity service accreditation processes across disciplines. Further exploration of these findings may yield greater understanding of feasible, practical, and effective training programs with the potential to enhance providers' abilities to identify and address obesity among patients. Such trainings may ultimately promote better health care delivery and overall health among children and families.

Acknowledgments

This work was supported by training and mentoring fellowships (T32 HL007456, T32 MH018269, T32 HS000078, K24 MH070446, and Washington University in St. Louis Dissertation Fellowship). The authors acknowledge Meghna Katakya and Meghna Nandi for their assistance in coding the data on which this article is based, as well as David Kolko, PhD, ABPP, for his valuable review and feedback.

References

- Adams KM, Kohlmeier M, Zeisel SH. Nutrition education in U.S. medical schools: latest update of a national survey. *Academic Medicine*. 2010; 85(9):1537–1542. [PubMed: 20736683]
- Alinier G, Hunt B, Gordon R, Harwood C. Effectiveness of intermediate-fidelity simulation training technology in undergraduate nursing education. *Journal of Advanced Nursing*. 2006; 54(3):359–369. [PubMed: 16629920]

- Barlow SE. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007; 120(Suppl 4):S164–192. [PubMed: 18055651]
- Barlow SE, Trowbridge FL, Klish WJ, Dietz WH. Treatment of child and adolescent obesity: reports from pediatricians, pediatric nurse practitioners, and registered dietitians. *Pediatrics*. 2002; 110(1 Pt 2):229–235. [PubMed: 12094000]
- Biggs J. Individual differences in study processes and the quality of learning outcomes. *Higher Education*. 1979; 8:381–394.
- Clifton A, Mann C. Can YouTube enhance student nurse learning? *Nurse Education Today*. 2011; 31(4):311–313. [PubMed: 21036430]
- Demidovich M, Kolko DJ, Bukstein OG, Hart J. Medication refusal in children with oppositional defiant disorder or conduct disorder and comorbid attention-deficit/hyperactivity disorder: medication history and clinical correlates. *Journal of Child and Adolescent Psychopharmacology*. 2011; 21(1):57–66. [PubMed: 21288119]
- Dimeff LA, Koerner K, Woodcock EA, Beadnell B, Brown MZ, Skutch JM, ...Harned MS. Which training method works best? A randomized controlled trial comparing three methods of training clinicians in dialectical behavior therapy skills. *Behaviour Research and Therapy*. 2009; 47(11): 921–930. [PubMed: 19695562]
- Edwards C, Nicholls D, Croker H, Van Zyl S, Viner R, Wardle J. Family-based behavioural treatment of obesity: acceptability and effectiveness in the UK. *European Journal of Clinical Nutrition*. 2006; 60(5):587–592. [PubMed: 16340947]
- Epstein L, Paluch R, Roemmich J, Beecher M. Family-based obesity treatment, then and now: twenty-five years of pediatric obesity treatment. *Health Psychology*. 2007; 26(4):381–391. [PubMed: 17605557]
- Ewy GA, Felner JM, Juul D, Mayer JW, Sajid AW, Waugh RA. Test of a cardiology patient simulator with students in fourth-year electives. *Journal of Medical Education*. 1987; 62(9):738–743. [PubMed: 3625738]
- Force UPST. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. *Pediatrics*. 2010; 125(2):361–367. [PubMed: 20083515]
- Foundation RWJ. Nurses evolving role in primary care. *Human Capital Blog*. Human Capital Blog. 2012 para. 1.
- Gance-Cleveland B, Aldrich H, Dandreaux D, Oetzel KB, Schmiede S. A Virtual Childhood Obesity Collaborative: Satisfaction With Online Continuing Education. *Journal of Pediatric Health Care*. 2015; 29(5):413–423. [PubMed: 25777493]
- Gance-Cleveland B, Sidora-Arcoleo K, Keesing H, Gottesman MM, Brady M. Changes in nurse practitioners' knowledge and behaviors following brief training on the healthy eating and activity together (HEAT) guidelines. *Journal of Pediatric Health Care*. 2009; 23(4):222–230. [PubMed: 19559990]
- Gerdprasert S, Pruksacheva T, Panijpan B, Ruenwongsa P. Development of a web-based learning medium on mechanism of labour for nursing students. *Nurse Education Today*. 2010; 30(5):464–469. [PubMed: 19931950]
- Golan M, Kaufman V, Shahar DR. Childhood obesity treatment: targeting parents exclusively v. parents and children. *British Journal of Nutrition*. 2006; 95(5):1008–1015. [PubMed: 16611394]
- Gordon JA, Wilkerson WM, Shaffer DW, Armstrong EG. "Practicing" medicine without risk: students' and educators' responses to high-fidelity patient simulation. *Academic Medicine*. 2001; 76(5): 469–472. [PubMed: 11346525]
- Haemer M, Cluett S, Hassink SG, Liu L, Mangarelli C, Peterson T, ...Weill B. Building capacity for childhood obesity prevention and treatment in the medical community: call to action. *Pediatrics*. 2011; 128(Suppl 2):S71–77. [PubMed: 21885648]
- Halberstadt J, Makkes S, de Vet E, Jansen A, Nederkoorn C, van der Baan-Slootweg OH, Seidell JC. The role of self-regulating abilities in long-term weight loss in severely obese children and adolescents undergoing intensive combined lifestyle interventions (HELIOS); rationale, design and methods. *BioMed Central Pediatrics*. 2013; 13:41. [PubMed: 23530979]

- Halfon N, Larson K, Slusser W. Associations between obesity and comorbid mental health, developmental, and physical health conditions in a nationally representative sample of US children aged 10 to 17. *Academic Pediatrics*. 2013; 13(1):6–13. [PubMed: 23200634]
- Hammond RA, Levine R. The economic impact of obesity in the United States. *Journal of Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*. 2010; 3:285.
- Herschell AD, Kogan JN, Celedonia KL, Gavin JG, Stein BD. Understanding community mental health administrators' perspectives on dialectical behavior therapy implementation. *Psychiatric Services*. 2009; 60(7):989–992. [PubMed: 19564234]
- Herschell AD, Kolko DJ, Baumann BL, Davis AC. The role of therapist training in the implementation of psychosocial treatments: a review and critique with recommendations. *Clinical Psychology Review*. 2010; 30(4):448–466. [PubMed: 20304542]
- Hollis S, Campbell F. What is meant by intention to treat analysis? Survey of published randomised controlled trials. *British Medical Journal*. 1999; 319(7211):670–674. [PubMed: 10480822]
- Holt N, Schetzina KE, Dalton WT III, Tudiver F, Fulton-Robinson H, Wu T. Primary care practice addressing child overweight and obesity: a survey of primary care physicians at four clinics in southern Appalachia. *Southern Medical Journal*. 2011; 104(1):14. [PubMed: 21119559]
- Issenberg SB, McGaghie WC, Hart IR, Mayer JW, Felner JM, Petrusa ER, ...Ewy GA. Simulation technology for health care professional skills training and assessment. *Journal of the American Medical Association*. 1999; 282(9):861–866. [PubMed: 10478693]
- Kalarchian MA, Levine MD, Arslanian SA, Ewing LJ, Houck PR, Cheng Y, ...Marcus MD. Family-based treatment of severe pediatric obesity: randomized, controlled trial. *Pediatrics*. 2009; 124(4):1060–1068. [PubMed: 19786444]
- Karver MS, Handelsman JB, Fields S, Bickman L. Meta-analysis of therapeutic relationship variables in youth and family therapy: the evidence for different relationship variables in the child and adolescent treatment outcome literature. *Clinical Psychology Review*. 2006; 26(1):50–65. [PubMed: 16271815]
- Kilbourne AM, Neumann MS, Pincus HA, Bauer MS, Stall R. Implementing evidence-based interventions in health care: application of the replicating effective programs framework. *Implementation Science*. 2007; 2:42. [PubMed: 18067681]
- Klein JD, Sesselberg TS, Johnson MS, O'Connor KG, Cook S, Coon M, ...Washington R. Adoption of body mass index guidelines for screening and counseling in pediatric practice. *Pediatrics*. 2010; 125(2):265–272. [PubMed: 20083518]
- Kolko DJ, Campo JV, Kelleher K, Cheng Y. Improving access to care and clinical outcome for pediatric behavioral problems: A randomized trial of a nurse-administered intervention in primary care. *Journal of Developmental and Behavioral Pediatrics*. 2010; 31(5):393. [PubMed: 20495474]
- Lampard AM, Byrne SM, Zubrick SR, Davis EA. Parents' concern about their children's weight. *International Journal of Pediatric Obesity*. 2008; 3(2):84–92. [PubMed: 18465434]
- McCallum Z, Wake M, Gerner B, Baur LA, Gibbons K, Gold L, ...Waters E. Outcome data from the LEAP (Live, Eat and Play) trial: a randomized controlled trial of a primary care intervention for childhood overweight/mild obesity. *International Journal of Obesity*. 2007; 31(4):630–636. [PubMed: 17160087]
- McClaran J, Snell L, Franco E. Type of clinical problem is a determinant of physicians' self-selected learning methods in their practice settings. *Journal of Continuing Education in the Health Professions*. 1998; 18:107–118.
- McConville SA, Lane AM. Using on-line video clips to enhance self-efficacy toward dealing with difficult situations among nursing students. *Nurse Education Today*. 2006; 26(3):200–208. [PubMed: 16300862]
- Miller WR, Sorensen JL, Selzer JA, Brigham GS. Disseminating evidence-based practices in substance abuse treatment: a review with suggestions. *Journal of Substance Abuse Treatment*. 2006; 31(1):25–39. [PubMed: 16814008]
- Moher D, Schulz KF, Altman DG. The CONSORT statement: revised recommendations for improving the quality of reports of parallel group randomized trials. *BioMed Central Medical Research Methodology*. 2001; 1:2. [PubMed: 11336663]

- NAPNAP. Identifying and preventing overweight in childhood: Clinical practice guideline: Part I. *Journal of Pediatric Health Care*. 2006; 20(2 Suppl):1–32.
- NAPNAP. NAPNAP position statement on the identification and prevention of overweight and obesity in the pediatric population. *Journal of Pediatric Health Care*. 2009; 23(6):A15–16. [PubMed: 19882803]
- NAPNAP. NAPNAP Position statement on the identification and prevention of overweight and obesity in the pediatric population. *Journal of Pediatric Health Care*. 2015; 29:A13–A15.
- Naquin SS, Holton EFI. The Effects of Personality, Affectivity, and Work Commitment on Motivation to Improve Work Through Learning. *Human Resource Development Quarterly*. 2002; 13(4):357–376.
- Nichols, DP. Choosing an intraclass correlation coefficient. 1998. Retrieved from <http://www.ats.ucla.edu/stat/spss/library/whichicc.htm>
- Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *Journal of the American Medical Association*. 2014; 311(8):806–814. [PubMed: 24570244]
- Phelan S, Burgess D, Yeazel M, Hellerstedt W, Griffin J, Ryn M. Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. *Obesity Reviews*. 2015; 16(4):319–326. [PubMed: 25752756]
- Poon MY, Tarrant M. Obesity: attitudes of undergraduate student nurses and registered nurses. *Journal of Clinical Nursing*. 2009; 18(16):2355–2365. [PubMed: 19374692]
- Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, ...Hensley M. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Administration and Policy in Mental Health and Mental Health Services Research*. 2011; 38(2): 65–76. [PubMed: 20957426]
- Proctor EK, Landsverk J, Aarons G, Chambers D, Glisson C, Mittman B. Implementation research in mental health services: an emerging science with conceptual, methodological, and training challenges. *Administration and Policy in Mental Health and Mental Health Services Research*. 2009; 36(1):24–34. [PubMed: 19104929]
- Puhl RM, Heuer CA. The stigma of obesity: a review and update. *Obesity*. 2009; 17(5):941–964. [PubMed: 19165161]
- Quattrin T, Roemmich JN, Paluch R, Yu J, Epstein LH, Ecker MA. Efficacy of family-based weight control program for preschool children in primary care. *Pediatrics*. 2012; 130(4):660–666. [PubMed: 22987879]
- Roediger HL 3rd, Butler AC. The critical role of retrieval practice in long-term retention. *Trends in Cognitive Science*. 2011; 15(1):20–27.
- Sarwer DB, Dilks RJ. Invited commentary: childhood and adolescent obesity: psychological and behavioral issues in weight loss treatment. *Journal of Youth and Adolescence*. 2012; 41(1):98–104. [PubMed: 21626434]
- Schwartz RP, Hamre R, Dietz WH, Wasserman RC, Slora EJ, Myers EF, ...Resnicow KA. Office-based motivational interviewing to prevent childhood obesity: a feasibility study. *Archives of Pediatrics and Adolescent Medicine*. 2007; 161(5):495–501. [PubMed: 17485627]
- Sholomskas DE, Syracuse-Siewert G, Rounsaville BJ, Ball SA, Nuro KF, Carroll KM. We don't train in vain: a dissemination trial of three strategies of training clinicians in cognitive-behavioral therapy. *Journal of Consulting and Clinical Psychology*. 2005; 73(1):106–115. [PubMed: 15709837]
- Sidani S, Epstein DR, Bootzin RR, Moritz P, Miranda J. Assessment of preferences for treatment: validation of a measure. *Research in Nursing & Health*. 2009; 32(4):419–431. [PubMed: 19434647]
- Small L, Anderson D, Sidora-Arcoleo K, Gance-Cleveland B. Pediatric nurse practitioners' assessment and management of childhood overweight/obesity: results from 1999 and 2005 cohort surveys. *Journal of Pediatric Health Care*. 2009; 23(4):231–241. [PubMed: 19559991]
- Small L, Bonds-McClain D, Melnyk B, Vaughan L, Gannon AM. The preliminary effects of a primary care-based randomized treatment trial with overweight and obese young children and their parents. *Journal of Pediatric Health Care*. 2014; 28(3):198–207. [PubMed: 23511090]

- Sonneville KR, Rifas-Shiman SL, Kleinman KP, Gortmaker SL, Gillman MW, Taveras EM. Associations of obesogenic behaviors in mothers and obese children participating in a randomized trial. *Obesity*. 2012; 20(7):1449–1454. [PubMed: 22349735]
- Sutin AR, Stephan Y, Terracciano A. Weight Discrimination and Risk of Mortality. *Psychological Science*. 2015; 26(11):1803–1811. [PubMed: 26420442]
- Tanda R, Salsberry P. The impact of the 2007 expert committee recommendations on childhood obesity preventive care in primary care settings in the United States. *Journal of Pediatric Health Care*. 2014; 28(3):241–250. [PubMed: 23831376]
- Taveras EM, Gortmaker SL, Hohman KH, Horan CM, Kleinman KP, Mitchell K, ...Gillman MW. Randomized Controlled Trial to Improve Primary Care to Prevent and Manage Childhood Obesity: The High Five for Kids Study. *Archives of Pediatrics and Adolescent Medicine*. 2011; 165(8):714–722. [PubMed: 21464376]
- Taylor R, Jung J, Loewen P, Spencer C, Dossa A, de Lemos J. Online versus Live Delivery of Education to Pharmacists in a Large Multicentre Health Region: A Non-inferiority Assessment of Learning Outcomes. *Canadian Journal of Hospital Pharmacy*. 2013; 66(4):233–240. [PubMed: 23950607]
- U.S. Preventive Services Task Force. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. *Pediatrics*. 2010; 125(2):361–367. [PubMed: 20083515]
- Wake M, Baur LA, Gerner B, Gibbons K, Gold L, Gunn J, ...Ukoumunne OC. Outcomes and costs of primary care surveillance and intervention for overweight or obese children: the LEAP 2 randomised controlled trial. *British Medical Journal*. 2009; 339:b3308. [PubMed: 19729418]
- Wilfley DE, Kass AE, Kolko RP. Counseling and behavior change in pediatric obesity. *Pediatric Clinics of North America*. 2011; 58(6):1403–1424. [PubMed: 22093859]
- Wilfley DE, Stein RI, Saelens BE, Mockus DS, Matt GE, Hayden-Wade HA, ...Epstein LH. Efficacy of maintenance treatment approaches for childhood overweight: a randomized controlled trial. *Journal of the American Medical Association*. 2007; 298(14):1661–1673. [PubMed: 17925518]
- Wilfley DE, Van Buren DJ, Theim KR, Stein RI, Saelens BE, Ezzet F, ...Epstein LH. The use of biosimulation in the design of a novel multilevel weight loss maintenance program for overweight children. *Obesity*. 2010; 18(Suppl 1):S91–98. [PubMed: 20107468]
- Worrall JM, Fruzzetti AE. Improving peer supervisor ratings of therapist performance in dialectical behavior therapy: An Internet-based training system. *Psychotherapy*. 2009; 46(4):476–479. [PubMed: 22121843]

Highlights

- Nurses and nursing students are well-positioned to address pediatric obesity.
- Training opportunities for delivering evidence-based obesity services are limited.
- We tested Live v. Web training of guideline-based obesity care in nursing students.
- Both training methods were feasible, acceptable, and improved knowledge and skill.
- Incorporating such training programs may enhance access and pediatric obesity care.

Figure 1.
Flow of nursing student participants in the pilot trial.

Figure 2.
Acceptability, knowledge, and skill scores for each training condition over time.

Table 1

Outline of Content for Training in Obesity Screening and Initial Goal Setting.

Training Content	Included in Live ^a	Included in Web ^a
Defining overweight and obesity	✓	✓
CDC ^a definitions of overweight and obesity for children, based on BMI ^a percentile	✓	✓
Importance of addressing obesity	✓	✓
Rates of obesity among children	✓	✓
Medical consequences of obesity in childhood	✓	✓
Psychosocial consequences of obesity in childhood	✓	✓
Long-term consequences of obesity: Persisting into adulthood	✓	✓
Evidence-based recommendations	✓	✓
Recommendations from the USPSTF ^a	✓	✓
FBSFT ^a	✓	✓
Traffic Light Plan for energy balance	✓	✓
Self-monitoring of eating and activity patterns	✓	✓
Obesity screening	✓	✓
Recommendations for obesity screening from the USPSTF and the AAP ^a	✓	✓
Calculating BMI and BMI percentile	✓	✓
<i>Demonstration:</i> Using growth charts to determine BMI percentile	✓	
<i>Interactive role play:</i> How to conduct obesity screening and diagnosis with families	✓	
Addressing Obesity: Initial goal setting	✓	✓
Recommendations for addressing obesity from the AAP and FBSFT	✓	✓
Effective goal setting strategies	✓	✓
<i>Demonstration:</i> Learning key information and determining initial goals to address obesity	✓	
<i>Interactive role play:</i> How to set an initial goal with families	✓	
Having the conversation: How to discuss weight without stigma	✓	✓
Fundamental principles for implementation	✓	✓
Summary and potential for impact	✓	✓

^a Abbreviations: Live = Live Interactive Training; Web = Web-facilitated Self-study Training; CDC = Centers for Disease Control and Prevention; BMI = body mass index; USPSTF = U.S. Preventive Services Task Force; FBSFT = Family-based Social Facilitation Treatment; AAP = American Academy of Pediatrics

Table 2

Participant demographic information.

Variable	Total Sample (N=63) Mean (SD) or N (%)	Live ^a (n=36) Mean (SD) or n (%)	Web ^a (n=27) Mean (SD) or n (%)	Test Statistic and <i>p</i> -value
Age in Years	24.68 (5.28)	24.28 (4.75)	25.22 (5.97)	<i>t</i> (61) = 0.70, <i>p</i> = .49
Race				
Asian/Asian American	2 (3.17%)	1 (2.78%)	1 (3.70%)	$\chi^2(3, N = 63) = 0.83, p = .84$
Black/African American	2 (3.17%)	1 (2.78%)	1 (3.70%)	
White/Caucasian	58 (92.06%)	33 (91.67%)	25 (92.59%)	
Mixed	1 (1.59%)	1 (2.78%)	0 (0.00%)	
Ethnicity ^b				
Hispanic	1 (1.59%)	1 (2.78%)	0 (0.00%)	
Non-Hispanic	62 (98.41%)	35 (97.22%)	27 (100.00%)	
Gender				
Male	5 (7.94%)	3 (8.33%)	2 (7.41%)	$\chi^2(1, N = 63) = 0.02, p = .89$
Female	58 (92.06%)	33 (91.67%)	25 (92.59%)	
Highest Education Degree Obtained				
High School Graduate	4 (6.35%)	2 (5.56%)	2 (7.41%)	$\chi^2(4, N = 63) = 1.75, p = .78$
Partial College	40 (63.49%)	24 (66.67%)	16 (59.26%)	
College Degree	15 (23.81%)	8 (22.22%)	7 (25.93%)	
Graduate Degree	3 (4.76%)	2 (5.56%)	1 (3.70%)	
Other	1 (1.59%)	0 (0.00%)	1 (3.70%)	
Previous Experience ^c				
No	44 (69.84%)	25 (69.44%)	19 (70.37%)	$\chi^2(1, N = 63) = 0.01, p = .94$
Yes	19 (30.16%)	11 (30.56%)	8 (29.63%)	

^a Abbreviations: Live = Live Interactive Training; Web = Web-facilitated Self-study Training^b Given that only one participant identified as Hispanic, this variable was not included in the analyses.^c Previous experience with any obesity/behavioral/counseling intervention

Table 3

Acceptability, knowledge, and skill scores by training condition and measurement time.

Within-Condition Change						
Timepoint	Acceptability Mean Estimate (SE) [95% CI]		Knowledge Mean Estimate (SE) [95% CI]		Skill Mean Estimate (SE) [95% CI]	
	Live ^a	Web ^a	Live ^a	Web ^a	Live ^a	Web ^a
Pre-training	Not assessed	Not assessed	40.28 (2.40) [35.55, 45.01]	43.83 (2.77) [28.37, 49.29]	21.17 (1.48) [18.23, 24.11]	20.27 (1.71) [16.87, 23.66]
Post-training	90.28 (1.96) [86.39, 94.17]	76.05 (2.26) [71.56, 80.54]	75.00 (2.40) [70.27, 79.73]	74.38 (2.77) [68.92, 79.84]	27.76 (1.48) [24.82, 30.70]	23.77 (1.71) [20.37, 27.16]
Follow-up	81.57 (1.96) [77.68, 85.46]	66.61 (2.29) [62.055, 71.16]	53.47 (2.40) [48.74, 58.20]	58.59 (2.82) [53.03, 64.15]	25.96 (1.48) [23.01, 28.90]	23.48 (1.71) [20.06, 26.91]

Between-Condition Contrasts		
Fixed Effects & Custom Hypoth. Parameters	Acceptability Statistic	Knowledge Statistic
Training Condition	$F(1, 61) = 31.22, p < .001$	$F(1, 61) = 1.16, p = .29$
Timepoint	$F(1, 61) = 37.25, p < .001$	$F(2, 122) = 99.43, p < .001$
Training Condition by Timepoint	$F(1, 60) = 0.061, p = .81$	$F(2, 122) = 0.81, p = .45$
Live vs. Web: Pre-training vs. Post-training	N/A	$\chi^2(121) = 0.90, p = .37, d = 0.23$ [95% CI = -0.27, 0.73]
Live vs. Web: Post-training vs. Follow-up	$\chi^2(121) = -1.23, p = .22, d = 0.06$ [95% CI = -0.44, 0.57]	$\chi^2(121) = -1.23, p = .22, d = -0.32$ [95% CI = -0.82, 0.19]
Live vs. Web: Pre-training vs. Follow-up	N/A	$\chi^2(121) = -.34, p = .74, d = -0.09$ [95% CI = -0.59, 0.42]

Across Condition Total Sample Change			
Timepoint Across Training Conditions	Acceptability Pairwise Comparisons Mean Difference Est. (95% CI), Sig.	Knowledge Pairwise Comparisons Mean Difference Est. (95% CI), Sig.	Skill Pairwise Comparisons Mean Difference Est. (95% CI), Sig.
Pre-training vs. Post-training	N/A	-32.64 (-37.24, -28.04), $p < .001$	-5.04 (6.83, -3.26), $p < .001$
Post-training vs. Follow-up	N/A	18.66 (14.03, 23.29), $p < .001$	1.04 (-0.75, 2.84), $p = .25$
Pre-training vs. Follow-up	N/A	-13.98 (-18.61, -9.35), $p < .001$	-4.00 (-5.80, -2.20), $p < .001$

^a Abbreviations: Live = Live Interactive Training; Web = Web-facilitated Self-study Training

* Tests evaluated changes from earlier to later assessments, and negative mean difference scores indicate improvements in outcome

Table 4

Frequency of content engagement in relation to training outcomes.

Frequency of engagement at follow-up				
Domain	Total (N = 62) Mean (SD)	Live ^a (N = 36) Mean (SD)	Web ^a (N = 26) Mean (SD)	Comparison of Live ^a vs. Web ^a
Frequency of Thinking about the Information	2.42 (0.84)	2.67 (0.72)	2.08 (0.89)	$t(60) = -2.89, p = .005$
Frequency of Thinking about the Strategies	2.61 (0.89)	2.89 (0.92)	2.23 (0.71)	$t(60) = -3.05, p = .002$
Frequency of Using the Information	2.05 (0.93)	2.19 (1.04)	1.85 (0.73)	$t(60) = -1.55, p = .13$
Frequency of Using the Strategies	2.03 (0.99)	2.06 (1.04)	2.00 (0.94)	$t(60) = -0.22, p = .83$

Acceptability: Between-Condition Contrasts				
Fixed Effects and Custom Hypothesis Parameters	Frequency of Thinking about Information Statistic	Frequency of Thinking about Strategies Statistic	Frequency of Using Information Statistic	Frequency of Using Strategies Statistic
Training Condition	$F(1, 59) = 18.66, p < .001$	$F(1, 59) = 17.52, p < .001$	$F(1, 59) = 26.05, p < .001$	$F(1, 59) = 29.56, p < .001$
Timepoint	$F(1, 60) = 37.72, p < .001$	$F(1, 60) = 37.72, p < .001$	$F(1, 60) = 37.72, p < .001$	$F(1, 60) = 37.72, p < .001$
Training Condition by Timepoint	$F(1, 60) = 0.09, p = .76$	$F(1, 60) = 0.09, p = .76$	$F(1, 60) = 0.09, p = .76$	$F(1, 60) = 0.09, p = .76$
Frequency of engagement	$F(1, 59) = 12.29, p < .001$	$F(1, 59) = 15.30, p < .001$	$F(1, 59) = 2.45, p < .12$	$F(1, 59) = 2.20, p < .14$

Knowledge: Between-Condition Contrasts				
Fixed Effects and Custom Hypothesis Parameters	Frequency of Thinking about Information Statistic	Frequency of Thinking about Strategies Statistic	Frequency of Using Information Statistic	Frequency of Using Strategies Statistic
Training Condition	$F(1, 59) = 1.50, p = .23$	$F(1, 59) = 1.05, p = .31$	$F(1, 59) = 1.13, p = .29$	$F(1, 59) = 1.20, p = .28$
Timepoint	$F(2, 120) = 95.45, p < .001$	$F(2, 120) = 95.45, p < .001$	$F(2, 120) = 95.45, p < .001$	$F(2, 120) = 95.45, p < .001$
Training Condition by Timepoint	$F(2, 120) = 0.85, p = .43$	$F(2, 120) = 0.85, p = .43$	$F(2, 120) = 0.85, p = .43$	$F(2, 120) = 0.85, p = .43$
Frequency of engagement	$F(1, 59) = 0.27, p = .60$	$F(1, 59) = 0.00, p = .98$	$F(1, 59) = 0.02, p = .89$	$F(1, 59) = 0.40, p = .53$

Skill: Between-Condition Contrasts				
Fixed Effects and Custom Hypothesis Parameters	Frequency of Thinking about Information Statistic	Frequency of Thinking about Strategies Statistic	Frequency of Using Information Statistic	Frequency of Using Strategies Statistic
Training Condition	$F(1, 59) = 0.88, p = .35$	$F(1, 59) = 0.55, p = .46$	$F(1, 59) = 1.31, p = .26$	$F(1, 59) = 1.04, p = .31$
Timepoint	$F(2, 120) = 17.76, p < .001$	$F(2, 120) = 17.76, p < .001$	$F(2, 120) = 17.76, p < .001$	$F(2, 120) = 17.76, p < .001$
Training Condition by Timepoint	$F(2, 120) = 1.23, p = .30$	$F(2, 120) = 1.23, p = .30$	$F(2, 120) = 1.23, p = .30$	$F(2, 120) = 1.23, p = .30$
Frequency of engagement	$F(1, 59) = 0.01, p = .92$	$F(1, 59) = 0.38, p = .54$	$F(1, 59) = 0.45, p = .50$	$F(1, 59) = 0.30, p = .58$

^a Abbreviations: Live = Live Interactive Training; Web = Web-facilitated Self-study Training