Published in final edited form as:
J Spec Pediatr Nurs. 2012 April ; 17(2): 121–128. doi:10.1111/j.1744-6155.2011.00322.x.

Educating diabetes camp counselors with a human patient simulator: A pilot study

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Abstract

Objective—To pilot test a novel method of teaching camp counselors hypoglycemia management.

Methods—During orientation counselors were assigned to the experimental (n=21) or control (n=15) group, and received hypoglycemia education. The experimental group received supplemental education with a human patient simulator (HPS).

Results—Baseline demographics, knowledge and self-efficacy were similar between groups. The experimental group had a significantly larger gain in diabetes knowledge than the control group. Within-participant change in self-efficacy did not differ by group. We observed (small n) a significant effect modification, with larger treatment-related differences in the subgroup with no previous diabetes exposure.

Conclusions—We demonstrated the ease of teaching diabetes management to camp counselors using HPS.

Keywords

type 1 diabetes; camp; diabetes education

Guidelines for managing children with type 1 diabetes (TIDM) at summer camp (ADA, 2007) has been clearly outlined by the American Diabetes Association (ADA) and is similar to day care or school guidelines except for the acknowledgement of increased physical activity. Diabetes camp allows opportunities for school-aged children and adolescents to interact with peers who also have diabetes but also provides an opportunity for them to live and learn more about their chronic condition in a safe environment. Self-management is promoted in a relaxed setting. Camp provides parents a respite from the pressures of day-to-day diabetes management. Recent empirical studies suggest improved short term (after 7 months) glycemic control for adolescents, especially girls with T1DM after attending summer camp (Wang, Stewart, Tuli, & White, 2008).

Typically, there is an experienced medical director at the camp who oversees the daily diabetes care of the children in partnership with the nursing staff educators, nutritionists, and in some instances, nursing, medical and pharmacy students (Condren, 2003). Camp counselors are also a critical group to the functioning of the camp and the day-to-day

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(1)"I confirm all patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story."

management of each child's diabetes as they have 24/7 contact with the children. They should be very familiar and comfortable with the identification and management of hypo-/hyperglycemia including administering glucagon(ADA, 2007). For the Joslin and Barton Diabetes camps, diabetes education for the camp staff occurs prior to start of camp. The camp staff have had varying exposure with diabetes, some have T1DM and have attended camp themselves, others have no personal experience with T1DM. Training includes overall review of pathophysiology, signs and symptoms of hypoglycemia and hyperglycemia with associated treatment (including emergency treatment), glucose monitoring, insulin injections, pump therapy, nutrition, insulin use and exercise, and psychological issues (ADA, 2007).

Human Patient Simulation (HPS) has been used in medical education (Alinier, Hunt, Gordon, & Harwood, 2006) for almost four decades, but only in the past ten years has nursing employed this educational strategy to enhance student nurse education (Dunn, 2004). In particular, the ability to improve critical thinking, decision making and clinical skills makes it potentially a viable teaching strategy to help teach caregivers of children with special health care needs (and in this case, T1DM). These life-sized computerized manikins can provide real time diabetes management experiences for parents in a controlled health care setting. Using this teaching strategy may help caregivers more quickly learn and become confident in managing the chronic condition. No reports could be found where this teaching technology has been used to educate camp staff. We were especially interested in those counselors who had not been exposed to T1DM and its management and to see if HPS would augment their learning experiences at the beginning of the camp orientation. Therefore, the purpose of this study was to pilot test the use of HPS with young adult camp staff. The aims included:

1. To test the feasibility of teaching camp counselors with a learning vignette on hypoglycemia using the HPS compared to the standard education experience
2. To measure differences between the experimental and control group on their diabetes knowledge and self-efficacy
3. To explore differences controlling for baseline exposure of caring for individuals with T1DM.

Theoretical Framework

The study was framed by Leventhal's (1983) well recognized self-regulation theory as interpreted, tested and applied by Johnson (Leventhal & Johnson, 1983; Johnson, 1999). This theoretical model has been used over the past 35 years for pre-operative and pre-procedural teaching especially in the field of nursing. Self-regulation theory was developed during the 1960s and 1970s in a cyclical fashion, with changes and modification of concepts and propositions based on empirical data (both laboratory and human intervention studies). In the 1970s nursing played an important role in developing this framework through informational teaching during pre-operative interventions. The early studies suggested that providing patients with pre-operative concrete, written information about a procedure (descriptions of physical sensations, the surgical environment, causes of sensations, and temporal conditions such as timing of procedure) actually decreased anxiety, improved patient confidence and decreased hospital stays.(Johnson & Leventhal, 1974) These studies started a practice revolution regarding patient education that has become standard of care. In the adult literature there have been numerous studies using self-regulation theory to craft educational interventions to decrease stress and anxiety and afford patients better coping strategies to rely on while undergoing a variety of medical screening procedures (colonoscopy, endoscopy, pelvic examination), during self-assessment for health-related issues such as self breast examination or acute myocardial infarction, during invasive

treatments such as chemotherapy and radiation, and for preparation for pre and post-operative surgical care.(Johnson, 1999)

In pediatric nursing, self-regulation theory was first used to test pre-procedural education for children. Johnson et al.'s cornerstone cast removal intervention study investigated providing young children with information, sounds, and visualization of what the cast removal experience would be like prior to the procedure (Johnson, Kirchoff, & Endress, 1975). It resulted in less stress and anxiety for those children receiving the intervention prior to cast removal. This study set the stage for pre-procedural and pre-surgical play education across the country.

Parent education is another area that fits well with self-regulation theory. For instance, partially based on the self-regulation theory, Melnyk et al. developed an in-hospital educational-behavioral intervention for mothers whose children were critically ill (Melnyk, Crean, F., Fairbanks, & Alpert-Gillis, 2007). Mothers who received the intervention reported significantly less stress, negative mood, and depression, and were more active in their children's hospital care compared to the control mothers.

There are four assumptions (Johnson, 1999) guiding self-regulation that are linked to information processing theory which are used to control our responses and behaviors when presented with a traumatic event or information. First, how we perceive and interpret traumatic or stressful experiences, such as a parent first learning about their child's chronic illness, inform responses and behaviors. Second, we take the experience information and develop a cognitive picture, visualization, or scheme (similar to reality) that will guide us for real life experiences as to what signs or sensations to look for, what actions to take, and what we might expect to see from our actions. This process also helps us develop confidence in our abilities to handle the experience if and when it occurs. Third, the information schema is organized from very concrete levels to abstract ones. It is hierarchical with, for example, lower level concrete tasks forming the groundwork for the higher level abstract concepts. For instance, learning how to administer insulin is a lower level task, while understanding how to adjust insulin dose contingent on carbohydrate intake and exercise is a higher level abstract task. Finally, knowing what to expect, how to respond to the intended experience (through knowledge and technical skill competence gained) and taking action, decreases any discrepancy of the expected event and reality, thus increasing parental confidence and decreasing associated fear and stress.

Thus, this well-established model provides individuals with concrete, written information about a procedure (visualization of the environment, descriptions of physical sensations, the surgical environment, causes of sensations, and temporal conditions such as timing of procedure) resulting in decreased anxiety and decreased length of stay (Johnson & Leventhal, 1974). It is proposed that by providing camp staff with an opportunity to practice and visualize the concept of managing and treating hypoglycemia in children (with the use of the child-size simulator), they will digest the information and feel more confident in providing care at camp.

METHODS

Sample and Setting

The study participants were recruited from the camp counselors (N=38) who, along with the camp health care providers, would be interacting closely with the campers during their 2-week camp stay. The Barton Center for Diabetes Education runs two camp sites: one for boys (formerly known as the Joslin Diabetes Camp) and one for girls (Barton Camp). Both are located in central Massachusetts and share a coordinated health care team and

supervisory staff. Orientation and training for both sites took place at the girls' camp. Because this is a pilot study, with a focus on obtaining preliminary data on feasibility and efficacy, we did not undertake a power analysis. Of those counselors approached, 36 agreed to participate. We conducted the study first thing in the morning when the volunteers were the most alert and interactive.

Hypoglycemia vignette

Since episodes of hypoglycemia are of big concern to counselors, parents and the children themselves, we decided to focus on its management and treatment. The hypoglycemia vignette included a two-part description for both mild-moderate and moderate-severe episodes of hypoglycemia based on comparable activities that could occur at camp. The vignette described a school-aged child playing soccer at camp who complained of feeling dizzy. The vignette prompted participants to think about what should be done first, why, what is going on, and how to prevent the situation from occurring in the future. For each of the hypoglycemia descriptions there were objectives for the diabetes educator who was leading the teaching session to follow. For instance, for the mild-moderate episode of hypoglycemia we included objectives such as the staff should be able to state signs and symptoms of hypoglycemia (mild to moderate); causes (precipitating factors) of hypoglycemia; three types of treatment; when blood glucose level should be rechecked and when and if treatment should be repeated; and when a snack of complex carbohydrate should be used in the presence of mild to moderate hypoglycemia. We also simulated hypoglycemic tremors and how to treat the critical incident.

The diabetes educator in the experimental group used the simulator to explain, review and illustrate the content described in the objectives. The simulator has a voice-over response (*I don't feel well, my stomach hurts)*, a bleeding finger for practicing glucose monitoring, fat pads for practicing insulin injections, and could simulate tremors/seizures for caregiver response practice. All these capabilities were threaded throughout the vignette which lasted approximately 1 1/2 hours. The same vignette and objectives were used by another Diabetes Educator with the control group, minus the visualization with the simulator, and lasting an equivalent teaching time duration.

Study Measures

Data were collected on demographic characteristics (race, educational level, ethnicity, whether or not they had T1DM or had a sibling or close relative that they had cared for with T1DM). At baseline, data were collected on their diabetes knowledge and self-efficacy. Diabetes Awareness and Reasoning Test-Parents (DART-P) (Heidgerken et al., 2007) is a 47-item multiple-choice (4 choices) questionnaire that measures diabetes knowledge and was developed for children and parents. We removed items that were not pertinent to the hypoglycemia teaching vignette for this study (such as school-related management, specific types of insulin) reducing it to 25 items. The maximum score was 25 indicating correct answers on all items. The reported Cronbach's alpha by the developers was .92 and for this study and with the modified version it was .81.

The Self-Efficacy for Diabetes (SED) is a 22-item (Likert scale, 1=very sure I can't , to 5= very sure I can, with higher scores=more confidence) instrument that originally measured parents' confidence in managing adolescents care (Grossman, Brinks, & Hauser, 1987) and was adapted to measure parents' confidence in caring for children with T1DM (Streisand, Swift, Wickmark, Chen, & Holmes, 2005). In our study we only used 12 (thus, a maximum score of 60) of the 22 adapted items that were pertinent to the camp caregiver perspective to measure confidence in specific tasks and skills associated with diabetes care, i.e. how confident the staff was that he or she could perform day-to-day diabetes management

(eliminating items such as parents' confidence in discussing care with health care providers). The adapted 22-item Likert scale had a reported Cronbach's alpha of .87 and for this study with 12 items it was .94.

Procedures

After IRB approval was secured from The University of Massachusetts, Worcester and at the camp, participants were recruited on the first day of orientation by the camp director. They were all given the option to participate and be selected for one of two groups. All but two agreed to participate in the study. The two males who did not want to participate were taught with the standard control education session group but did not complete the questionnaires. They chose not to participate because they didn't want to fill out the forms. After each participant completed the informed consents and baseline questionnaires, the camp medical director had them line up and sequentially assign them to alternate between group A (the control group, n=15) and group B (the experimental group, n=21). The 1 1/2 hour teaching sessions were conducted in two separate locations in the camp. Post-education session the participants completed the same questionnaires.

Data management and analysis

Data were double entered into SPSS 14.0 then converted into a SAS dataset and analyzed using SAS version 9.2. (SAS Institute, 2008)(SAS Institute, 2008) Continuous variables were summarized by means and standard deviations, and discrete variables by frequencies and percents. The two treatment groups were compared regarding baseline characteristics using chi-square tests for categorical variables and Wilcoxon two-sample rank testing for continuous variables. The primary analytic approach was analysis of covariance (ANCOVA) for within-person change (post minus pre) for each outcome (total DART score and total SED score) separately as a function of treatment arm, adjusting for pre score in order to account for possible regression to the mean (Chuang-Stein & Tong, 1997). Adjustment for baseline characteristics related to change in outcomes (Pocock, 2002) had little impact on treatment-related differences; thus, results adjusted only for the baseline outcome value are presented.

In addition to these analyses, we conducted two sets of analyses to assess the possible impact of ceiling effects, where a respondent's baseline response was already at the maximum value for the outcome scale and thus improvement was not possible. In particular, this was a concern for the DART in participants with previous diabetes exposure. First, we used Tobit modeling (Greene, 1993) with right- rather than leftcensoring. In other words, a DART score of 25 and a SED score of 60 were treated as censored, i.e., all we know is that the "true" score on a hypothetical scale that would allow for larger scores is at least as large as 25 or 60, respectively. Second, the two treatment arms were compared regarding mean within-participant change using a method applied by Evans et al. which accounts for the fact that the possible range of change from pre- to post-intervention depends on the participant's pre-intervention score (Evans, Beckett, Albert, & al., 1993). Briefly, within-participant changes in the outcome were ranked separately for each pre-intervention score, the ranks were transformed using normal scores in order to make change scores comparable regardless of the pre-intervention score, and the two treatment arms were compared regarding these transformed ranks using Wilcoxon signed rank testing.

Finally, exploratory analyses were conducted to test for interaction (effect modification) between treatment arm and previous diabetes exposure, to test whether treatment-related difference in change was larger in those with no previous exposure.

Results

Table 1 displays the demographic data for the 36 participants, with 10 males and 24 females (2 chose not to denote gender). The majority of participants identified as white, one black, one Asian and two reported 'other.' In both the study arms, the majority (n=25) had some previous diabetes exposure. Mean age was 19 years in the control group, and 20 years in the experimental group. With the exception of education – a higher percentage of the experimental group had ever attended college –there were no significant differences between groups on demographics. Nor did the groups differ regarding baseline DART or SED scores (p=.9360 and .5939 respectively).

For aim 1 we were able to demonstrate the ease of teaching a diabetes-related vignette to camp caregivers, making it very action-oriented. According to the camp director, it generated more discussion than the usual passive teaching strategy, i.e. teacher talking with students listening. The camp staff were intrigued by the patient simulator and enjoyed participating in the educational session.

For aim 2, Table 2 displays between pre and post group means as well as baseline-adjusted within-participant change in DART and SED by treatment arm. Camp participants in the experimental arm had a significantly larger change in DART scores than did control participants. Within-participant change in SED scores however, did not differ significantly by treatment arm. For both outcomes, conclusions are similar for ANCOVA, Tobit, and the ranks approach (results are not shown for Tobit and ranks for the sake of brevity).

Table 3 presents results of exploratory ANCOVA for aim 3, testing the hypothesis that experimental-related differences in DART and SED change were larger in the subgroup with no previous diabetes exposure. For both outcomes, experimental participants' mean change was significantly larger than control participants' mean change in the subgroup with no previous diabetes exposure, but smaller and not statistically significant in the subgroup with any previous diabetes exposure, as hypothesized. Moreover, the interaction between treatment arm and previous diabetes exposure was statistically significant for both outcomes, suggesting the presence of effect modification by previous diabetes exposure.

Several caveats need to be noted, however. First, the number of participants with no previous diabetes exposure is very small – three in the control arm and four in the experimental arm. Second, likely due to these small sample sizes, one of the observations in the experimental arm with no previous exposure had a relatively high Cook's distance (0.65), indicating possible undue influence on the model estimates, although its value did not reach the cutoff of 1.0 (Field, 2005). Re-running the analyses removing this observation, however, yielded similar conclusions (data not shown). Third, in the subgroup with no previous diabetes exposure, the control participants' scores at baseline were higher than the experimental participants' scores for both the DART and the SED, consistent with a larger ceiling effect – and corresponding smaller within-participant change – for the control participants than for the experimental participants. Results from Tobit analyses, however, were consistent (data not shown). Fourth, the ranks approach did not find statistically significant treatment-related differences in the subgroup with no previous exposure, perhaps because of the small sample sizes as well as the use of ranks, which can attenuate the impact of large values. In sum, these results regarding effect modification must be considered exploratory in nature.

DISCUSSION

The study results are promising for short-term knowledge gains with camp counselors. Visualizing and practicing diabetes management with a HPS during orientation can help the

learner internalize the sequential steps of care and increase an individual's knowledge according to self-regulation theory. HPS has been used successfully in a variety of health care related education venues, and may be advantageous especially when someone has not had clinical experiences such as at camps for children with special health care needs. Given the caveats noted above regarding the results for effect modification, these results should be interpreted as exploratory or suggestive only. However, the findings warrant further investigation with a powered sample. It is also not clear that the cost (~$22,000) to purchase a HPS is worth the small gain exhibited. A larger, better controlled study and a more significant intervention dose needs to be conducted to warrant the cost compared to the standard education orientation. It is also possible that this type of teaching modality could also be useful to review managing acute diabetes related events with a possible decrease in morbidity and acute side effects.

It was also not surprising not to see changes in the self-efficacy scores among the staff especially at the start of the camp season before they had a chance to apply the diabetes knowledge in real time. A longitudinal study will be needed to see changes over time. Another interesting methods issue was the randomization process. Although it was supposed to equalize groups, we suspect a few counselors shifted position during randomization to get into the experimental group out of curiosity or for peer support, thus potentially confounding the data. A future study would need to better control the randomization process.

There are also potential other uses of HPS in camp. Critical incidents that occur could be reviewed and practiced with the device. Booster teaching sessions during camp could provide continuity of care and enhance camp safety. In addition, using the HPS to educate the campers about their diabetes and self-management is another option that needs to be explored.

Limitations

This study was limited to a culturally homogeneous group of camp counselors in New England. In future studies, strategies need to be explored to recruit culturally diverse counselors and those with less clinical experience with T1DM. A powered study with randomization is the next step to see if this teaching strategy provides better knowledge and self-efficacy gains for camp counselors. We only provided a one-time, one-topic teaching session with HPS, thus we need to explore if more intensive doses of the intervention 'active ingredient' would result in more statistically significant findings. There was also no qualitative data due to time constraints. This exploratory component of study will be included in a future RCT.

Conclusion

Use of HPS with camp staff may provide a creative and less threatening teaching strategy especially for those with limited or no experience managing campers' special health care needs. This innovative teaching-learning approach has the potential ability to improve critical thinking, decision making and clinical skills for not only the counselors but for the campers as well. Increasing counselor competence and confidence with diabetes management and recognition of both mild and moderate hypoglycemia could also potentially avert severe episodes of hypoglycemia and seizures. Novel ways to quickly learn and become confident in managing T1DM, such as using HPS, may provide more individuals who fear they do not hold the necessary skill-set to work in a camp. They may be more willing to sign on for an invaluable and fulfilling summer experience.

Acknowledgments

The authors thank Claire Baldwin for her editorial expertise.

NOTE: This study was partially funded by Meyers Primary Care Institute Internal Grants Initiative; MML & SSB are members of the UMass Diabetes Education Research Center (DK32520)

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Table 1

Baseline characteristics of participants by treatment arm

Characteristic	All participants	Control	Experimental	p-value for treatment
	N=36	n=15	N=21	arm difference[(a)]
Age: Mean (SD)	19.6 (2.9)	18.7 (2.6)	20.3 (3.0)	.0645
Male gender: % (N)	29.4 (10)	35.7 (5)	25.0 (5)	.7041
Any college % (N)	64.7 (22)	35.7 (5)	85.0 (17)	.0048
Caucasian: % (N)	88.9 (32)	86.7 (13)	90.5 (19)	1.0000
Any previous diabetes exposure: %(N)	80.6 (29)	80.0 (12)	81.0 (17)	1.0000

[(a)] Based on Fisher's exact test for categorical variables and Wilcoxon rank-sum test for continuous variables

SD = standard deviation

Table 2

Within-Participant Change in DART and SED, Adjusted for Baseline Outcome Value, by Treatment Arm

	Control (N=15)			Experimental (N=21)				
Outcome	**Mean baseline score (SD)**	**Mean post-intervention score (SD)**	**Mean Change (SE)[a]**	**Mean baseline score (SD)**	**Mean post-intervention score (SD)**	**Mean Change (SE)[a]**	**p-value for baseline difference[b]**	**p-value for difference in mean change[c]**
DART	21.20 (3.00)	21.60 (2.13)	0.58 (0.28)	20.62 (4.21)	22.57 (2.01)	1.24 (0.37)	.9360	.0019
SED	47.07 (8.12)	50.73 (6.73)	4.83 (1.25)	43.11 (12.83)	49.33 (7.12)	5.77 (1.10)	.5939	.5822

[a] Adjusted for baseline value; note that mean post-intervention score minus mean baseline score equals mean change unadjusted for baseline value, which differs from change adjusted for baseline value

[b] Based on Wilcoxon rank-sum test

[c] Based on analysis of covariance

SE = standard error

Table 3

Within-Participant Change in DART and SED, Adjusted for Baseline Outcome Value, by Previous Diabetes Exposure Within Treatment Arm

	Control		Experimental				
Outcome	**Mean change (SE)**	**N**	**Mean change (SE)**	**N**	**Mean between-arm difference (SE)**	**p-value for between-arm difference[(a)]**	**p-value for interaction[(a)]**
DART:							.0025
No previous diabetes exposure	−1.00 (0.59)	3	2.54 (0.72)	4	3.54 (0.78)	<.0001	
Any previous diabetes exposure	0.97 (0.28)	12	1.66 (0.25)	17	0.69 (0.35)	.0601	
SED:							.0009
No previous diabetes exposure	4.52 (2.25)	3	18.39 (3.07)	3	13.87 (3.60)	.0006	
Any previous diabetes exposure	4.21 (1.16)	12	3.92 (0.99)	16	−0.29 (1.48)	.8474	

[(a)]Based on analysis of covariance

SE = standard error