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Self-Management Problem Solving for Adolescents with Type 1 Diabetes: Intervention Processes Associated with an Internet Program

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Abstract

Objective—Describe intervention processes associated with an Internet self-management problem solving program for adolescents with type 1 diabetes, and relate participant characteristics to program use.

Methods—Forty-one adolescents with type 1 diabetes, aged 13–17, participated in an Internet intervention.

Results—Participants reported psychosocial self-management barriers related to social issues (45%), time pressures (22%), and emotions (25%). Most adolescents (76%) completed the two guided problem solving cycles, and most (97%) problems were appropriate and specific to diabetes. Of the 61 diabetes problems reported, 92% were mostly or completely solved. Baseline hemoglobin A1c, diabetes duration, and age were not related to online activities, however females posted more often to the forum ($U=130.0$, $Z=2.13$, $p=.033$). The majority of parents (87%) interacted with their child about the website.

Conclusion—Adolescents experience psychosocial barriers to self-management that can be addressed by teaching problem solving via the Internet.

Practice Implications—An Internet self-management problem solving program with minimal external support provides a viable option for diabetes clinics to improve pediatric diabetes outcomes.

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Author Statement: 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. The authors have no conflicts of interest to report.

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Keywords

type 1 diabetes mellitus; Internet; self-management; problem solving; coping; problem-based learning; adolescent; feasibility

1. Introduction

In the United States, approximately one in every 400 to 500 children and adolescents has type 1 diabetes (T1DM) [1,2]. Adherence to recommended self-management tasks improves glycemic control and reduces disease-related complications in persons over 13 years of age [3–6]. However, diabetes control and adherence are often suboptimal during adolescence [7–10].

Problem solving is a generalizable skill that is recommended as part of diabetes education [11–19]. Problem solving may be best taught with problem-based learning, where a specific relevant and realistic problem situation is presented as a vehicle for the development of generalizable knowledge using inductive reasoning [20–22]. Because of flexibility, penetration, and engagement, the Internet is now increasingly used to design and administer patient education programs [23–25].

The YourWay Internet intervention, described here, incorporated problem-based learning and guided mastery experiences [26] to improve self-management behaviors. A description of the positive impact of the intervention on hemoglobin A1c (HbA1c) has been reported [27]. The goals of the current analyses were to describe psychosocial self-management barriers, problem solving processes, and parent participation, and relate program use to participant characteristics within the initial YourWay trial.

2. Methods

2.1. Design, Development, and Implementation

2.1.1. Intervention Components—Multimedia problem-based stories that modeled problem solving psychosocial barriers to self-management were created by patients and a multidisciplinary team of diabetes experts. Each participant was prompted to complete six stories and two guided problem solving cycles. Stories were broken down into segments, after which participants were asked to relate their own experiences to those depicted in the story. Problem solving cycles consisted of problem identification, solution generation, solution selection, implementation planning, evaluation, and revision. Participants were asked to return to the website twice to report on their progress in solving problems.

Social networking and a peer forum were used to enhance engagement. Participants could select an avatar, create a user profile for others to see, and view others' responses to the stories. Two didactic multimedia presentations were created regarding how to use the website and problem solving steps. Participants received weekly emails prompting them to visit the website, were compensated for completing assessments and intervention activities, and had no interactions with clinicians or parents through the website.

2.2. Study Design, Setting, and Recruitment

In this report, process results are presented from a two-group randomized controlled pilot trial. [27]. Participants between 13–17 years diagnosed with T1DM for at least six months were recruited from an academic pediatric diabetes clinic, had access to the Internet, spoke English, and had no cognitive or perceptual disabilities that precluded understanding website

content. The study was approved by the Vanderbilt University Institutional Review Board (IRB), and parental consent and adolescent assent were obtained.

2.3. Measures

Demographic and psychosocial data were collected from adolescents at baseline. A semi-structured telephone interview was conducted with participants after week ten. Frequency of online activities was tracked through the website database. HbA1c was obtained through medical record review.

2.4. Analytic Approach

An index of overall intervention participation was created through summation of intervention-related activities. Participant characteristics gender, age, HbA1c, and duration of diabetes were associated with intervention participation using Spearman correlations (r_s). Tests of differences were conducted using Mann-Whitney tests. Analyses were conducted using SPSS v.17

3. Results

3.1. Sample

Seven of the 48 participants randomized to the website condition did not subsequently log into the website, leaving 41 for the current analyses. Baseline demographic and clinical variables for participants with intervention data are presented in Table 1.

3.2. Intervention Activity Levels

Table 2 shows mean levels of website activities. Although not all participants posted to the forum (59% posted at least once), 96% reported they found reading comments posted by other participants useful.

3.3. Website Experiences and Processes

A total of 31/41 active participants (76%) were successfully contacted for feedback interviews. The majority (63%) gave the website an overall grade of A (excellent); the remainder gave it a B (good). Across the six stories, 74–96% of adolescents indicated that the story characters seemed ‘very’ or ‘mostly’ real; 97–100% thought the problems depicted were ‘definitely’ or ‘probably’ ones that adolescents with diabetes actually face; and the majority (77%) felt the YourWay website provided adequate support to solve their self-management problems.

The 41 participants reported a total of 63 diabetes problems. Two non-diabetes-related problems were removed, leaving 61 for analyses (97%). Participants reported being ‘mostly’ (45%) or ‘totally’ (45%) successful in resolving the identified self-management problem. Self-management problems were attributed to social issues (45%), psychological reasons (24%), time pressures (21%), planning (6%), and forgetting (4%). Social issues included embarrassment, wanting to spend time with friends, or a specific problematic person. Psychological reasons attributed to self-management problems included burn out, stress, impulsivity, and laziness. When asked to identify their best resources for solving the diabetes problem, adolescents most frequently identified their own personal qualities (70%), parents (46%), friends (44%), and the YourWay website (29%).

3.4. Parent Participation

In interviews, 87% of adolescents reported that parents participated with them in some way related to the website intervention. Of those parents involved, 81% talked with their child

about the website, 58% viewed the website with their child, and 42% of parents helped them problem solve.

3.5. Participant Characteristics in Relation to Participation

Gender was associated with website activities ($r_s = .33, p=.036$). Age ($r_s = .17, p=.273$), duration of diabetes ($r_s = -.09, p=.577$), and baseline HbA1c ($r_s = .02, p=.894$) were not associated with website activities. Females had a higher activities index (Mean 22.6, SD 9.6; Median 23) compared to males (16.5, SD 9.5; Median 15; $U=130.5, Z=2.08, p=.038$). This was due to the fact that females posted to the forum considerably more often (Mean 7.1, SD 5.5; Median 6) as males (Mean 3.6, SD 5.2; Median 1; $U=130.0, Z=2.13, p=.033$).

4. Discussion and Conclusions

4.1. Discussion

Although the number of Internet programs for pediatric diabetes education is limited, they show promise in improving outcomes [27,28]. Educational approaches vary, but the use of stories and narratives to change behavior has gained recent attention [29]. Social learning theory [26] suggests modeling behaviors is likely to improve skill building and self-efficacy.

Each multi-media story received high participant endorsement. Adolescents were able to independently select and solve relevant diabetes problems. However, despite the fact that participants reported success in solving problems, it is unlikely that all problems with diabetes self-management were permanently solved. This underscores the cyclical nature of learning and problem solving, and the need for readily accessible resources to sustain ongoing learning.

Internet programs are hypothesized to be influenced by user characteristics [24]. Adolescents turned to the forum for comments and support but, overall, not at desired rates, given documented benefits of social support in adolescent diabetes [30]. Forum activity patterns support previous research indicating that females are more likely to utilize that form of communication and support [31].

Many parents spontaneously discussed the intervention with their child, viewed the website, or provided emotional and/or instrumental support. As children progress through adolescence, the role of parents in supporting adherence becomes variable [32]. Parent participation in online activities could be implemented as an optional component in order to be responsive to adolescents who would prefer a purely peer experience.

Although designed as a pilot study, the small sample was a limitation in analyses. Modifications related to longer duration and an enhanced forum are indicated, as well as a larger efficacy trial and cost-effectiveness analyses.

4.2. Conclusion

This is the first program to use interactive online problem solving for this population. The results provided support for the design, implementation, and feasibility of the current approach to teaching self-management problem solving. Minimal external support was successfully used in order to establish the most feasible model.

4.3. Practice Implications

An Internet self-management problem solving program with minimal external support provides a viable option for diabetes clinics to improve pediatric diabetes outcomes.

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Table 1

Baseline demographic and clinical diabetes data of active intervention participants (N=41).

Variable	Mean (SD) or %
Age	15.1 (1.5)
Gender (Female)	49%
Duration of Diabetes (Years)	6.3 (3.6)
Age at Diagnosis	8.8 (3.7)
On <u>Insulin</u> Pump (Yes)	58%
Duration on <u>Insulin</u> Pump	3.1 (1.8)
Baseline HbA1c	9.2 (1.9)
Internet Access at Home (Yes)	100%
Confidence Using a Computer (Max=4)	3.8 (.46)
Access Internet Every Other Day or More	93%
Use Internet for Diabetes (visits per month)	2.0 (1.2)

Table 2

Completion of website intervention activities.

Intervention Activity	Mean (SD)	Median	Mode	Range
Stories Completed	5.22 (2.02)	6	6	0–8*
Problem Solving Cycles (max=2)	1.49 (0.75)	2	2	0–2
Forum Posts	5.27 (5.58)	4	0	0–15
Problem Solving Presentation	1.41 (1.16)	1	0	0–3
Get Started Presentation	0.63 (0.48)	1	1	0–1
Log-Ins	5.07 (2.10)	5	5	2–9
Activities Index	19.46 (9.92)	20	22	3–36

* Participants could complete stories more than one time.