Published in final edited form as:

Pediatr Diabetes. 2016 December ; 17(8): 567–575. doi:10.1111/pedi.12338.

Efficacy and Implementation of an Internet Psychoeducational Program for Teens with Type 1 Diabetes

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Abstract

Objective—The purpose of the study was to evaluate the participation and preliminary efficacy of an internet psychoeducational program (Teens.Connect) shown to be efficacious under controlled conditions compared to an open-access diabetes website for youth (Planet D) on the primary outcomes of A1C and quality of life (QOL), and secondary outcomes of psychosocial and behavioral factors.

Research Design and Methods—Teens with type 1 diabetes (n=124, 11-14yrs) from 2 clinical sites were randomly prescribed one of the programs and completed baseline, 3-month and 6-month data. A1C was obtained from clinic records. Participation data included number of logins, posts to the discussion board, and lessons completed (Teens.Connect only). Descriptive and mixed model analyses were used.

Results—Eighty-five percent (85%) of consented teens registered for their prescribed program. Satisfaction and logins were similar between groups (satisfaction ranged 3.3–3.5/5; mean logins=14/teen). Posts to the discussion forum were higher in Planet D (mean=28 vs 19). Participation in the Teens.Connect lessons was low, with only 69% of teens completing any lesson. After 6 months there were no significant differences in A1C, QOL or secondary outcomes between groups. Teens in the Teens.Connect group reported lower perceived stress over time (p<.01).

Conclusions—Teens do not actively participate in an internet psychoeducational program when they do not have frequent reminders, which may have contributed to a lack of treatment effect. Teens have many competing demands. Strategic implementation that includes targeted reminders and family support may be necessary to assure participation and improvement in health outcomes.

Keywords

Diabetes Mellitus; Type 1; Internet; Psychoeducation; Randomized Clinical Trial; Quality of Life

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The authors have no relevant conflicts of interest to disclose.

Intensive management and improved metabolic control can reduce complications in adolescents with type 1 diabetes (T1D) by 27% to 76% (1). Consequently, current recommendations by the American Diabetes Association (ADA) are that all children and adolescents achieve A1C levels as close to normoglycemia (A1C < 7.5%; 53mmol/mol) as possible while avoiding severe hypoglycemia (2). Intensive management of T1D is complex and demanding and places a significant burden on youth and their families.

Adolescence is an especially vulnerable time for maintaining optimal management of T1D and deteriorations in diabetes self-management and metabolic control are common. The number of youth meeting targets for A1C drops from 64% among young children to 43% among youth 6 to <13 years of age to 21% among youth 13 to 20 years of age (3). Causes of these declines are likely attributable to rapid biopsychosocial changes, increased experimentation and risk-taking behaviors (4), and increased autonomy which may result in lower self-management and adherence (5, 6). Adolescents need additional support that is developmentally appropriate to maintain and improve self-management and metabolic control. Enhancing problem-solving capacity around self-management and the coping skills of teens transitioning to adolescence may help to prevent the deterioration of self-management and metabolic control throughout the teen years.

Research has demonstrated the positive effects of psychoeducational programs in supporting optimal management in teens with T1D. These programs encompass a variety of activities that may include intensive education at diagnosis (7), summer camp experiences (8, 9), a family-based intervention in which the parent simulates diabetes care (10), and an internet program to help problem-solve barriers to good management (11). Our team has developed a group-based coping skills training (CST) program that demonstrated improved metabolic control and QOL in teens with T1D (12, 13). To facilitate dissemination by reducing scheduling and travel barriers to in-person group meetings, we translated this CST program to an internet-based platform (TEENCOPE™) and conducted a randomized controlled trial comparing TEENCOPE™ to an internet-based diabetes education program, Managing Diabetes (14). In a multi-site trial of a diverse sample of teens with T1D (n=320), we demonstrated high satisfaction and participation with 78% of our participants completing four of the five sessions. While there were no significant differences between groups on primary outcomes of A1C and QOL, teens who completed TEENCOPE™ or Managing Diabetes had stable QOL and minimal increases in A1C levels (mean=.12%) after 12 months (15). After 12 month data were collected, teens were given the option to complete the alternate program and, at 18 months, those who completed both programs demonstrated significant improvements in QOL, social acceptance, self-efficacy, stress, and family conflict compared to teens who completed only one program. Improvement in A1c (those who completed one program mean A1c=8.74±1.8% versus those who completed both programs mean A1c= 8.32±1.4%; p=.04) was also observed (15). This modest improvement in A1c is important as an increase of approximately 2% during the adolescent years has been reported (16). Thus, we hypothesized that a combination of TEENCOPE™ and Managing Diabetes may result in a more efficacious program, and providing the program via the internet has great potential to be easily integrated into clinical care.

The purpose of this study was to evaluate the participation and preliminary efficacy of an internet psychoeducational program (combined Managing Diabetes and TEENCOPE™ to 'Teens.Connect') in clinical practice compared to the use of an open-access internet diabetes website for youth (Planet D + discussion board) on the primary outcomes of metabolic control (A1C) and quality of life (QOL), and the secondary outcomes of psychosocial and behavioral health.

Research Design and Methods

The study was a two-site randomized trial conducted at diabetes clinics at Yale University and the Children's Hospital of Philadelphia. Inclusion criteria were that adolescents were diagnosed with T1D for at least 6 months, aged 11 to 14 years who were naïve to TEENCOPE™ and/or Managing Diabetes, English-speaking, had access to the internet, assented and whose parent/guardian consented. Institutional review boards at both sites approved the study. Due to the research process requiring staff to approach patients for informed consent, providers did not prescribe the program. Instead, a research associate approached teens during regularly scheduled visits to assess interest in participation and eligibility and to obtain informed consent. The research associate gave consented teens a "web-based information prescription" in a sealed envelope that contained the instructions for the data collection procedure and general study procedures. Envelopes were pre-randomized in blocks of ten and assigned a unique study identification number to assure blinding of clinicians. Providers were asked to endorse participation in an internet prescribed program, without regard to the specific program.

Once preliminary data collection was complete, teens were provided links to the Teens.Connect website or the Planet D website + discussion board for teens. They were asked to log on to the websites at least twice weekly for 30 minutes each over 4 weeks and participate on the discussion boards. Follow-up to assure adherence to this schedule was limited. All teens received 3 automated emails reminding them to log on, and two phone calls/voicemail messages from study staff – 1 at program launch, and 1 after 2 weeks to determine if there were any issues with getting started. As with the original TEENCOPE trial, there were no incentives for program participation; incentives were provided for completion of online data collection (\$20.00 at baseline; \$25.00 at 3 months; \$30.00 at 6 months) to minimize attrition.

The *Teens.Connect* program contains two components, TEENCOPE™ and Managing Diabetes. TEENCOPE™ is an interactive internet program aimed at increasing teens' coping and social self-efficacy by retraining inappropriate or non-constructive coping styles and forming more positive styles and patterns of behavior. TEENCOPE™ consists of a series of 5 interactive internet sessions that were adapted from our CST group intervention and uses a cast of ethnically diverse characters in a graphic novel format (17). The coping skills of social problem solving, stress management, cognitive behavior modification, assertive communication, and conflict resolution are included as well as an asynchronous moderated discussion board. The second component, Managing Diabetes, is an internet-based, age-appropriate diabetes educational program that focuses on problem-solving to improve diabetes self-management. The program contains 5 lessons and uses case studies

and interactive exercises to enhance teens' capability to make diabetes-related decisions. It is visually enhanced with pictures and teens receive tailored feedback on their answers to questions and problem-solving activities. To encourage completion of sessions, different badges are earned and posted to personal profiles as teens go through the programs.

Planet D is a website developed by the ADA for children and teens with diabetes that was available to the public between 2007 and 2014. The website provided age-appropriate diabetes education on a variety of topics and social networking discussion boards on diabetes, food and exercise, personal interests, and diabetes camp. Teens who registered for Planet D were able to create a profile, identify favorite news and blog feeds as well as provide comments or tags to other members.

Primary Outcomes

All measures used in this study are aligned with our conceptual framework (18) and have demonstrated reliability and validity in teens with T1D. Reliability coefficients were estimated at baseline. Self-report data were obtained from a secure internet website at baseline, 3, and 6 months.

Participation was assessed via IT programming available on each intervention website. The Teens.Connect website was hosted on a Yale server. This system allowed the tracking of registration for the program, number of logons to the general site, lesson completion, and posts to the discussion board. Planet D was hosted by ADA where data for the Planet D website and discussion board were stored separately. We were able to retrieve data showing total logons to the Planet D website, and whether teens registered for and posted to the discussion board.

A1C was assessed using the Bayer Diagnostics DCA2000® (normal range = 4.2–6.3%) and was obtained via chart review. All A1C data between baseline and 6 months were collected and data at 2–4 and 5–7 months from baseline date were used in the analysis. *QOL* was measured by the Diabetes-specific Pediatric Quality of Life Inventory (Peds-QL) (Teen version) (19). The PedsQL-Diabetes is a 28-item measure assessing diabetes-specific QOL (20), with 5 discrete subscales: 1) diabetes symptoms (11 items), 2) treatment barriers (4 items), 3) treatment adherence (7 items), 4) worry (3 items), and 5) communication (3 items). Higher scores indicate fewer symptoms or problems.(21) High reliability and validity have been established (19, 22). In our study, averaging the subscales generated a diabetes QOL total score. Reliability in our data for the current study was $\alpha=0.88$.

Secondary Outcomes

Secondary outcomes included self-care, self-efficacy, perceived stress, and depressive symptoms. *Diabetes self-efficacy* was assessed using the Self-Efficacy for Diabetes Scale, which was developed to measure self-perceptions or expectations held by persons with T1D about their personal competence, power, and resourcefulness for successfully managing their T1D (23). Participants are asked to rate their degree of confidence for all items on a five-point scale ("very sure I can't" to "very sure I can"). Higher scores indicate less self-efficacy. The reliability coefficient for the diabetes subscale was $\alpha=0.92$.

Self-care was assessed with the 14-item Self-Care Inventory (SCI), which was designed to assess adherence to diabetes self-care behaviors from the view of the teen or the parent (24). Respondents report on their behavior over a 2-week interval using a 5-point Likert scale. Items on the SCI reflect the main components of the T1D regimen, including monitoring and recording glucose, administering and adjusting insulin, regulating meals and exercise, and keeping appointments. This measure has high test-retest reliability ($r=.90$), and high construct and convergent validity (24). The reliability coefficient for this scale was $\alpha=.80$.

Perceived stress was measured with the Perceived Stress Scale (PSS), a 14-item scale that measures the degree to which situations in one's life are appraised as stressful (25). Items assess feelings of stress, hassles, and coping during the past month. Respondents rate items on a 5-point Likert scale ranging from 0 (never) to 4 (very often), with higher scores indicative of greater perceived stress and less effective coping. The reliability coefficient in our data was $\alpha=.84$.

Depressive symptoms were assessed using the Children's Depression Inventory (CDI) (26). It contains 27 multiple-choice items that yield total scores from 0 to 54. Higher scores reflect more symptoms. The CDI has been used extensively in community samples of youth, in groups with known mental health problems, and in studies of youth with T1D (27–29). The reliability coefficient in our data was $\alpha=.90$. One item that assesses suicidal ideation was eliminated due to the inability to immediately respond to a positive endorsement of suicidal ideation. Thus, the questionnaire had a total of 26 items, and a score of 12 was interpreted as the criterion score for depression in this study.

Data were also collected on *sociodemographic data* (i.e., ethnicity, socioeconomic status, number of children, and sex of child with diabetes) at baseline from the consenting parent/guardian. *Diabetes clinical variables*, such as length of time since diagnosis and treatment type (pump, basal or conventional injections), were collected by research staff from the medical record. *Satisfaction* was evaluated by teens with a 6-item survey on how helpful, enjoyable, easy to use, and worthwhile the program was. Items were rated on a 5-point Likert-type scale from “not at all” to “very satisfied”, with higher scores indicative of higher satisfaction. Scale reliability in our sample was 0.73.

Data analyses

We used descriptive and summary statistics to examine each of the study variables. Baseline group differences were examined with *t*-tests, chi-square, or the Cochran Armitage Trend test. The main hypotheses tested were that teens who participated in the Teens.Connect program would demonstrate better A1C and QOL than those who participated in the Planet D program. To test the effect of the intervention on the primary and secondary outcomes, we used a random intercept model with a correlation matrix of repeated measures adjusted for duration of diabetes. All analyses were conducted using both per-protocol and intent-to-treat procedures. Significance was considered as $p<.05$, two-tailed. Participation was assessed by describing subject participation on the websites (number registered for Teens.Connect and the Planet D discussion board, number of lessons completed in Teens.Connect). All analyses were conducted using SAS version 9.3 (SAS Institute, Cary, NC)

Results

In total, 145 of 170 (85%) of eligible teens approached for participation consented. One hundred twenty-four (85%) of those teens confirmed email communication and completed the online baseline assessment. Final enrollment rate was 73% with 15% active refusal (n=25) and 13% passive refusal rates (n=21; i.e. teens who did not logon to complete the baseline assessment) (Figure 1). Reasons given for refusal were “not interested in the study” (n=14), “too busy” (n=8), “did not have home internet” (n=2) and “wanted to confer with the other parent” (n=1). Boys had a greater tendency to refuse at point of contact and teens from families of lower income had a greater tendency to refuse after consent.

There were 25 teens who enrolled in the study (signed informed consent and completed baseline data) but who did not register for the programs (Teens.Connect [n=14] and Planet D [n=11]). These teens were excluded from the analysis of program efficacy since they were not exposed to either program. This group was similar to teens who registered in regards to all socio-demographic factors with the exception of race; more non-white teens completed baseline data but did not register for programs compared to white teens (p=.05). Attrition at 6-month follow-up was 12%.

The age of registered teens was 12.1 (SD=1.1) years and diabetes duration was 4.83 (SD=3.47) years at baseline. The majority of the sample was female (63%), had a high household income (68% > \$80,000), and was white (82%). Most participants were using a pump (66%) (Table 1). The sample was representative of US prevalence rates of T1D in this age group (70% white, 13% black, 15% Hispanic, 2% other) (30). The Teens.Connect and Planet D groups were comparable at baseline with the exception of duration and perceived stress, which were controlled in the mixed model analyses.

With respect to participation, the number of logons was similar between groups (14 logons/teen). Posts to the discussion board were higher in Planet D (28 vs. 19). Participation in the 10 Teens.Connect lessons was low, with 31% of teens not completing any lesson, 38% completing 1–7 lessons, and 31% completing 8–10 lessons. A comparison of program reminders and participation for TEENCOPE, TEENCOPE crossover, and Teens.Connect is provided in Table 3. When participation was highly monitored and reminders were individualized to the teen (TEENCOPE), there was high participation in lessons. When program reminders were less frequent and/or less individualized/more automated, participation in lessons was lower (TEENCOPE crossover and Teens.Connect).

Eighty-eight teens completed an online program evaluation survey immediately after the intervention period. Results showed that satisfaction was moderately high (3.2–3.5 on a scale of 1–5) with no significant difference between groups on how helpful, enjoyable, interesting, or worthwhile the programs were. Teens had a significantly easier time navigating the Teens.Connect website compared to Planet D (p=.02).

We evaluated the preliminary efficacy of the programs on the primary outcomes of A1C and QOL. In the intent-to-treat mixed model analysis, teens in both programs had no change in mean A1C over 6 months and there were no significant differences by intervention group (Table 2). There was also no significant difference in the diabetes-related QOL between

groups (Table 2). Further dose-effect analysis estimating change in A1C showed that Planet D teens had increased A1C ($p=.02$) over 6 months, while the A1C of teens who completed less than 7 Teens.Connect lessons remained the same ($p=.13$), and the A1C of those who completed 7 or more lessons was reduced ($p=.76$). Dose-effects on A1C by number of posts was not demonstrated in either the Teens.Connect group ($p=.41$) or the Planet D group ($p=.60$) (data not shown).

With respect to secondary outcomes, there was no significant differences in diabetes self-efficacy, self-care, and depression between groups (Table 4). Teens in the Teens.Connect group had a significant decrease in perceived stress over time ($p<.01$); however this was not significantly different from *Planet D*.

Discussion

Intensive management of T1D and improved metabolic control can reduce the risk of complications in adolescents (1, 31), yet only 29% of teens with T1D attain treatment goals (32). Depressive symptoms, anxiety, anger, and distress are more prevalent in adolescents with T1D than those without T1D, contribute to poorer coping, and are associated with poorer self-management and adverse health outcomes (33–35). Research has demonstrated the efficacy of psychosocial and psychoeducational programs in ameliorating these symptoms and improving QOL, adherence to treatment plans, and metabolic control in teens with T1D (11–13). Despite this, no such program has been implemented in clinical practice.

Internet healthcare programs offer convenience for users and reduced user isolation (36, 37). In addition, they support clinical goals while placing little burden on providers and clinics. The internet has great potential for healthcare interventions in adolescents with chronic conditions due to their eager adoption of technology and widespread use of social media (38). More than 93% of teens access the internet regularly, and the ‘digital divide’ is shrinking (38). However, 32% of teens ($n=46$) who consented to participate in this study did not complete online data collection or register for the program. While there were no differences between those who registered vs. not, low-income teens were more likely to consent but not complete online data collection. This is possibly due to inconsistent home internet access in families with low SES (38).

Teen participation in terms of initial registration to the online program and number of logins was similar between groups. More teens posted to the Planet D discussion board, likely due to it being publicly accessible and having more established and plentiful discussion options. Yet, teens reported having a significantly easier time navigating the Teens.Connect website. This is likely due to Planet D teens being asked to visit the intervention website as well as a discussion board via two different URLs. Participation in program lessons was low for teens randomized to the Teens.Connect program with only 31% receiving an adequate ‘dose’ of the program (8–10 lessons). This is less participation than in the TEENCOPE trial and subsequent crossover, which may be due to less frequent and individualized reminders or may be a result of how the lessons were released. In the TEENCOPE trial, lessons were released weekly; in the Teens.Connect trial, all lessons were available as soon as teen registered for the program. Attrition, based on 6-month data collection, not program

participation, was only 12%, which may have been a result of increasing incentives over time for data collection completion.

Since the development of this program in 2002, smartphones and tablets have become ubiquitous and social media has become the primary mechanism of communication for teens (38). This may explain the increase in posts to the discussion board that we demonstrated between the TEENCOPE trial and the Teens.Connect trial. The proliferation of mobile and smartphones provides a 'powerful channel' to reach teens with health-related interventions. Future research on psychoeducational programs that incorporate mobile devices, social media, and strategies to optimize participation is warranted.

This study is limited by a small sample that may be underpowered to detect small effects. In addition, adolescents were recruited from only 2 sites on the East Coast with strong diabetes centers. Thus, youth had relatively good metabolic control at study start. In addition, the sample does not adequately represent the diversity of youth with type 1 diabetes in this age group. Thus, our findings cannot be generalized to all teens with T1D who are transitioning to adolescence. Another limitation to the study is that information about the pattern of website usage and the length of time adolescents used the websites is unknown.

Our previous research showed that a large diverse group of adolescents (n=320, 37% non-white) experienced high satisfaction as well as significant improvements in metabolic control, quality of life, social acceptance, self-efficacy, stress, and family conflict after completing both an internet CST and diabetes education program (15). The current study tested the combined program in a more naturalistic setting that simulated clinician prescription and provided minimal follow-up for study participant adherence. This effort resulted in considerable enthusiasm by providers and teens regarding the prescription of internet programs in clinical practice. However, not all teens actively participate in an internet psychoeducational program after obtaining a prescription for the program in the clinic setting. Since significant positive treatment effects were seen in the TEENCOPE trial with teens who had more active participation in lessons, low participation in the program may have contributed to a lack of treatment effect. Teens have many competing demands and may need personalized and/or parental reminders as well as clinician support to assure participation in programs to improve health outcomes. Measures to increase participation in Teens.Connect lessons are a future area of study.

Acknowledgements

We would like to gratefully acknowledge all adolescents who participated in this study and research personnel. We also graciously thank our funding sources: the American Diabetes Association (1-12-SAN-10). Development of the Internet programs was supported by intramural funds provided to Margaret Grey. AC was funded by pre-doctoral fellowships from the Jonas Center for Nursing Excellence and the NINR/NIH (T32NR00834610; F31NR014375). KM was funded by a pre-doctoral fellowship from the NIDDK/NIH (T32DK07718).

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**Note that "Registered" refers to teens who signed on to their intervention website*

Figure 1.
Consort table

Table 1

Baseline differences between groups, registered n=99

	Registered Subjects N=99	Group Difference		p-value
		Teens.Connect N=50	Planet D N=49	
Age	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)	
	12.1 (1.1)	12.1 (1.1)	12.2 (1.1)	.77
Duration since diagnosed (in years)	4.83 (3.47)	4.18 (2.97)	5.50 (3.84)	.06
Gender				
Male	37 (37.4%)	19 (38.0%)	18 (36.7%)	.90
Female	62 (62.6%)	31 (62.0%)	31 (63.3%)	
Income				
Less than \$19,999	4 (4.1%)	2 (4.2%)	2 (4.8%)	.85*
\$20,000–39,999	4 (4.1%)	2 (4.2%)	2 (4.8%)	
\$40,000–59,999	15 (15.5%)	8 (16.7%)	7 (14.3%)	
\$60,000–79,999	8 (8.2%)	3 (6.2%)	5 (10.2%)	
\$80,000–99,999	17 (15.5%)	6 (12.5%)	9 (18.4%)	
\$100,000+	51 (52.6%)	27 (56.3%)	24 (49.0%)	
Race/Ethnicity				
White/Non-Hispanic or Latino	81 (81.8%)	41 (82.0%)	40 (81.6%)	.89 [#]
Black/African American	8 (8.1%)	4 (8.0%)	4 (8.2%)	
Asian	2 (2.0%)	1 (2.0%)	1 (2.0%)	
Hispanic/Latino	7 (7.1%)	3 (6.0%)	4 (8.2%)	
More than one race	1 (3.0%)	1 (2.0%)	0 (0%)	
Treatment				
Pump	65 (65.7%)	34 (68.0%)	31 (63.3%)	.74
Injections Basal	25 (25.2%)	11 (22.0%)	14 (28.6%)	
Injections Conventional	9 (9.1%)	5 (10.0%)	4 (8.2%)	
A1C				
NGSP %	8.16 (1.38)	8.18 (1.42)	8.14 (1.36)	.89
IFCC mmol/mol	66 (15.1)	66 (15.5)	65 (14.9)	

	Registered Subjects N=99	Group Difference		p-value
		Teens, Connect N=50	Planet D N=49	
Total QOL	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)	
	73.79 (13.53)	73.95 (13.73)	73.62 (13.46)	.91
Diabetes Self-Efficacy (SED)				
Diabetes Specific	42.80 (12.19)	43.82 (12.85)	41.75 (11.52)	.40
Self-Care (SCI)				
Overall Adherence	4.41 (0.57)	4.42 (0.61)	4.39 (0.54)	.79
Perceived Stress (PSS)	19.93 (8.81)	21.98 (8.69)	17.83 (8.50)	.02
Depressive Symptoms (CDI)	4.48 (5.76)	5.48 (6.87)	3.47 (4.18)	.08

Note. P-values were obtained from t-test and chi-square test for mean and proportion difference, respectively.

* P-value was obtained from Cochran-Armitage Trend test.

‡ P-value was obtained from chi-square test to compare the proportions of white between two groups.

Table 2

Analysis of changes in A1C and QOL between two intervention groups for subjects who registered and completed data collection at baseline and 6 months (n=86).

	Group	Estimated Time Effect Coefficient (SE)	Test for Time Effect	Test for Group Effect (Group-Time Interaction)
A1C				
	Teens.Connect	0.135 (0.184)	.46	.58
	Planet D	−0.020 (0.211)	.93	
QOL				
	Teens.Connect	0.535 (0.894)	.55	.55
	Planet D	1.293 (0.899)	.15	

Note. Coefficients and standard errors were estimated from Random Intercept Model with correlation matrix of repeated measures. The model includes time, group, time-group interaction, and duration of diabetes. The estimated coefficient represents slope (average increase of outcome per 3 month) of time in each group over 6 months.

Table 3

Comparison of program reminders and participation between TEENCOPE, TEENCOPE crossover and Teens.Connect interventions

	TEENCOPE	TEENCOPE crossover	Teens.Connect
Program delivery	Participants randomized to TEENCOPE or Managing Diabetes program. Each program had 5 lessons. Lessons released weekly.	Participants invited to complete alternate program after 12- month data collection. Program had 5 lessons. Lessons released weekly.	Participants randomized to Teens.Connect or Planet D. Teens.Connect had 10 lessons available at any time. Planet D did not have lessons.
Reminders	5 automated emails weekly with link to website. 1 phone call to teen at week one. Weekly email, phone call and/or postcard if lesson not completed in one week. 1 parent email at 3 weeks.	5 automated emails weekly with link to website. 1 phone call to teen at week one. Weekly follow up if lesson not completed in one week was sporadic.	3 automated emails with link to website/3 texts/3 parent email at week 1, 3, 5 2 phone calls (1 at week one and other after 4 weeks to remind to log onto website)
Incentives	None for program Incentive for data collection.	None for program. Incentive for data collection.	None for program Incentive for data collection
Lessons completed	0 lessons – 10 % 1–3 lessons – 12% 4–5 lessons – 78%	0 lessons – 26% 1–3 lessons – 18 % 4–5 lessons – 56 %	0 lessons – 31% 1–7 lessons – 38% 8–10 lessons – 31%
Posts to discussion board	Mean = 6 (SD=9) Median = 2	Data not available	Mean = 14.4 (SD=41) Median = 3
Percent of teens who posted once	61%	Data not available	78%
Percent of teens who posted 5 or more times	36%	Data not available	44%

Estimated time effects on mediating variables over 6 months for subjects who registered and completed data collection at baseline and 6 months (n=86).

Table 4

PedsQoL Subscale	Group	Estimated Time Effect Coefficient (SE)	Test for Time Effect	Test for Group-Time Interaction
Diabetes Self-Efficacy (SED)				
Diabetes-Specific (SED-D)	Teens, Connect	-1.198 (0.843)	.16	.52
	Planet D	-0.434 (0.849)	.61	
Self-Care (SCI)				
Blood	Teens, Connect	-0.028 (0.045)	.54	.37
	Planet D	0.030 (0.046)	.52	
Emergency	Teens, Connect	0.029 (0.063)	.65	.99
	Planet D	0.029 (0.063)	.65	
Exercise	Teens, Connect	-0.093 (0.063)	.14	.71
	Planet D	-0.060 (0.064)	.35	
Insulin	Teens, Connect	0.006 (0.041)	.89	.52
	Planet D	-0.031 (0.041)	.45	
Overall Adherence	Teens, Connect	-0.023 (0.033)	.49	.65
	Planet D	-0.001 (0.033)	.97	
Perceived Stress (PSS)	Teens, Connect	-1.682 (0.579)	.01	.28
	Planet D	-0.780 (0.585)	.18	
Depressive Symptoms (CDI)	Teens, Connect	-0.487 (0.373)	.19	.56
	Planet D	-0.173 (0.379)	.65	