Published in final edited form as:

Patient Educ Couns. 2014 October ; 97(1): 96–100. doi:10.1016/j.pec.2014.07.005.

Development and Validation of the Diabetes Adolescent Problem Solving Questionnaire

Shelagh A. Mulvaney, PhD^{a,b,c}, Sarah S. Jaser, PhD^c, Russell L. Rothman, MD, MPP^{c,d}, William Russell, MD^c, Eric J. Pittel, BS^c, Cindy Lybarger, APRN^c, and Kenneth A. Wallston, PhD^a

^aSchool of Nursing, Vanderbilt University Medical Center, Nashville, TN, USA

^bDepartment of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN, USA

^cDepartment of Pediatrics, Vanderbilt University Medical Center, Nashville, TN, USA

^dDepartment of Medicine, Health Services Research, Vanderbilt University Medical Center, Nashville, TN, USA

Abstract

Objective—Problem solving is a critical diabetes self-management skill. Because of a lack of clinically feasible measures, our aim was to develop and validate a self-report self-management problem solving questionnaire for adolescents with type 1 diabetes (T1D).

Methods—A multidisciplinary team of diabetes experts generated questionnaire items that addressed diabetes self-management problem solving. Iterative feedback from parents and adolescents resulted in 27 items. Adolescents from two studies (N=156) aged 13–17 were recruited through a pediatric diabetes clinic and completed measures through an online survey. Glycemic control was measured by HbA1c recorded in the medical record.

Results—Empirical elimination of items using Principal Components Analyses resulted in a 13-item unidimensional measure, the Diabetes Adolescent Problem Solving Questionnaire (DAPSQ) that explained 57% of the variance. The DAPSQ demonstrated internal consistency (Cronbach's $\alpha = 0.92$) and was correlated with diabetes self-management ($r=0.53$, $p<.001$), self-efficacy ($r=0.54$, $p<.001$), and glycemic control ($r= -0.24$, $p<.01$).

Conclusion—The DAPSQ is a brief instrument for assessment of diabetes self-management problem solving in youth with T1D associated with better self-management behaviors and glycemic control.

© 2014 Elsevier Ireland Ltd. All rights reserved.

Corresponding Author: Shelagh Mulvaney, PhD, Vanderbilt University Medical Center, 461 21st Avenue South, Nashville, TN 37240, Telephone: 615-322-1198; Fax: 615-343-5898, shelagh.mulvaney@vanderbilt.edu.

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.

Practice Implications—The DAPSQ is a clinically feasible self-report measure that can provide valuable information regarding level of self-management problem solving and guide patient education.

Keywords

type 1 diabetes; adolescent; problem solving; assessment; self-management; glycemic control

1. Introduction

Type 1 diabetes (T1D) is one of the most common chronic illnesses of childhood, with approximately 15,000 new cases reported annually and rates that are increasing worldwide [1]. The recommended treatment regimen for T1D is demanding, requiring frequent monitoring of blood glucose levels, multiple daily insulin injections or use of an insulin pump, monitoring carbohydrate intake, and altering insulin dose to match diet and activity patterns. Adherence to this regimen is linked with better glycemic control, reducing the risk for acute and long-term medical complications [2]. However, for youth with type 1 diabetes adolescence is often associated with problems with self-management and deteriorating metabolic control [3,4].

Professional diabetes organizations have identified problem solving as a critical patient skill and element of patient education by which to improve patient self-management in adults and adolescents [5,6]. Human problem solving has been conceptualized and studied from multiple perspectives including clinical and neuropsychology, cognitive science, computer science, education, and social science [7–11]. Several important common areas of focus emerge across disciplines: the implementation of problem solving steps, generalization of problem solving skills within and across domains, the context of problems, and individual characteristics such as attitudes toward problem solving [12,13]. Problem solving has been conceptualized as a form of active or approach type of coping with challenges and is contrasted with avoidance or avoidant problem solving [13]. Different styles of problem solving, including impulsive or careless problem solving, have also been identified [13]. Across all areas of scholarship, the core process of problem solving has included a set of goal-oriented behaviors that includes identifying a problem, generating a set of potential strategies for problem resolution, selecting the most appropriate strategy, implementing that strategy, and evaluating and potentially revising the strategy [8,14]. The appropriate and successful application of these steps may be influenced by a wide range of additional factors including individual characteristics, prior experience in a given behavioral domain, and relevant social or environmental resources [15–17].

In diabetes, problem solving has been the focus of several pediatric coping and problem solving interventions and research has demonstrated associations of problem solving with better self-management and better glycemic control [18–22]. Despite the importance of problem solving for health, few instruments have been developed to measure this construct. Existing measures of problem solving skills for youth with T1D utilize qualitative methods and are not feasible for routine clinical use [20,23]. In order to utilize the data from those methods, clinicians need to be trained to reliably score open-ended text responses. Using

interview methods or open-ended items involves relatively more time and skill to administer and score the items compared to a quantitative self-report measure. Additionally, current measures focus on specific self-management behaviors, such as correcting blood glucose values, instead of generally assessing problem solving that can apply to all areas of self-management. Finally, none of the existing measures assess how well a young patient evaluates or revises problem solutions that have been implemented.

Given these limitations, the purpose of the current study was to develop a brief self-report measure of diabetes self-management problem solving for adolescents with T1D for clinical and research use. For this measure we focused our efforts on assessing two aspects of diabetes problem solving: the implementation of the steps of problem solving for self-management and self-management problem solving avoidance. We hypothesized that higher scores on the problem solving measure would be associated with higher self-management self-efficacy, more frequent self-management behaviors, and lower glycemic control.

2. Methods

2.1. Measure development

A multidisciplinary team of five diabetes professionals (a pediatric psychologist, pediatric nurse practitioner and certified diabetes educator, a pediatric endocrinologist, a social health psychologist, and a physician researcher specializing in diabetes education) along with a young adult with T1D participated in the development process. The group reviewed relevant research literature including available instruments, then generated items to address the steps of problem solving established in clinical research: problem awareness, brainstorming, implementation, evaluation, and revision. Problem avoidance, or the propensity to avoid solving problems, has been included in previous conceptualizations of problem solving and was deemed potentially relevant as a focus of item generation [8,24]. A five-point ordinal response scale was selected ranging from 'Never' to 'Always.'

An initial set of 33 potential items for the Diabetes Adolescent Problem Solving Questionnaire (DAPSQ) was administered to five adolescents with T1D and a parent who provided oral feedback on readability, comprehension, and completeness of the items. Based on this feedback, some items were reworded and five items were eliminated. This process was repeated again with five different adolescents with T1D. Certain items underwent minor rewording and one item was eliminated, resulting in a total of 27 items for more formal testing.

2.2. Participants

One hundred fifty-six adolescents with T1D participated in this study. Eligibility criteria included a diagnosis of T1D for at least 6 months, age between 13–17 years, English speaking, and no cognitive or perceptual difficulties that would preclude reading and comprehending text. Sample size for the study was guided by the need for a recommended minimum 5:1 subjects-to-item ratio [25].

2.3. Setting and procedure

Baseline data from two different studies were combined for the analyses reported in this paper. For both studies, participants were recruited from the same large academic specialty clinic between 2009 and 2012. For sample 1, 72 participants completed measures as part of their baseline assessment within a randomized controlled trial of a self-management intervention study [19]. For that study baseline measures were completed in the clinic on the REDCap online survey system before the randomization process occurred [26]. For sample 2, data from 84 subjects were obtained as baseline data within a mobile health descriptive study [27]. For this second sample, potential participants derived from the clinic database had letters sent to their homes inviting them to participate in a survey research study. The letter included a website address where the parent completed eligibility, consent, and demographic forms. Once the forms had been completed, the adolescent with T1D was sent a similar invitational letter by email and was able to complete the study measures online. Both studies were approved by the Institutional Review Board, and parental consent and adolescent assent were completed before study procedures commenced.

2.4. Measures

Demographic and clinical information including adolescent age, gender, race, insulin pump use, and duration of diabetes were collected through baseline parent report. Glycemic control was assessed through medical chart review using the most recent hemoglobin A1C (HbA1c) test obtained. The HbA1c blood test provides an estimate of the average level of glycemic control over the previous 3 months.

The initial 27 problem solving items of the Diabetes Adolescent Problem Solving Questionnaire (DAPSQ), derived from the development process described above, were administered with other baseline self-report measures.

Self-management was assessed using the Diabetes Behavior Rating Scale (DBRS) [28]. The DBRS is a 37-item validated self-report measure of T1D self-management behaviors with adequate internal consistency (Cronbach's alpha .70), concurrent validity with the diabetes self-management profile (DSMP) and predictive validity in relation to glycemic control. Response options range from "Never" to "Always." Total score range for the DBRS is 1–5.

The Self-Efficacy for Diabetes Self-Management measure (SEDM) is a 10-item self-report scale with demonstrated internal reliability (Cronbach's alpha = .90) [29]. The SEDM items cover all major domains of diabetes self-management such as monitoring blood glucose, dosing insulin, food choices, and exercise, including doing these tasks when feeling overwhelmed or frustrated. SEDM scores are negatively related to HbA1c. Total score range for the SEDM is 1–10.

2.5. Statistical analysis

Descriptive analyses provided the basis for the initial round of elimination of DAPSQ problem solving items. Items skewed more than ± 1.0 were eliminated. Principal Components Analysis was used to empirically identify the number of underlying factors and for item reduction. Only items with loadings of at least .50 on a single factor were retained

[30]. Items that loaded on more than one factor were eliminated, as were factors comprised of less than three items. Internal reliability was calculated using Cronbach's alpha. Spearman rho bivariate correlations were used to assess associations among study measures. Tests of differences between the two study samples were assessed using ANOVA. All analyses were conducted using SPSS v22 (Chicago, IL, USA).

3. Results

3.1. Sample characteristics

There were no statistically significant differences between the two study samples on any demographic, clinical, or self-report variables. Characteristics of the sample are presented in Table 1. Mean age of the sample (N=156) was 15.2 years (SD 1.5). 93.6% were White, and 52.6% were female. Approximately half (49.4%) used an insulin pump (CSII), duration of diabetes in years was 6.6 (SD 3.3), and the average HbA1c was 8.81 (1.80). All participants had HbA1c tests completed within three months of completing the surveys. The sample mean for the Diabetes Behavior Rating Scale was 3.85 (SD .48) and mean Self-Management Self-Efficacy (SEDM) score was 7.61 (SD 1.49).

3.2. DAPSQ item reduction, item scores, reliability, and readability

Of the 27 items developed by the team of diabetes professionals, in consultation with adolescents with T1D and a young adult with T1D, five items were skewed greater than ± 1.0 and were eliminated. To empirically determine if there was more than one factor underlying the remaining 22 items, a Principal Components Analysis (PCA) with an orthogonal rotation was conducted. Using a Kaiser criterion of eigenvalues >1.0 , four factors were obtained explaining 62.1% of the variance. Five items were eliminated because they did not load at least .50 on any factor or loaded on more than one factor. Two factors (with four items total), including two items focused on problem avoidance, were then eliminated because they had fewer than three items each. A final PCA was run which resulted in a 13-item unidimensional measure that explained 56% of the variance. Table 2 shows the 13 items, intended problem solving step the item addresses, item descriptive statistics, and final loadings. The resulting DAPSQ total score mean was 3.56 (SD 0.84; 95% CI 3.42–3.68), median 3.73, range (1.15–5.00), and skewness -0.64 . Cronbach's alpha internal consistency reliability of the DAPSQ was .92. The Flesh-Kincaid readability for the final items was at the 6.5 grade level, with a reading ease score of 71. We estimate that the thirteen items could be completed by an adolescent in under 5 minutes.

3.3. DAPSQ construct and predictive validity

Table 3 shows bivariate relationships between the DAPSQ, participant characteristics, and HbA1c. The DAPSQ was not related to adolescent demographic or clinical characteristics, but was appropriately, positively associated with diabetes self-management (DBMS; $r=0.53$, $p<.001$), self-management for diabetes self-efficacy (SEDM; $r=0.54$, $p<.001$) and negatively associated with glycemic control ($r=-0.24$, $p<.01$).

4. Discussion and conclusion

4.1. Discussion

The purpose of this study was to develop and validate a brief self-report measure of self-management problem solving for adolescents with T1D suitable for use in routine diabetes care and patient education programs. Results suggest that the DAPSQ is a reliable and valid method to assess the extent to which adolescents utilize problem solving for diabetes self-management. The measure is internally consistent and appropriately correlated with diabetes self-management behaviors, self-management self-efficacy and glycemic control. These latter associations provide initial evidence of the measure's construct validity. The fact that DAPSQ scores were not related to demographic or clinical background factors (such as whether the adolescent was using an insulin pump) might provide evidence of the scale's discriminant validity.

The thirteen DAPSQ items that remained after item reduction address all of the steps of the problem solving process. Items related to several of the steps were eliminated as were the items related to problem avoidance. The resulting unidimensional scale measures the extent to which adolescents report utilizing all steps of the problem solving process for self-management, but not avoidance of using them. Similarly, the measure does not assess problem solving resources, individual characteristics, or problem solving styles which may be related to the successful application of problem solving skills.

The current study was limited by the cross-sectional nature of the research design. Although the DAPSQ was not related to adolescent age or duration of diabetes in our study, problem solving is an executive cognitive function that continues to develop into early adulthood [31]. Longitudinal research is needed to document the developmental trajectory and psychosocial correlates of problem solving skills across pediatric and young adult age groups and also to examine the instrument's predictive validity. The cross-sectional study design also did not allow for assessing test-retest reliability of the DAPSQ, which should be accomplished in future research.

Additionally, although the sample was predominantly White, it is representative of the population of adolescents with T1D [32,33]. Nevertheless, the lack of racial/ethnic diversity in our study limits the generalizability of the results for adolescents of other racial and ethnic backgrounds with T1D. Finally, self-management was assessed via adolescents' self-report in this study. Future research could incorporate other indicators of self-management such as parental reports of their child's self-management behaviors or use of blood glucose values from a meter over a specified period of time [34].

4.2. Conclusion

Improvement of self-management problem solving is a recognized and important focus of patient education in diabetes. For adolescents, the limited feasibility of available measures for clinical settings has precluded widespread evaluation of those skills. Evaluation of those skills is critical to document baseline levels, skill improvement, and tailor educational programming to individual needs. The DAPSQ makes this type of evaluation possible. Youth with diabetes will benefit from a continued focus on methods to better evaluate and

improve their disease-related problem solving skills. Efforts to improve measurement methods will ultimately result in better design and evaluation of patient-facing tools and programs to support patient self-management problem solving.

4.3. Practice implications

The availability of a valid and brief problem solving measure may provide clinical researchers and clinicians the ability to feasibly document levels and improvement in the problem solving skills of their participants and patients. For researchers, the measure provides a means to establish levels of problem solving that are related to healthy glycemic control and to document changes in problem solving after a theory-based intervention or experimental manipulation. Within the clinic, the measure could provide justification for further discussion between clinicians, young patients, and their caregivers regarding specific examples of problems and problem solving processes that may be in need of support. Low scores on the DAPSQ could warrant referral to continuing diabetes self-management educational resources either within or outside of the clinic setting.

Acknowledgments

This research was supported by the National Institutes of Health (DK070026) and a Vanderbilt Diabetes Research and Training Center Pilot and Feasibility grant (P60 DK020593), and a Vanderbilt CTSA award (UL1TR00045) from the National Center for Advancing Translational Sciences. The authors have no conflicts of interest to disclose.

References

1. Patterson CC, Dahlquist GG, Gyürüs E, Green A, Soltész G. Incidence trends for childhood type 1 diabetes in Europe during 1989–2003 and predicted new cases 2005–20: a multicentre prospective registration study. *The Lancet*. 373(9680):2027–2033.
2. Diabetes Control and Complications Trial Research Group. Effect of intensive diabetes treatment on the development and progression of long-term complications in adolescents with insulin-dependent diabetes mellitus: diabetes control and complications trial. *J. Pediatr.* 1994 Aug; 125(2):177–188. [PubMed: 8040759]
3. Helgeson VS, Siminerio L, Escobar O, Becker D. Predictors of Metabolic Control among Adolescents with Diabetes: A 4-Year Longitudinal Study. *J. Pediatr. Psychol.* 2009 Apr; 34(3):254–270. [PubMed: 18667479]
4. Greening L, Stoppelbein L, Konishi C, Jordan SS, Moll G. Child routines and youths' adherence to treatment for type 1 diabetes. *J. Pediatr. Psychol.* 2007 May; 32(4):437–447. [PubMed: 17030526]
5. Haas L, Maryniuk M, Beck J, et al. National Standards for Diabetes Self-Management Education and Support. *Diabetes Care*. 2013 Jan 1; 36(Supplement 1):S100–S108. 2013. [PubMed: 23264420]
6. Global IDF/ISPAD Guideline for Diabetes in Childhood and Adolescence. Brussels, Belgium: International Diabetes Federation;
7. Wade SL, Walz NC, Carey J, et al. A randomized trial of teen online problem solving for improving executive function deficits following pediatric traumatic brain injury. *J. Head Trauma Rehabil.* 2010 Nov-Dec;25(6):409–415. [PubMed: 21076241]
8. Hill-Briggs F. Problem solving in diabetes self-management: a model of chronic illness self-management behavior. *Ann. Behav. Med.* 2003 Summer;25(3):182–193. [PubMed: 12763713]
9. Hmelo-Silver C. Problem-based learning: what and how do students learn? *Educ Psychol Rev.* 2004 Sep; 16(3):235–266.
10. D'Zurilla TJ, Nezu A. A study of the generation-of-alternatives process in social problem solving. *Cognitive Therapy and Research*. 1980; 4(1):67–72.

11. Ram, P.; Ram, A.; Holzman, J.; Sprague, C. IADIS International Conference on e-Learning. Lisbon: Portugal; 2007. A cognitive model of problem-based learning and its application to educational software design.
12. Compas BE, Conner-Smith JK, Saltzman H, Thomsen AH, Wadsworth ME. Coping with stress during childhood and adolescence: problems, progress, and potential in theory and research. *Psychol. Bull.* 2001; 127:87–127. [PubMed: 11271757]
13. Hill-Briggs F, Yeh HC, Gary TL, Batts-Turner M, D’Zurilla T, Brancati FL. Diabetes Problem-Solving Scale Development in an Adult, African American Sample. *The Diabetes Educator.* 2007 Mar-Apr;33(2):291. [PubMed: 17426304]
14. Mulvaney SA. Improving patient problem solving to reduce barriers to diabetes self-management. *Clin Diabetes.* 2009; 27(3):99–104.
15. D’Zurilla TJ, Maydeu-Olivares A, Gallardo-Pujol D. Predicting social problem solving using personality traits. *Personality and Individual Differences.* 2011; 50(2):142–147.
16. Heaney, C.; Israel, B. Social networks and social support. In: Glanz, K., editor. *Health Behavior and Health Education: Theory, Research, & Practice.* San Francisco: Jossey Bass; 2008.
17. Patrick J, Strough J. Everyday Problem Solving: Experience, Strategies, and Behavioral Intentions. *Journal of Adult Development.* 2004; 11(1):9–18. 2004/01/01.
18. Graue M, Wentzel-Larsen T, Bru E, Hanestad BR, Sovik O. The Coping Styles of Adolescents With Type 1 Diabetes Are Associated With Degree of Metabolic Control. *Diabetes Care.* 2004 Jun; 27(6):1313–1317. [PubMed: 15161781]
19. Mulvaney SA, Rothman RL, Wallston KA, Lybarger C, Dietrich MS. An Internet-Based Program to Improve Self-Management in Adolescents With Type 1 Diabetes. *Diabetes Care.* 2010 Mar 1; 33(3):602–604. [PubMed: 20032275]
20. Wysocki T, Iannotti R, Weissberg-Benchell J, et al. Diabetes problem solving by youths with type 1 diabetes and their caregivers: measurement, validation, and longitudinal associations with glycemic control. *J. Pediatr. Psychol.* 2008 Sep; 33(8):875–884. [PubMed: 18346973]
21. Fitzpatrick SL, Schumann KP, Hill-Briggs F. Problem solving interventions for diabetes self-management and control: A systematic review of the literature. *Diabetes Res. Clin. Pract.* 2013
22. Thorpe CT, Fahey LE, Johnson H, Deshpande M, Thorpe JM, Fisher EB. Facilitating healthy coping in patients with diabetes: a systematic review. *The Diabetes Educator.* 2013 Jan-Feb;39(1): 33–52. 2013. [PubMed: 23073967]
23. Cook S, Aikens JE, Berry CA, McNabb WL. Development of the diabetes problem-solving measure for adolescents. *Diabetes Educ.* 2001 Nov-Dec;27(6):865–874. [PubMed: 12211926]
24. Frauenknecht M, Black DR. Social Problem-Solving Inventory for Adolescents (SPSI-A): Development and preliminary Psychometric Evaluation. *Journal of Personality Assessment.* 1995 Jun; 64(3):522–539. [PubMed: 7760259]
25. Gorsuch, G. *Factor Analysis.* Mahawah, NJ: Erlbaum; 1983.
26. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform.* 2009; 42(2):377–381. [PubMed: 18929686]
27. Mulvaney SA, Rothman RL, Dietrich MS, et al. Using Mobile Phones to Measure Adolescent Diabetes Adherence. *Health Psychol.* 2012; 31(1):43–50. [PubMed: 21967662]
28. Iannotti RJ, Nansel TR, Schneider S, et al. Assessing Regimen Adherence of Adolescents With Type 1 Diabetes. *Diabetes Care.* 2006 Oct; 29(10):2263–2267. [PubMed: 17003304]
29. Iannotti RJ, Schneider S, Nansel TR, et al. Self-efficacy, outcome expectations, and diabetes self-management in adolescents with type 1 diabetes. *J. Dev. Behav. Pediatr.* 2006 Apr; 27(2):98–105. [PubMed: 16682872]
30. Comrey, AL.; Lee, HB. *A first course in factor analysis.* Hillsdale, NJ: Lawrence Erlbaum; 1992.
31. Skinner EA, Zimmer-Gembeck MJ. The Development of Coping. *Annu. Rev. Psychol.* 2007 Aug. 58:119–144. [PubMed: 16903804]
32. Nansel TR, Iannotti R, Liu A. Clinic-integrated behavioral intervention for families of youth with type 1 diabetes: randomized clinical trial. *Pediatrics.* 2012; 129:e866. [PubMed: 22392172]

33. Duncan GE. Prevalence of diabetes and impaired fasting glucose levels among US adolescents: National Health and Nutrition Examination Survey, 1999–2002. *Arch. Pediatr. Adolesc. Med.* 2006 May; 160(5):523–528. [PubMed: 16651496]
34. Guilfoyle SM, Crimmins NA, Hood KK. Blood glucose monitoring and glycemic control in adolescents with Type 1 diabetes: meter downloads versus self-report. *Pediatr Diabetes.* 2011; 12(6):560–566. [PubMed: 21392192]

Highlights

- * There are no measures to feasibly assess problem solving in adolescents with T1D.
- * A 13-item questionnaire was developed and validated with 156 adolescents.
- * The questionnaire was found to be internally consistent and valid.

Table 1

Sample characteristics (N=156).

Variable	Mean (SD) or %
Age	15.22 (1.46)
Gender (female)	
Race/Ethnicity	
White	93.6%
African American	4.5%
Hispanic / Latino	1.3%
Pacific Islander /Other	0.6%
Regimen	
Insulin pump (yes)	49.4%
Duration of diabetes (years)	6.62 (3.34)
A1C	8.81 (1.80)
Diabetes Behavior Rating Scale	
Self-Management Self-Efficacy	7.61 (1.49)

Table 2

Diabetes Adolescent Problem Solving Questionnaire items, item means (standard deviations), associated problem solving steps, and final component loadings.

Problem Solving Step	Item	Mean (SD)	Loadings
Awareness	1. Before I solve a diabetes problem, I try to understand as much as I can about it.	3.43 (1.14)	.805
Awareness	2. When I think a situation will get in the way of taking care of my diabetes, I do something to prevent that from happening.	3.51 (1.14)	.645
Awareness	3. If I don't understand how to do something related to diabetes, I try to get that information pretty quickly.	3.70 (1.07)	.800
Brainstorm	4. I try to look at a diabetes problem in different ways before I take action.	3.17 (1.17)	.806
Brainstorm	5. I try to predict what will happen if I choose a certain solution to a diabetes problem.	3.50 (1.13)	.742
Brainstorm	6. Before I try a solution with my diabetes, I try to figure out what could go wrong.	3.22 (1.14)	.733
Brainstorm	7. Before I try to solve a diabetes problem, I like to be clear on a plan.	3.48 (1.17)	.746
Implement	8. I don't let a diabetes problem go on too long before I take action.	3.79 (1.10)	.632
Implement	9. I follow through and put my diabetes solutions into action.	3.67 (1.09)	.841
Evaluate	10. If a solution to a diabetes problem doesn't work, I try to figure out why.	3.60 (1.21)	.811
Evaluate	11. After trying to solve a diabetes problem, I notice if the situation is better.	3.85 (1.07)	.731
Evaluate	12. I learn something when a solution to a diabetes problem doesn't work.	3.63 (1.12)	.807
Revise	13. If my first try doesn't work, I go back and try to solve the diabetes problem again.	3.69 (1.11)	.784

Table 3

Bivariate correlations between DAPSQ and study variables.

	DAPSQ	Age	Gender	Pump	Duration	DBRS	SMSE	HbA1c
DAPSQ	1.00							
Age	0.05	1.00						
Gender	-0.08	0.06	1.00					
Pump	0.11	-0.11	0.08	1.00				
Duration	-0.12	-0.23**	0.06	0.04	1.00			
DBRS	0.53***	-0.05	-0.08	.28***	-0.10	1.00		
SMSE	0.54***	0.18*	-0.11	0.03	-0.05	0.40***	1.00	
HbA1c	-0.24**	-0.01	0.08	-0.11	0.18*	-0.18*	-0.14	1.00

Notes: Spearman Rho used to assess bivariate relationships. DAPSQ, Diabetes Adolescent Problem Solving Questionnaire; Duration, duration of diabetes in years; DBRS, Diabetes Behavior Rating Scale; SMSE, Self-Management Self-Efficacy; HbA1c, hemoglobin A1c indicator of glycemic control.

* p<.05

**

p<.01

*** p<.001