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Exploring the role of motivational interviewing in adolescent patient-provider communication about type 1 diabetes

Laura J. Caccavale¹, Rosalie Corona², Jessica G. LaRose³, Suzanne E. Mazzeo², Alexandra R. Sova³, Melanie K. Bean¹

¹Department of Pediatrics, Children's Hospital of Richmond at Virginia Commonwealth University, Richmond, Virginia

²Department of Psychology, Virginia Commonwealth University, Richmond, Virginia

³Department of Health Behavior and Policy, Virginia Commonwealth University School of Medicine, Richmond, Virginia

Abstract

Objective: Adolescents with type 1 diabetes (T1D) frequently experience deterioration in glycemic control. Providers have unique opportunities to address diabetes self-management, yet little is known about the most effective way to communicate with adolescents. This investigation used a motivational interviewing (MI) framework to characterize naturally-occurring adolescent patient-provider communication in medical encounters and examined relations between adolescent patient-provider communication and (a) T1D self-management and (b) glycemic control (hemoglobin A1c [HbA1c]).

Methods: Medical encounters between pediatric endocrine providers and 55 adolescents with T1D (49% female; M age = 14.8 years; M baseline HbA1c = 8.6%) were audio recorded and coded using standardized rating instruments. Patients and parents completed measures assessing T1D care behaviors and self-efficacy. Assessments were completed at routine endocrinology visits (baseline) and 1 and 3-month post-baseline; HbA1c was obtained from medical records at baseline and 3-month.

Results: Hierarchical multiple regressions showed that greater provider use of MI non-adherent behaviors (eg, confronting, persuading) was associated with (a) poorer 3-month HbA1c, $P < 0.001$; (b) worse 1-month adolescent diabetes adherence $P < 0.001$, and (c) lower diabetes self-efficacy at 1-month ($P < 0.001$) follow-up. Lower patient self-efficacy for diabetes self-management mediated the relation between provider use of MI non-adherent language and lower diabetes adherence ($P = 0.020$).

Conclusion: Providers' use of persuasion and confrontation regarding risks of non-adherence was associated with poorer glycemic control and adherence. Communication training for providers that targets reductions in MI-inconsistent language may have the potential to improve diabetes self-care in this vulnerable population.

Keywords

adolescents; communication; motivational interviewing; type 1 diabetes

1 | INTRODUCTION

Type 1 diabetes (T1D) management is complex and requires adherence to numerous disease care behaviors to maintain glycemic control. There is a well-established decline in glycemic control observed during adolescence, because of a complex interplay of behavioral (eg, reduction in diabetes self-management behaviors and self-efficacy) and physiological factors (eg, puberty-related hormonal shifts).^{1,2} Consequently, adolescents with T1D are at risk for acute and long-term complications.³ Given that quarterly visits with an endocrine provider are recommended,⁴ and provider communication can meaningfully impact patient behavior,^{4,5} characterizing communication between adolescents with T1D and their providers during routine visits might help to identify aspects of communication associated with patient outcomes and guide future intervention efforts.

Effective patient-provider communication is described as the core component of T1D treatment,⁶ and thus it is essential to the deliver high-quality care.^{7,8} Indeed, effective patient-provider communication is positively related to patient satisfaction, treatment adherence, and health outcomes.^{7,9} Adolescents with T1D who have more positive perceptions of patient-centered communication have higher competence in managing diabetes, which, in turn, is related to better adherence and glycemic control.⁵ Effective communication might enable providers to foster adolescent self-efficacy, a key construct associated with adherence and glycemic control.^{10,11}

Although the ideal communication approach is not clear, motivational interviewing (MI) is a particularly promising strategy that has improved treatment engagement and outcomes in multiple health domains.^{12–16} MI has proven beneficial in the management of chronic health conditions in adolescents, and might represent a brief, disseminable communication approach to improving T1D self-care.^{17,18} With MI, providers seek to understand patients' perspectives, accept their motivations, affirm their decisions, and evoke "change talk."¹⁹ MI contrasts with approaches that rely on confrontation, warning about risks of non-adherence or giving advice without patient collaboration. The potential benefit of MI-consistent communication was showed in two studies, one with adults²⁰ and one with adolescents²¹ with obesity. In these studies, when providers, who were not trained in MI, used more MI-consistent techniques (eg, collaborating, evoking, and asking permission prior to providing information), patients experienced greater weight loss,^{20,21} increased exercise, and reduced screen time,²¹ compared with patients whose providers used more MI-inconsistent approaches (eg, advising without permission, confronting, and directing). Importantly, these effects were evident with minimal use of MI, well below competency thresholds.²²

There is emerging empirical support for the use of MI with T1D populations. Channon et al²³ reported a positive effect of MI, compared with support visits, on hemoglobin A1c (HbA1c) among adolescents with T1D in a small pilot study.²³ However, MI sessions were delivered in variable doses (based on patient preferences) and occurred outside of the clinic

(eg, in homes or cafes), which limits generalizability and translation potential. Furthermore, fidelity to MI was not reported. Another study evaluated an MI-informed intervention implemented within pediatric endocrinology clinics in the United Kingdom. Although improved glycemic control was not found,²⁴ authors noted that MI-consistent aspects of communication (eg, reflective listening) should be explored as potential intervention targets. Given mixed and limited evidence, objective assessment of natural patient-provider communication within an MI framework during diabetes encounters is needed, prior to developing broad scale provider trainings. In addition, it is important to better understand how communication might increase other important constructs, like self-efficacy, which ultimately impacts adherence.^{10,25} Self-efficacy is crucial and an important theoretical construct present in many health behavior theories because as a patient's confidence in his or her ability to perform certain health behaviors increases, she/he will engage in more positive health behaviors such as adherence.²⁵ Therefore, the promotion of self-efficacy is critical for self-management of many health behaviors including T1D.^{10,25} MI, with its focus on promoting a patient's own autonomy presents as a potentially important communication style that might increase a patient's sense of self-efficacy for diabetes management.

Given the increased risk of complications and documented decline in adherence among adolescents with T1D, the development of effective, scalable T1D interventions is urgently needed. However, implementing interventions within a clinical care setting that are feasible, acceptable to providers and patients, and effective in small doses, is challenging.²⁶ Provider communication training might be a viable option that can be easily adopted into clinical care. It is unclear which communication aspects might be most potent to target for a training specific to adolescents with T1D. Thus, the current investigation explored naturally-occurring diabetes-related conversations within a clinical context between adolescents and endocrine providers, using an MI framework. Associations between communication and patient outcomes (T1D adherence behaviors and HbA1c) were examined. Results can inform development of an intervention with potentially high impact to reduce complications in this high-risk population of adolescents with T1D.

It was hypothesized that: (a) greater use of MI-adherent language (measured by the Motivational Interviewing Treatment Integrity Code²⁷; MITI 4.1) would be associated with greater T1D adherence, higher T1D self-efficacy and lower HbA1c, (b) greater use of MI non-adherent language would be associated with lower T1D adherence and self-efficacy, and higher HbA1c. In addition, it was hypothesized that self-efficacy would mediate the association between MI adherence and (a) HbA1c and (b) T1D adherence.

2 | METHODS

2.1 | Participants

Participants included adolescent patients with T1D, their primary caregivers, and pediatric endocrinology providers (ie, physicians and nurse practitioners [NP]). Adolescent participants were current patients of a pediatric endocrinology practice at a large, urban, academic medical center. Patient eligibility included (a) clinical diagnosis of T1D for >1 year, (b) age 13 to 18 years, and (c) English-speaking. Adolescents were ineligible if they: (a) were moving away from home during the study (eg, to college), (b) had significant

psychiatric, cognitive, medical, or developmental conditions that would impair their ability to complete assessments and/or engage in diabetes self-care behaviors (eg, malignancies, psychosis, and severe intellectual disability), as documented in the medical record or showed at informed consent visit, and (c) had medically-induced diabetes or diabetes other than T1D. All physicians and NPs practicing at this clinic were eligible. This study was approved by the Institutional Review Board of [redacted].

2.2 | Procedure

2.2.1 | Recruitment and retention—Providers were recruited during a division meeting; all eligible providers consented (eight physicians [five attending physicians and three fellows] and three NPs consented. Five of these providers were ultimately included in the analyses because they saw study families. Providers were told that the study's purpose was to enhance understanding of patient-provider communication about T1D, and that encounters would be audio-recorded. Providers were blinded to study hypotheses and the MI coding framework. Parents/caregivers of potentially eligible patients were sent a physician-endorsed letter (n = 288) introducing the study and providing a number to call with questions. Research staff attempted telephone contact with families that had upcoming appointments within the study timeline to provide study details, confirm eligibility, and if appropriate, schedule a baseline visit during an upcoming routine endocrinology appointment. Sixty-five patients were successfully contacted by phone and were eligible and willing to participate. Of these, 85% (n = 55) completed consent/assent and baseline assessments. Of those who consented, 94.5% completed 1-month assessments and 92.7% attended their subsequent quarterly endocrinology appointment during which 3-month follow-up assessments were obtained (Figure 1).

2.2.2 | Study procedures—Interested adolescents and parents were instructed to arrive approximately 30 minutes prior to their routine quarterly endocrinology appointment to meet with research staff, complete informed consent/assent, and baseline assessments. Patient encounters were audio-recorded. One month after baseline visits, parents were emailed REDCap links for them and their adolescent to complete follow-up study measures. One week prior to the adolescent's subsequent endocrinology visit (~3-month post-baseline), parents were again emailed a REDCap link to complete study measures. Medical data and HbA1c were obtained through chart review at baseline and 3 months.

2.2.3 | Assessment of medical encounters—Trained raters (undergraduate research assistants), blind to study hypotheses, coded randomly selected 20-minute segments of each audio-recorded visit using the MITI 4.1.²⁷ 10% of sessions were double coded and rater agreement calculated using intraclass correlations (ICCs) for the MITI ratings. ICCs = 0.80 were established at study onset and reevaluated throughout the investigation to prevent rater drift. Encounters were also coded in a second pass using a Diabetes Encounter Rating Instrument (described below) although this instrument was not double coded.

2.3 | Measures

2.3.1 | Adolescent and parent measures

Demographics: Parents completed a demographic questionnaire at baseline, which included parent and adolescent sex, age, race, ethnicity, family income, and insurance status.

Diabetes adherence: The diabetes behavior rating scale (DBRS; adolescent and parent versions) assessed adolescent and parent report of frequency of diabetes care tasks across four subscales (daily prevention behaviors, intervention behaviors, modification of diabetes care plan, and diabetes care practices); a total score was then calculated.²⁸ This measure has good internal consistency, test-retest reliability, and content validity.²⁸ In the present study, adolescent and parent DBRS scales had good internal consistency ($\alpha = 0.72$; $\alpha = 0.86$, respectively).

Self-efficacy for diabetes self-management: Adolescents completed the self-efficacy for diabetes self-management measure (SEDSM) to assess confidence in completing diabetes tasks.¹⁰ The scale yields internally consistent and stable scores; Cronbach alpha in the current sample was adequate ($\alpha = 0.69$).¹⁰

Medical data: Duration of T1D diagnosis, current therapy (insulin pump, basal/bolus, and multiple daily injections), and other medical conditions were obtained from parents and verified through chart review. Glycemic control was measured by point of care HbA1c, an indicator of average blood glucose concentration from the previous 3-month period; values were extracted from medical records at baseline and 3 months. Higher HbA1c values indicate poorer glycemic control with a target of $\leq 7.5\%$ for adolescents.⁴

2.3.2 | Provider measure—At baseline, providers reported their age, sex, race/ethnicity, years of clinical experience, prior MI training and professional background.

2.3.3 | Encounter rating measures

Motivational interviewing treatment integrity (MITI): The MITI 4.1 assesses adherence to MI, and includes overall global ratings and behavior counts.²⁷ Global scores capture raters' overall impressions of how well the provider meets the dimension being measured using a five-point scale, and includes: cultivating change talk, softening sustain talk, partnership, and empathy. Behavior counts capture specific behaviors without regard to how they fit into the overall impression of MI use; these include: giving information, persuading, persuading with permission, questioning, simple reflection, complex reflection, affirming, seeking collaboration, emphasizing autonomy, and confronting. A total MI-adherent score was calculated by the sum of the seeking collaboration, affirm, and emphasizing autonomy behavior counts and total MI non-adherent score was calculated by the sum of the confront and persuade behavior counts. (Table 1).

Session characteristics: A diabetes encounter rating instrument assessed which target behaviors were discussed (eg, blood glucose monitoring, insulin administration, diet, and exercise), to whom the conversation was directed (eg, parent or adolescent), and what % of time each person spoke. Session length, time waiting to see the provider, and provider

communication strategies used (eg, agenda setting, asking about a typical day, prescriptive goal setting) were also assessed. This measure was designed for this study and has not been validated, but is similar to systems developed previously.²⁹

2.4 | Data analyses

Analyses were performed using SPSS v24. Descriptives and univariate normality were assessed for all variables. Adolescent race/ethnicity was dichotomized into White (76.4%) and racial/ethnic minority status (23.6%). Pearsons or point-biserial correlations between demographics, MI variables, and outcomes were calculated. Previous provider MI training, patient age and race/ethnicity were included as covariates in multivariate models based on significant first-order correlations. Hierarchical linear regression models examined associations among MI variables (eg, summary scores of MI adherent and MI non-adherent) and (a) glycemic control at 3 months, (b) adherence at 1 and 3 months, and (c) self-efficacy for diabetes self-management at 1 month. Variables were entered into the model in steps, with Step 1 including baseline scores of the dependent variable and covariates. Finally, a series of multivariate analyses were conducted in the general linear model framework to examine whether self-efficacy at 1-month would mediate the relation between baseline MI adherence and 3-month diabetes-related outcomes (glycemic control and diabetes-related behaviors).³⁰ The Sobel test evaluated the magnitude of the mediation effect. To more fully explore the data available related to session characteristics, post-hoc analyses explored relations among MITI summary score variables and time waiting to see the provider, time spent with the provider, and the target of providers' comments. Power analyses determined that, with a sample size of 55, this study would have 80% power to detect a significant association between MI summary score (from the MITI) and baseline HbA1c (corresponding to a 0.15 effect size). This relatively simple power analysis was used given the lack of established effect sizes. The present study is also adequately powered for tests of mediation.³¹

3 | RESULTS

3.1 | Descriptives

3.1.1 | Participants—Fifty-five adolescents with T1D and parent/caregivers participated. Most adolescents (75%) were on insulin pump therapy, with an average T1D duration of 7.9 ± 3.9 years, and M baseline HbA1c of $8.6 \pm 1.4\%$. Five providers participated. The average number of years providing clinical services was 13.6 ± 15.2 ; 60% reported attending a prior formal MI training (more than a lecture or didactics about MI). (Table 2). There were no differences between participants who completed the 1-month survey compared to those who did not, with respect to patient demographics and medical variables (eg, gender, age, race, ethnicity, family income, insurance status, single-parent status, insulin regimen, length of diagnosis, and HbA1c).

3.1.2 | Medical encounters—MITI summary scores were compared to recommended competency and proficiency thresholds. Providers' average scores ranged from below fair to good proficiency thresholds. (Table 3). The average MITI technical summary score across encounters ($M = 3.57$, $SD = 0.73$) and percent complex reflections summary score ($M =$

0.49, SD = 0.42), were between the Fair and Good proficiency thresholds. MITI Relational summary score (M = 3.71, SD = 0.88) and reflection-to-question ratio summary score (M = 0.49, SD = 0.24) were below the fair proficiency threshold. Finally, the average MI adherent summary score was 1.50 (SD = 1.50) and average MI non-adherent summary score was 2.29 (SD = 3.01). Inter-rater reliability rating system (IRRs) were assessed with intraclass correlations for the MITI and ranged from 0.74 to 0.98 across domains. Using the diabetes encounter rating instrument, characteristics (eg, session strategies used, behaviors addressed during the encounter) of patient-provider encounters were assessed by trained research staff through audio-recording review. The top strategies providers used included asking about the patient's typical day (76.4%), prescriptive goal setting (67.3%), giving advice (65.5%), problem solving (41.8%), and collaborative goal setting (41.8%). Checking blood sugar (78.2%), insulin administration (76.4%), and carbohydrate counting/diet (72.2%) were the most frequent behaviors addressed.

3.2 | MI communication and outcomes

After controlling for covariates, provider use of MI non-adherent communication (eg, confronting, persuading) was associated with (a) poorer HbA1c at 3 months, $\beta = 0.24$, $P = 0.038$; (b) worse diabetes adherence at 1 month, $\beta = -0.30$, $P = 0.021$, and (c) lower patient self-efficacy for diabetes self-management at 1 month, $\beta = -0.41$, $P = 0.004$. Use of MI adherent behaviors was not significantly associated with HbA1c, adherence, or self-efficacy ($P > 0.05$). (Tables 4 and 5). Use of MI non-adherent communication was also associated with poorer diabetes adherence at 3 months, $\beta = -0.38$, $P = 0.016$; however, this association was not significant after controlling for baseline levels of adherence.

Patient self-efficacy for diabetes self-management mediated the effect of provider MI non-adherent behaviors on diabetes adherence, but not glycemic control. Specifically, lower patient self-efficacy at 1-month mediated the relation between greater baseline provider use of MI non-adherent behaviors and poorer 3-month T1D adherence (Figure 2). A Sobel test also supported this mediation ($z = -2.33$, $P = 0.020$).

3.2.1 | Post-hoc Analyses—Patients waited in the examination room to see the provider for an average of $24.0 \pm 10:57$ minutes; providers spent $23.5 \pm 9:02$ minutes with patients. Session length was correlated with poorer baseline glycemic control ($r = 0.29$, $P = 0.031$) and adherence ($r = -0.32$, $P = 0.019$). At least one parent attended all sessions. Providers spoke for more than half of the encounter (53%), followed by parents (28%) and adolescents (19%). Providers directed communication to the adolescent (61%) more than the parent (39%). The percentage of time providers spoke was negatively correlated with MI reflection-to-question ratio ($r = -0.352$, $P = 0.015$) but was not significantly related to any other MI variables.

4 | DISCUSSION

When endocrine providers used MI non-adherent behaviors (eg, confronting and persuading) during medical encounters, adolescents showed poorer diabetes-related adherence at 1-month follow up, and poorer glycemic control at 3 months. Furthermore, when providers used more MI non-adherent behaviors, adolescents reported lower self-efficacy for diabetes

self-management at 1-month follow-up. In addition,, patients' self-efficacy for diabetes self-management mediated the relation between MI non-adherent behaviors and diabetes adherence, after controlling for patient and provider characteristics. Thus, when providers were confronting and persuading during an encounter, patients reported less self-efficacy for managing diabetes behaviors, which in turn, was associated with reduced engagement in adherence behaviors. Given the relation between adherence and glycemic control,²⁰ the negative health consequences of uncontrolled blood sugars,³² and the positive relation between self-efficacy and adherence,^{10,11} these findings might have important clinical implications. Although providers did not reach or exceed the "good" level of basic competency and proficiency thresholds, use of MI adherent behaviors (eg, seeking collaboration, affirming, and emphasizing autonomy) was not associated with any of the primary diabetes-related outcomes of adherence or glycemic control. Although preliminary based on the quasi-experimental study design and small sample size, results suggest that targeted provider trainings to minimize MI-inconsistent language might be sufficient to promote meaningful changes in adolescent self-efficacy and adherence. Furthermore, the examination of the natural occurring communication suggests that providers are using certain MI-consistent communication, such as complex reflections. Notably, they also appear to be relying on asking a lot of questions during encounters, which may make the encounter more provider-driven and therefore reduce partnership during the encounter. However, randomized controlled trials are needed to further examine these relations.

Descriptive results characterizing encounters might also inform intervention development. On average, providers spent 24 minutes with patients (about the same amount of time patients spent waiting to see them). Longer visit duration was correlated with poorer glycemic control, but because of the observational nature of the study, it is impossible to determine causality. Given that patients with more diabetes difficulties and higher HbA1c values might require more attention and time, it is understandable that providers spend longer in these sessions. Results also suggest that simply spending more time with patients was not associated with better health outcomes; although more research is needed, this finding suggests that the types of communication strategies used during the encounter might be more important. For example, if MI non-adherent behaviors dominate the clinical encounter, more arguments against change might be elicited from the adolescent, leading to a less productive (and lengthier) encounter. Of note, providers were still using MI-inconsistent techniques despite the fact that the majority had received at least an introductory MI training. This is consistent with research showing that advanced training and supervision/feedback are needed to sustain MI skills among medical professionals.³³

During the encounters, providers spent just over half of the session talking. The percentage of time providers spoke was negatively correlated with MI reflection to question ratio, suggesting that during longer visits, providers are using fewer reflections in their communication with patients. Although this finding is based on a cross-sectional analysis, it is still noteworthy for physicians to be aware that when they are talking for more of the session they might be using fewer MI-consistent strategies, like reflections, that have been shown in previous studies to be associated with greater adolescent adherence to health behaviors.²¹ Sixty-one percent of the time providers directed the conversation towards the adolescent and 39% towards the parents (at least one parent attended every encounter). Of

note, although providers spent a greater percentage of the time directing the conversation towards the adolescent, parents were still talking more than adolescents. This presents an area for future study, as it could be problematic given previous findings that adolescents' verbal engagement and communication in sessions can be limited by parent and provider conversation.³⁴ Research suggests that adolescents with chronic illnesses want to be partners in their healthcare; however, typically parents, including those in the study, take a dominant role during encounters.³⁵ Thus, future provider trainings might focus on ways to effectively engage the adolescent in a supportive way, while reducing the focus on the parent. Such an approach might serve to enhance adolescent autonomy and independence in self-management behaviors.

Study limitations include the small sample of patients and providers from one practice, increasing the likelihood of type 2 error and limiting generalizability; however, participants were demographically representative of patients seen at this large academic clinic. Nevertheless, our sample included families from predominately high socioeconomic status which limits generalizability. Furthermore, some adolescents saw different providers at their baseline and 3-month follow-up visits, a pattern frequently encountered in academic medical settings and group practices (also note that the 3-month assessment of HbA1c and T1D behaviors would not have been impacted by the medical encounter). We also did not have any information regarding whether eligible participants who declined to participate differed from those who ultimately participated. Past experiences or relationships with a patient or prior knowledge of typical adherence might have impacted the provider communication style. To address this limitation, baseline levels of variables were controlled for in all regression models. In addition, because measures were completed in clinic, it is possible that participants over-reported adherence in an effort to please their endocrinologist, despite the fact that study confidentiality was reviewed with families. Finally, providers were aware that encounters were being audio-recorded, which might have impacted their behaviors; however, they were unaware of the specific study hypothesis related to MI.

There are also notable strengths. This is the first study to apply an MI framework to examine patient-provider communication in this population and relate communication to an objective outcome (HbA1c). While there is emerging support for MI's use in the management and treatment of pediatric chronic illness,¹⁸ few studies examine the potential impact of MI-consistent language on health outcomes for adolescents with T1D; thus, this study broadens this research area. Furthermore, the study examined patient-provider communication in a natural setting, during a medical encounter and used a validated coding system and objective assessments of these encounters. When considering generalizability, studying communication patterns in a typical medical setting is important. However, more research is needed to identify communication patterns associated with improved outcomes, particularly for adolescents. In sum, findings suggest that when communicating with adolescent patients with T1D, the use of MI-inconsistent language is related to worse adherence, self-efficacy, and glycemic control. Results can directly inform both clinical practice and future interventions to improve health outcomes in this high-risk population.

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FIGURE 1.

Consolidated standards of reporting trials diagram with participant flow through recruitment and study

FIGURE 2.

Mediation model with self-efficacy for diabetes self-management. Values in parentheses represent the standardized relation between motivational interviewing (MI) non-adherent behaviors and adherence after controlling for diabetes self-efficacy, adolescent age and race/ethnicity, and provider MI training. *Note:* this model did not control for baseline adherence

TABLE 1

Description of motivational interviewing treatment integrity 4.1 global scores and behavior counts

Global scores	Description
Cultivation change talk	Provider actively encourages patient's own language in favor of change goal, and confidence for making that change
Softening sustain talk	Provider avoids a focus on reasons against changing or for maintaining the status quo
Partnership	Provider conveys an understanding that expertise and wisdom about change reside mostly within the patient
Empathy	Provider understands or makes an effort to grasp patient's perspective and experience (ie, how much the provider attempts to "try on" what the patient feels or thinks)
Behavior counts	Description
Giving information	Provider gives information, educates, provides feedback, or expresses a professional opinion without persuading, advising, or warning
Persuade	Provider makes overt attempts to change patient's opinions, attitudes, or behavior using tools such as logic, compelling arguments, self-disclosure, or facts (and the explicit linking of these tools with an overt message to change)
Persuade with permission	Provider includes an emphasis on collaboration or autonomy support while persuading
Question	All questions from providers (open, closed, evocative, fact-finding)
Simple reflection	Provider conveys understanding or facilitates patient-provider exchanges; simple reflections add little or no meaning (or emphasis) to what patients have said
Complex reflection	Provider adds substantial meaning or emphasis to what the patient has said; complex reflections serve the purpose of conveying a deeper or more complex picture of what the patient has said
Affirm	Provider accentuates something positive about the patient; the utterance must be genuine and about patients' strengths, efforts, intentions, or worth
Seeking collaboration	Provider explicitly attempts to share power or acknowledge expertise of the patient; genuinely seeks consensus with the patient regarding tasks, goals or directions of the session
Emphasizing autonomy	Provider clearly focuses the responsibility with the patient for decisions about and actions pertaining to change; highlight patient's sense of control, freedom of choice, and personal autonomy
Confront	Provider confronts patient by directly and unambiguously disagreeing, arguing, correcting, shaming, blaming, criticizing, labeling, warning, moralizing, ridiculing, or questioning patient's honesty

Global score and behavior count descriptions are from the motivational interview treatment integrity coding manual 4.1²⁷; Total motivational interviewing adherent score = seeking collaboration+affirm +emphasizing autonomy; total motivational interviewing non-adherent score = confront + persuade.

TABLE 2

Baseline characteristics of adolescents, parent and providers

Variable	Adolescents (n = 55) n (%)	Parents (n = 55) n (%)	Providers (n = 5) n (%)
Female	27 (49.1%)	48 (87.3%)	4 (60.0%)
Race			
African American/Black	9 (16.4%)	9 (16.4%)	0 (0%)
Asian	1 (1.8%)	1 (1.8%)	2 (40.0%)
Caucasian/White	42 (76.4%)	42 (76.4%)	3 (60.0%)
Other	3 (5.5%)	3 (5.5%)	0 (0%)
Hispanic ethnicity	4 (7.3%)	3 (5.5%)	0 (0%)
Adolescent insulin regimen			
Insulin pump	41 (74.5%)	—	—
Basal/bolus	3 (5.5%)	—	—
Multiple daily injections	11 (20.0%)	—	—
Family income ^a			
<\$1 000/year	—	9 (16.4%)	—
>\$1 000/year	—	42 (76.4%)	—
Insurance status			
None	—	0 (0%)	—
Medicaid	—	5 (9.1%)	—
Private	—	50 (90.9%)	—
Provider role			
Physician-attending	—	—	4 (80.0%)
Nurse practitioner	—	—	1 (20.0%)
Provider MI training experience			
None	—	—	1 (20.0%)
Lectures/didactics	—	—	1 (20.0%)
Introductory/advanced training	—	—	3 (60.0%)
Variable	M (SD)	M (SD)	M (SD)
Age (years)	14.8 (1.6)	46.5 (5.9)	42.8 (13.0)
T1D duration (years)	7.9 (3.9)	—	—
Baseline HbA1c (%)	8.6 (1.4)	—	—
Years in clinical service	—	—	13.6 (15.2)

Abbreviations: HbA1c, hemoglobin A1c; MI, motivational interviewing; T1D, type 1 diabetes.

^aFamily income missing for four families, total, n = 51.

TABLE 3

Motivational interviewing treatment integrity 4.1 summary scores and comparison to basic competency (n = 55 encounters)

Summary scores	Overall mean M (SD)	Basic competence and proficiency thresholds	
		Fair	Good
Technical ^a	3.57 (0.7)	3	4
Relational ^b	3.71 (0.9)	4	5
Percent complex reflections ^c	0.49 (0.2)	40%	50%
Reflection-to-question ratio ^d	0.44 (0.3)	1:1	2:1
Total MI adherent ^e	1.50 (1.5)	—	—
Total MI non-adherent ^f	2.29 (3.0)	—	—

Basic competences and proficiency threshold are based upon expert opinion; currently, no recommended competency and proficiency thresholds exist for MI Adherent and MI Non-adherent summary scores²⁴

^aTechnical global score = (cultivating change talk+ softening sustain talk)/2.

^bRelational global score = (partnership+ empathy)/2.

^cPercent complex reflections score = complex reflections/(simple reflections+ complex reflections).

^dReflection-to-question ratio score = total reflections/total questions.

^eTotal motivational interviewing adherent score = seeking collaboration +affirm +emphasizing autonomy.

^fTotal motivational interviewing non-adherent score = confront +persuade.

TABLE 4

Linear regression models with MI non-adherent communication predicting adherence (DBRS) and self-efficacy for diabetes self-management (SEDSM) at 1-month and glycemic control (HbA1c) at 3 months

Independent variable	DBRS (1 month)				SEDSM (1 month)				HbA1c (3 months)			
	B	β	t	R ²	B	β	t	R ²	B	β	t	R ²
DBRS baseline	0.62	0.55	4.79***	—	n/a	n/a	n/a	—	n/a	n/a	n/a	—
SEDSM baseline	n/a	n/a	n/a	—	0.31	0.41	3.09**	—	n/a	n/a	n/a	—
HbA1c baseline	n/a	n/a	n/a	—	n/a	n/a	n/a	—	0.42	0.32	2.89**	—
Adolescent age	-0.19	-0.02	-0.14	—	-0.80	-0.07	-0.59	—	0.02	0.02	0.16	—
Adolescent race/ethnicity	2.51	0.05	0.48	—	0.10	0.00	0.02	—	-1.69	-0.44	-4.00***	—
Provider training	-2.29	-0.04	-0.39	—	-1.59	-0.03	-0.24	—	0.13	0.24	2.13	—
Total MI non-adherent	-1.98	-0.30	-2.39*	0.52	-2.50	-0.41	-3.01**	0.42	0.05	0.13	2.13*	0.55

Abbreviations: DBRS, diabetes behavioral rating scale; HbA1c, hemoglobin A1c; MI, motivational interviewing; n/a, not available; SEDSM, self-efficacy for diabetes self-management scale.

Final model step is displayed. Step 1 of all models controlled for baseline values of the dependent variable (Model 1: DBRS; Model 2: SEDSM; Model 3: HbA1c), adolescent age, race/ethnicity, and provider MI training.

* $P < 0.05$,

** $P < 0.01$,

*** $P < 0.001$.

TABLE 5

Linear regression models with MI adherent communication predicting adherence (DBRS) and self-efficacy for diabetes self-management (SEDSM) at 1-month and glycemic control (HbA1c) at 3-months

Independent variable	DBRS (1 month)				SEDSM (1 month)				HbA1c (3 months)			
	B	β	t	R ²	B	β	t	R ²	B	β	t	R ²
DBRS baseline	0.73	0.64	0.73 ***	—	n/a	n/a	n/a	—	n/a	n/a	n/a	—
SEDSM baseline	n/a	n/a	n/a	—	0.42	0.55	3.99 ***	—	n/a	n/a	n/a	—
HbA1c baseline	n/a	n/a	n/a	—	n/a	n/a	n/a	—	0.44	0.34	2.93	—
Adolescent age	-0.06	0.00	-0.04	—	-1.18	-0.10	-0.80	—	0.04	0.04	0.36	—
Adolescent race/ethnicity	7.24	0.15	1.38	—	3.80	0.09	0.66	—	-1.96	-0.51	-4.47 ***	—
Provider training	3.38	0.06	0.58	—	7.66	0.16	1.18	—	-0.31	-0.08	-0.72	—
Total MI adherent	-0.56	-0.04	-0.34	0.46	0.001	1.00	0.07	0.60	0.43	0.09	0.08	0.52

Abbreviations: DBRS, diabetes behavioral rating scale; HbA1c, hemoglobin A1c; MI, motivational interviewing; n/a, not available; SEDSM, self-efficacy for diabetes self-management scale.

Final model step is displayed. Step 1 of all models controlled for baseline values of the dependent variable (Model 1: DBRS; Model 2: SEDSM; Model 3: HbA1c), adolescent age, adolescent race/ethnicity, and provider MI training.

* $P < 0.05$,

** $P < 0.01$,

*** $P < 0.001$.