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

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EXPLORING THE ROLE OF MOTIVATIONAL INTERVIEWING IN ADOLESCENT PATIENT-PROVIDER COMMUNICATINON ABOUT TYPE 1 DIABETES

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

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Abstract

EXPLORING THE ROLE OF MOTIVATIONAL INTERVIEWING IN ADOLESCENT PATIENT-PROVIDER COMMUNICATINON ABOUT TYPE 1 DIABETES

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Type 1 diabetes (T1D) is one of the most common pediatric chronic illnesses. Glycemic control among patients with T1D often deteriorates during adolescence; yet little is known about the most effective way for providers to communicate with adolescents to prevent this decline. Given the importance of effective communication, examination of effective patient-provider communication strategies is needed. The current investigation used Motivational Interviewing (MI) as a framework to help characterize naturally-occurring adolescent patient-provider communication in medical encounters and examined the relations between provider communication and T1D self-management and control.

Participants were five pediatric endocrine providers and 55 adolescents with T1D (49% female; 76% White; *M* age= 14.8 years, *SD*= 1.6). Mean T1D duration was 7.9 years (*SD*= 3.9) and mean baseline HbA1c was 8.58% (*SD*= 1.4). Adolescents and caregivers completed surveys related to diabetes self-management and psychosocial functioning at a routine endocrinology visit and again at one and three months post-baseline. Medical encounters were audio-recorded and coded. HbA1c was obtained via medical chart review at baseline, three, and six month appointments.

Hierarchical multiple regressions revealed that, after controlling for prior MI training (providers) and adolescent baseline HbA1c, age, and race, use of MI non-adherent behavior (e.g., confronting, persuading) was associated with 1) poorer three month HbA1c, $F(5,45)= 11.19$, $p < .001$; $R^2 = .554$ and 2) worse adolescent diabetes adherence, $F(5, 46)= 9.86$, $p < .001$; $R^2= .517$. MI non-adherent behavior emerged as a significant predictor in each model, $t(45)= 2.13$,$p = .038$, $\beta = .242$ and $t(46) = -2.39$, $p= .021$, $\beta= -.300$, respectively. A mediation analysis determined that patient self-efficacy for diabetes self-management mediated the relation between the use of these MI non-adherent behaviors and lower diabetes adherence.

In TalkT1me, providers' overreliance on persuasion and confronting adolescents about the risks of non-adherence was paradoxically associated with poorer glycemic control and adherence. Certain communication techniques that are inconsistent with MI, like confronting or persuading, appear to have a negative impact on diabetes self-care and HbA1c. Results from this evaluation of naturally occurring communication can help guide targeted training efforts to enhance communication and improve diabetes self-care with these vulnerable patients.

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

Type 1 diabetes (T1D) is a chronic illness affecting approximately 2.4 per 1,000 youth under age 20 years in the United States (Centers of Disease Control and Prevention, 2011; Menke et al., 2013). T1D management is complex and requires adherence to numerous disease care behaviors such as blood glucose monitoring and insulin administration in order to improve glycemic control. Despite evidence of health benefits of better glycemic control, optimal control is difficult to achieve and as a result, adolescents with T1D are at risk for acute and long-term complications (Simon & Zieve, 2013). Glycemic control typically deteriorates during adolescence (Hood, Peterson, Rohan, & Drotar, 2009); therefore evidence-based approaches to improve adolescent T1D self-management and glycemic control in order to reduce risk of long-term complications are needed.

The difficulties with glycemic control evident among adolescents are concerning, as poorer glycemic control increases an adolescent's risk of short and long-term complications. Although long-term survival of individuals with T1D has dramatically increased, significant complications still exist including retinopathy, nephropathy, and neuropathy (Centers of Disease Control and Prevention, 2011; Silverstein et al., 2005). In particular, individuals with T1D have ten times greater risk for cardiovascular disease compared with healthy peers, and myocardial infarctions account for 60% of deaths in patients with diabetes (Simon & Zieve, 2013). A recent statement from the American Heart Association and the American Diabetes Association highlighted the importance of focusing on cardiovascular disease in patients with T1D (de Ferranti et al., 2014). Further, they challenged researchers to examine lifestyle modification interventions that minimize risk of hypoglycemia and reduce cardiovascular disease risk (de

Ferranti et al., 2014). An evaluation of the specific aspects of clinical care which might be related to improved health among this age group is warranted.

Healthcare providers can play a major role in assisting adolescents and their families with complex T1D management tasks. Yet, normative developmental factors associated with adolescence (e.g., increased autonomy) can contribute to ineffective patient-provider communication (Hilliard, Holmes, et al., 2013). Given the potential impact providers' behavior can have on adolescent patients' motivation for behavior change (Moyers & Martin, 2006), identification of effective patient-provider communication strategies is needed. Although the ideal communication approach is not clear, the use of Motivational Interviewing (MI) by providers is a particularly promising strategy that has proven beneficial in the management of other chronic health conditions in adolescents, and might represent a brief, disseminable approach to improving self-care in this age group (Armstrong et al., 2011; Gayes & Steele, 2014). The current study uses MI as a framework to characterize diabetes-related conversations between adolescents with T1D and providers, and examines if providers' use of a more MI-consistent approach is associated with better disease care behaviors and glycemic control in adolescents with T1D.

Type 1 Diabetes and Adolescence

T1D is a common pediatric chronic illnesses that requires lifetime adherence to numerous disease care behaviors, including frequent blood glucose monitoring, insulin administration, and proper nutrition and exercise (Centers of Disease Control and Prevention, 2011). Individuals with TID must inject exogenous insulin to survive. Insulin is administered via various methods including continuous subcutaneous insulin infusion (CSII), basal/bolus regimens, or multiple daily injections (MDI). To maintain better glycemic control and reduce the impact of long-term disease complications, intensive insulin therapy of three or more injections per day or CSII is recommended (DCCT, 1993). Monitoring of blood glucose levels provides data on current glucose concentrations, helps determine insulin requirements, and guides insulin adjustments to avoid harmful blood glucose fluctuations (Rewers et al., 2007). Blood glucose monitoring is usually completed with a finger prick to draw a drop of blood for a test strip that is read by a blood glucose meter. Self-monitoring of blood glucose is important to try to keep blood glucose levels in the normal range of 80-120 mg/dl (American Diabetes Association, 2012). Frequent monitoring is associated with better glycemic control for adolescents (Anderson, Ho, Brackett, Finkelstein, & Laffel, 1997).

Nutritional recommendations for adolescents with T1D are based on general health requirements to promote healthful consumption of essential vitamins and minerals (Silverstein et al., 2005). Adolescents with TID also might require individualized meal plans, flexible insulin regimens and algorithms, or nutrition therapy to learn to count carbohydrates. They must monitor nutrition, especially carbohydrate intake, to determine insulin needs and to maintain blood glucose goals (Rewers et al., 2007). The exercise recommendation for all adolescents, including those with T1D, is 60 minutes of physical activity per day. Benefits of exercise for adolescents with T1D are similar to those for all individuals, including a greater sense of well-being, better weight control, improved physical and cardiovascular fitness, and lower blood pressure (Silverstein et al., 2005). Adolescents with T1D should monitor blood glucose levels before, during, and after exercise and adjust insulin and food intake as needed.

Adherence to the diabetes management behaviors discussed might lessen the risk of both acute and long-term complications (Rewers et al., 2007). However, glycemic control frequently deteriorates in adolescence (Helgeson, Siminerio, Escobar, & Becker, 2009); during this developmental period, adolescents often struggle to keep glycosylated hemoglobin (HbA1c) values within the recommended range (below 7.5% for youth ages 13 to 19 years) (Hood et al., 2009). Increased insulin resistance during puberty (Amiel, Sherwin, Simonson, Lauritano, & Tamborlane, 1986) and hormonal changes can make it difficult to manage changing insulin requirements (Helgeson et al., 2009).

Moreover, developmental changes associated with adolescence often result in poorer disease care behaviors and a corresponding decrease in glycemic control. Indeed, glycemic control in adolescence is poorer than at any other time during the lifespan (Wills et al., 2003), with many adolescent with T1D developing serious complications during this period (Bryden, Dunger, Mayou, Peveler, & Neil, 2003; Bryden et al., 2001). Declines in glycemic control during adolescence can also be a result of various behavioral factors such as an increased focus on peers, desire for independence, and resistance to authority, all of which are associated with reduced self-care. Treatment adherence problems, for example, decreased frequency of blood glucose monitoring, frequently begin in early adolescence (ages 10-14) (Helgeson, Honcharuk, Becker, Escobar, & Siminerio, 2011; Reeves et al., 2012) and often continue throughout this developmental period. Age-related declines in glycemic control are more common among adolescents with low self-esteem, multiple stressful life events, and lower parental support (Helgeson et al., 2011). Other demographic factors such as high family density, low socioeconomic status (SES), and racial and ethnicity minority status are also important factors to consider given the associations among these variables and poorer glycemic control (Bell et al., 2009; Brown et al., 2008; Caccavale et al., 2015; Mullins et al., 2011; Willi et al., 2015).

Challenges to glycemic control. Overall declines in glycemic control are related to physiological (e.g., hormonal changes in puberty) (Hannon, Janosky, & Arslanian, 2006) and psychosocial factors (e.g., increased attention on peers rather than diabetes management) (Weissberg-Benchell, Wolpert, & Anderson, 2007), which can reduce commitment to T1D care. Adolescents are also more likely to engage in risky behaviors that can interfere with diabetes self-management. Females are more likely to intentionally mismanage diabetes care (e.g., not taking insulin in order to lose weight) while males are more likely to engage in risky behaviors such as alcohol use (Silverstein et al., 2005). Normative developmental processes, such as role transformations and opposition to authority (Holmbeck, 1996), can have negative implications for diabetes treatment given their deleterious impact on parent-child and patient-provider relationships.

Developmental factors related to adolescent-caregiver relationships can also impact adolescents' diabetes care. With increased independence, parents might have fewer opportunities to interact with their adolescent and influence diabetes behaviors. Parents might transfer diabetes management to adolescents to decrease family stress (Carroll & Marrero, 2006) resulting in reduced parental involvement in disease care behaviors during adolescence (Berg et al., 2007). Although adolescents might have the cognitive skills to complete diabetes management tasks, adherence to disease care behaviors can be difficult with relatively greater attention given to school, extracurricular activities and peers, rather than to diabetes management. Further, overdependence on parents’ T1D knowledge and lack of autonomy development are also related to poorer adolescent self-management (Visentin, Koch, & Kralik, 2006). As such, during this high-risk period, it is important to evaluate factors that might enhance adolescents’ T1D self-management and improve glycemic control, thus reducing risk of health complications.

Research has clearly established a decline in diabetes management and subsequent glycemic control during adolescence, but less is known about effective ways to intervene to reverse this trajectory. Given the frequency with which adolescents visit their endocrine providers (i.e., quarterly visits are recommended; Standards of Medical Care in Diabetes, 2014) and the demonstrated impact provider communication can have on patient behavior (Croom et al., 2011), a better understanding of communication between adolescents with T1D and their providers during routine visits might help identify areas of communication associated with improved patient outcomes. Patients with providers who use more positive patient-provider communication have improved health outcomes in multiple health domains (Ha & Longnecker, 2010); however, less is known specifically about effective communication strategies, particularly among providers and adolescents with T1D.

Provider Communication Affects Behavior Change

Health care providers play a crucial role in helping adolescent patients manage complex diabetes tasks. Effective patient-provider communication is described as the core component of treatment (Van Servellen, 1997) and thus is essential to the delivery of high quality care (Ha & Longnecker, 2010). Across chronic illness domains, including T1D, positive and effective patient-provider communication is related to greater patient satisfaction, better treatment adherence, and improved health outcomes (Ha & Longnecker, 2010; Heisler, Bouknight, Hayward, Smith, & Kerr, 2002). Within adult diabetes care, patient satisfaction with the patient-provider relationship is associated with better treatment adherence (Sherbourne, Hays, Ordway, DiMatteo, & Kravitz, 1992) and metabolic control (Viinamaki, Niskanen, Korhonen, & Tahka, 1993). Similarly, perceptions of patient-centered communication relate to health outcomes. Adolescents with T1D who have greater positive perceptions of patient-centered communication have higher competence in managing diabetes, which, in turn, is related to greater adherence and glycemic control (Croom et al., 2011).

A closer examination of communication suggests that eliciting patient discussions about change is predictive of positive outcomes (Moyers & Martin, 2006; Powell, Hilliard, & Anderson, 2014). However, providers' communication styles vary and the most effective mode of communication is unknown. Research does suggest that certain communication behaviors (e.g., confronting) are associated with more negative patient outcomes (Moyers & Martin, 2006; Powell et al., 2014). For example, when adolescents experience difficulties with adherence, providers typically respond with expert advice or emphasize the health risks of non-adherence (Rollnick, Miller, & Butler, 2008). Although medically accurate, these approaches are often viewed as confrontational and are met with increases in patient discord, thus decreasing the likelihood of change (Moyers & Martin, 2006). Conversely, more collaborative approaches are linked to increases in positive health behaviors (Croom et al., 2011; Erickson, Gerstle, & Feldstein, 2005; Moyers & Martin, 2006; Pollak et al., 2010). Motivational Interviewing (MI) is a collaborative conversation style, in which providers facilitate health behavior change by eliciting adolescents' own motivations for change, and has great potential to enhance diabetes care behaviors among adolescents.

The potential impact of MI as a patient-provider communication style was demonstrated in two studies examining the relation between an MI consistent communication style and patient health behaviors and outcomes (e.g., weight loss) among adults (Project CHAT) (Pollak et al., 2010) and adolescents (Teen CHAT) (Pollak et al., 2009) with obesity. These studies showed that when providers, who were not trained in MI, used more MI-consistent techniques (e.g., asking permission, affirming, and providing supportive statements), patients demonstrated greater weight loss (Pollak et al., 2010; Pollak et al., 2009), increases in exercise, and reductions in screen time (Pollak et al., 2009), compared with patients whose providers used more MI-inconsistent approaches (e.g., advising without permission, confronting, and directing). A further look at specific MI strategies revealed that when physicians used reflective statements, patients were more likely to perceive greater autonomy support (Pollak et al., 2011). Similarly, when physicians were more empathic, patients reported greater satisfaction with their providers (Pollak et al., 2011). Importantly, these effects were evident with minimal use of MI, well below thresholds for competency as measured by validated MI treatment integrity measures (Moyers, Martin, Manuel, Miller, & Ernst, 2010). These studies highlight the importance of a more collaborative provider communication style, and support use of an MI framework to evaluate patient-provider communication about health behavior change.

Motivational Interviewing and Patient Outcomes

MI is a communication approach demonstrated to increase treatment engagement and improve outcomes in multiple health domains (Emmons & Rollnick, 2001; Hettema, Steele, & Miller, 2005; Martins & McNeil, 2009; Miller & Rollnick, 2013; Suarez & Mullins, 2008). MI involves seeking to understand patients' perspectives, accepting their motivations, affirming their decisions and evoking "change talk" (Moyers et al., 2007). MI contrasts with approaches that rely on confrontation, warning about risks of non-adherence, or giving advice without patient collaboration. These approaches have an immediate detrimental effect on patient readiness to change, increase resistance, and reduce adherence to target behaviors (Moyers & Martin, 2006). MI thus presents as a useful framework for examining provider communication with adolescents with T1D.

MI is designed to enhance an individual's motivation for and movement towards a specific goal by eliciting and exploring his or her own reasons for change. Rather than simply involving a list of techniques, MI is a method or style of interacting with individuals. This interaction is characterized by the “spirit” of MI which is based on collaboration/partnership, evocation, acceptance, and compassion (Miller & Rollnick, 2013). Collaboration, in contrast to confrontation, helps the provider form a partnership with a patient. Evocation, rather than imposition, suggests that the best reasons for change will be evoked from a patient instead of instilled by the provider. Acceptance is the ability to see a person as she or he is, and respect his or her individuality. The final component of the MI spirit, compassion, promotes a patient’s welfare and gives priority to a patient’s needs.

Consistent with MI spirit, there are four processes used with a patient: engaging, focusing, evoking, and planning (Miller & Rollnick, 2013). While engaging in these processes, in order to support and elicit patients' motivations, providers work to increase patients' discussion of behavior change. Research demonstrates a connection between a patient’s statements about change and outcomes or success in changing a behavior (Miller & Rollnick, 2013; Moyers et al., 2007). By asking evocative open-ended questions, the provider aims to elicit different types of change talk. Miller and Rollnick (2013) classify change talk into two broad categories: preparatory language and mobilizing language. The initial type of change, preparatory, is focused on the patient’s desires, ability, reasons, and need for change. Preparatory language might be a patient stating that she wants to test more often before lunch. Mobilizing language, on the other hand, centers on the patient’s commitment, activation, and steps towards change. An example of mobilizing language is a patient describing her plan to set an alarm so she is reminded to test her blood sugar before lunch.

The opposite of change talk is sustain talk, in which the patient discusses reasons for staying the same and not changing. Sustain talk is generally related to the patient’s ambivalence around change and is considered a normal part of the change process. In MI, instead of confronting the patient when sustain talk is expressed, the provider is encouraged to reflect ambivalence and benefits of sustaining the status quo, while also reflecting patient’s own reasons or motivations for change. By avoiding correcting the patient, a provider avoids “discord” and can better understand the patient’s concerns without imposing her own way of thinking. For example, a patient might say “I really hate stopping what I’m doing to check my blood sugar.” Consistent with MI, a provider might respond with a reflection that acknowledges the sustain talk and integrates it with previously expressed change talk; for example, “It’s really annoying to stop what you’re doing to check *and* you have a goal of checking more regularly.” The goal is to elicit a patient’s own thoughts in a collaborative, accepting way that honors the patient’s autonomy.

A final strategy of MI is to develop discrepancy. Individuals are motivated to change when they perceive an inconsistency between their current circumstances or behavior and their values and future goals. Through MI, the goal is for the patient to recognize that her current behaviors are in conflict with her values and interfere with accomplishment of self-identified goals, thus creating dissonance. Highlighting this dissonance typically leads to an increase in motivation to make behavioral changes to enhance congruency between values, goals and behaviors (Miller & Rollnick, 2004; Miller, Yahne, Moyers, Martinez, & Pirritano, 2004). The patient’s values (e.g., improving HbA1c in order to feel better during soccer games) might differ from those of the providers (e.g., improving HbA1c in order to improve health), but it is critical to focus on the patient’s motivation and values. Change is more likely to occur when the individual perceives a significant difference between her goals and values and the status quo.

When using MI, providers work to adhere to the MI spirit, use core MI skills, and elicit change talk from the patient. Open ended questions, affirmations, reflections, and summaries are considered the core skills used by providers to elicit discussions around change. Conversely, confronting the patient, trying to persuade the patient, and giving advice are communication styles to avoid. In sum, MI is a method for communicating with others about their difficulties with change and possibility of engagement in different, healthier behaviors that are more consistent with their goals and values (Miller & Rollnick, 2013; Naar-King & Suarez, 2010). The style, process, and strategies used in MI are readily applicable to patient-provider communication about T1D in which providers can work with patients on their desires, ability, reasons, and need for change.

Theoretical Foundation of Motivational Interviewing

Although MI is not based on one specific theory, the Transtheoretical Model (TTM) of behavior change (Prochaska & Diclemente, 1982; Prochaska, DiClemente, & Norcross, 1992) and Self-Determination Theory (SDT) (Deci & Ryan, 2002; Ng et al., 2012) provide a useful framework for understanding the process of change within this approach (Miller & Rollnick, 2004). The TTM posits that behavior change is not necessarily linear, but rather, is an evolving process. In this model, change is believed to occur in six stages: 1) precontemplation (not considering the possibility of change, 2) contemplation (considering change but also feeling ambivalent about making changes), 3) preparation (deciding and committing to change), 4) action (engaging in change behavior), 5) maintenance (sustaining progress), and 6) termination (change has become habitual (Prochaska et al., 1992). Relapse is possible during the action or maintenance phases, when a person is unsuccessful at maintaining change. In the context of MI, understanding the change process is crucial. A major component of MI is the acceptance of the patient’s readiness to change while also supporting his or her progress towards healthier behavioral changes. The TTM is complementary and consistent with MI as individuals differ in their needs and therefore the discussion of change will vary throughout treatment (Miller & Rollnick, 2004). Assessing a patient's readiness to change is useful to understand the dynamic nature of motivation for that individual. For example, starting with the action stage (e.g., increasing blood sugar checking) before the patient is ready might be ineffective. For adolescents in particular, assessing and considering readiness to change is important for overall engagement (Naar-King & Suarez, 2010).

MI is also grounded in SDT, which posits that internal motivation is more strongly connected to sustained behavior change than external motivation. Overall, behavior change is more effective and lasting when patients are autonomously motivated (Ng et al., 2012). Within a health context, SDT focuses on patients' perceptions of practitioners' support for their autonomy. Consistent with MI, this theory recognizes the importance of autonomy and suggests that highly autonomous individuals are more motivated to make positive health-related behavior changes (Miller & Rollnick, 2012). Satisfaction of fundamental needs of autonomy and competence leads to improved mental health and more health-conducive behaviors (Ng et al., 2012). Results from a meta-analysis of empirical literature testing SDT in health care settings supported this conceptual framework in the study of MI (Ng et al., 2012). Thus, MI has strong theoretical underpinnings that support its use in effecting behavior change.

MI appears to be a conceptually appropriate and effective way for providers to communicate with patients to improve adherence in adolescents with T1D. Therefore, MI was used as the framework for evaluating adolescent patient-provider communication. Specifically, this study assessed which parts of MI are occurring naturally and if those techniques relate to improvements in adherence and glycemic control.

Motivational Interviewing and Type 1 Diabetes in Adolescents

The majority of evidence-based treatments used to increase adolescent T1D adherence are lengthy and impractical for most clinic settings (Maher & Bean, 2014). Brief effective treatments, such as MI, that can be integrated into routine care are more cost-effective and have greater dissemination potential.

There is emerging support for MI's use in the management and treatment of pediatric chronic illness (Gayes & Steele, 2014). MI increases treatment engagement and improves pediatric health outcomes (Armstrong et al., 2011) including T1D (Gayes & Steele, 2014). A recent meta-analysis of MI interventions across pediatric health domains showed a small to moderate effect size for MI compared with both active treatments and no treatment, with the largest effect sizes found in T1D (Gayes & Steele, 2014). Although promising, the authors emphasized the need for further study given small samples and concerns about treatment fidelity (Gayes & Steele, 2014). Another concern is related to lack of generalizability due to small sample sizes and atypical treatment settings. Specifically, Channon et al. reported a positive effect of MI compared with support visits on HbA1c among adolescents with T1D in a small pilot study (Channon, Smith, & Gregory, 2003) and subsequent RCT (Gayes & Steele, 2014). However, MI sessions occurred outside of the clinic (e.g., in homes or cafes), and were delivered in variable doses (based on patient preferences), which limits generalizability and translatability.

MI is an approach that could be implemented as part of routine care, thus examination of its use in this setting is needed. One study conducted in the United Kingdom evaluated an MI-informed intervention implemented within pediatric endocrinology clinics. Although improved glycemic control was not found in this trial (Robling et al., 2012), the authors noted that additional MI consistent aspects of communication (e.g., reflective listening) should be explored as potential intervention targets. Reflective listening and other MI communication skills were not specifically examined since the study was not an MI intervention. Moreover, given differences in healthcare systems, findings might not be generalizable to the United States. This study highlights the importance of objective assessment of natural patient-provider communication during diabetes encounters prior to developing broad scale provider training (Robling et al., 2012). A first important step is to observe provider-adolescent communication as it naturally occurs. A better understanding of communication techniques and how they impact adherence will be helpful in the development of an intervention that can realistically be implemented within current practice.

Given MI's potential to enhance T1D self-management among adolescents, the current investigation conducted an in-depth evaluation of patient-provider communication occurring within the endocrine clinic as part of routine care, using MI as a framework, to help determine the potential for the use of this approach with adolescents with T1D within the existing clinic setting. Findings can be used to develop a tailored intervention in which providers incorporate MI techniques into their usual care.

Statement of the Problem

Given the increased risk of complications in patients with T1D and the documented decline in adherence during adolescence, the development of effective, scalable T1D interventions is urgently needed. However, implementing interventions within a clinical care setting that are feasible, acceptable to both providers and patients, and effective in small doses, is a clear challenge. As such, the current investigation, TalkT1me, explored what is naturally occurring in diabetes-related conversations between adolescents and their endocrine providers. Specifically, using MI as a framework, the associations between communication behaviors and patient outcomes (T1D behaviors and HbA1c) were examined. Observing provider-adolescent communication as it naturally occurs provides rich data to facilitate the tailoring of an intervention that is feasible, can be implemented faithfully by the provider, and is sustainable within current practice. Thus, results inform development of an intervention with potentially high impact to reduce the risk of complications in this high-risk population of adolescents with T1D.

Specific Aims and Hypotheses

This study had three specific aims. The first aim was to examine diabetes-related discussions between endocrine providers and adolescents with T1D. Specifically, audio-recorded encounters between pediatric endocrinology providers and adolescents with T1D were examined to enhance understanding of: 1) which diabetes-related behaviors providers are discussing with adolescents and their parent(s) (e.g., self-monitoring of blood glucose values, insulin administration, diet, exercise); 2) the naturally occurring amount of MI providers are using; 3) level of observer-rated working alliance during the patient provider encounter; 4) the amount of time families spend waiting to see the provider and time spent with the provider; and 5) the percentage of time different people are talking during the encounter and to whom the provider is directing the discussion.

The second aim was to examine whether providers’ use of MI communication and working alliance was related to positive patient behaviors and health outcomes at one, three, or six months after their visit, controlling for baseline values. Behavior and health outcomes examined included: 1) primary outcomes of glycemic control (measured by glycosylated hemoglobin [HbA1c]) and diabetes adherence behaviors (Diabetes Behavior Rating Scale); 2) secondary psychosocial outcomes of diabetes-specific quality of life (PedsQL-Diabetes), self-efficacy (Self-efficacy for Diabetes Self-Management), diabetes-related family conflict (Diabetes Related Family Conflict Scale), adolescent responsibility for diabetes management (Diabetes

Family Responsibility Questionnaire), and autonomy support (Health Care Climate Questionnaire). It was hypothesized that greater MI technical, relational, percent complex reflections, reflection-to-question ratio, and total MI adherent behaviors summary scores would be associated with positive patient behaviors and health outcomes. Additionally, it was hypothesized that higher MI non-adherent summary scores and poorer working alliance would be associated with poorer patient behaviors and outcomes.

The final aim was to explore possible mediators of the relation between 1) the use of MI and glycemic control and 2) the use of MI and diabetes-related adherence. It was hypothesized that greater self-efficacy and autonomy support would each mediate the relation between MI adherent or MI non-adherent techniques and HbA1c or adherence.

Method

Overview

TalkT1me characterized medical providers' discussions with adolescents with T1D and examined whether use of MI-consistent techniques was related to improvement in diabetes-care behaviors and glycemic control (HbA1c). Adolescent-parent dyads and providers were recruited from a pediatric endocrinology clinic. Adolescents and parents completed baseline survey measures before and after a routine endocrinology visit during which adolescent patient-provider communication was audio-recorded, and HbA1c was obtained. Providers completed a survey at study onset. Adolescent and parent participants repeated study measures at one and three months post baseline and HbA1c was obtained at subsequent routine appointments at three and six months post baseline.

Participants

Participants included adolescent patients with T1D, their primary caregiver, and pediatric endocrinology providers (i.e., 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 1) ability to speak and read English; 2) ages of 13-18 years; and 3) a clinical diagnosis of T1D for greater than one year. Adolescents were ineligible if they: 1) were moving away from home (e.g., going to college) during the study duration; 2) had significant psychiatric, cognitive, medical or developmental conditions that would impair their ability to complete assessments and/or engage in diabetes self-care behaviors (e.g., malignancies, psychosis, severe intellectual disability), as documented in the medical record or revealed at informed consent visit; and 3) had medically-induced diabetes or diagnosis of diabetes other than type 1. The same parent or caregiver who started the study was requested to complete all assessments. All physicians and nurse practitioners currently practicing at the endocrinology clinic were eligible for participation.

Procedure

Recruitment and retention. Providers were recruited during a division meeting and informed consent was obtained. All eligible providers consented (eight physicians [five attending physicians and three fellows] and three NPs consented (of three eligible NPs). Five of these providers were ultimately included in the analyses because they saw TalkT1me participant families. Potentially eligible adolescents were initially identified based on age and diabetes diagnosis. Parents or caregivers of potentially eligible patients were sent a physician-endorsed letter (*n* = 288), signed by the endocrinology division chief, introducing the study and providing a number to call with questions or to refuse to be contacted. Study staff attempted follow up contact with all families to provide details about the study, confirm eligibility, and if appropriate, schedule a baseline visit during routine endocrinology appointment; 176 patients remained eligible after this contact. Thirty-seven percent (65/176) of families were successfully contacted by phone, and appeared eligible, and were willing to participate. Of these, 85% (55/65) attended their baseline visit and completed informed consent and assent forms. See Figure 1.

To enhance retention, reminder calls and emails were made for all study visits. Informed consent and assent forms, and baseline assessments were completed by N = 55 adolescent/parent dyads; 94.5% (n = 52) completed one month follow-up assessments (obtained online) and 92.7% (n = 51) attended their subsequent quarterly endocrinology appointment during which three month study follow-up assessments were obtained. One family had a change in insurance after baseline and had to change healthcare providers; three families were unable to be contacted by study staff and did not reschedule their endocrinology appointment within the study timeframe. At six months, 94.5% (52/55) of participants attended their scheduled endocrinology appointment. One adolescent was admitted to an inpatient diabetes facility; two other families were unable to be contacted and never attended their six month clinic visit, thus study data could not be obtained. See Figure 1.

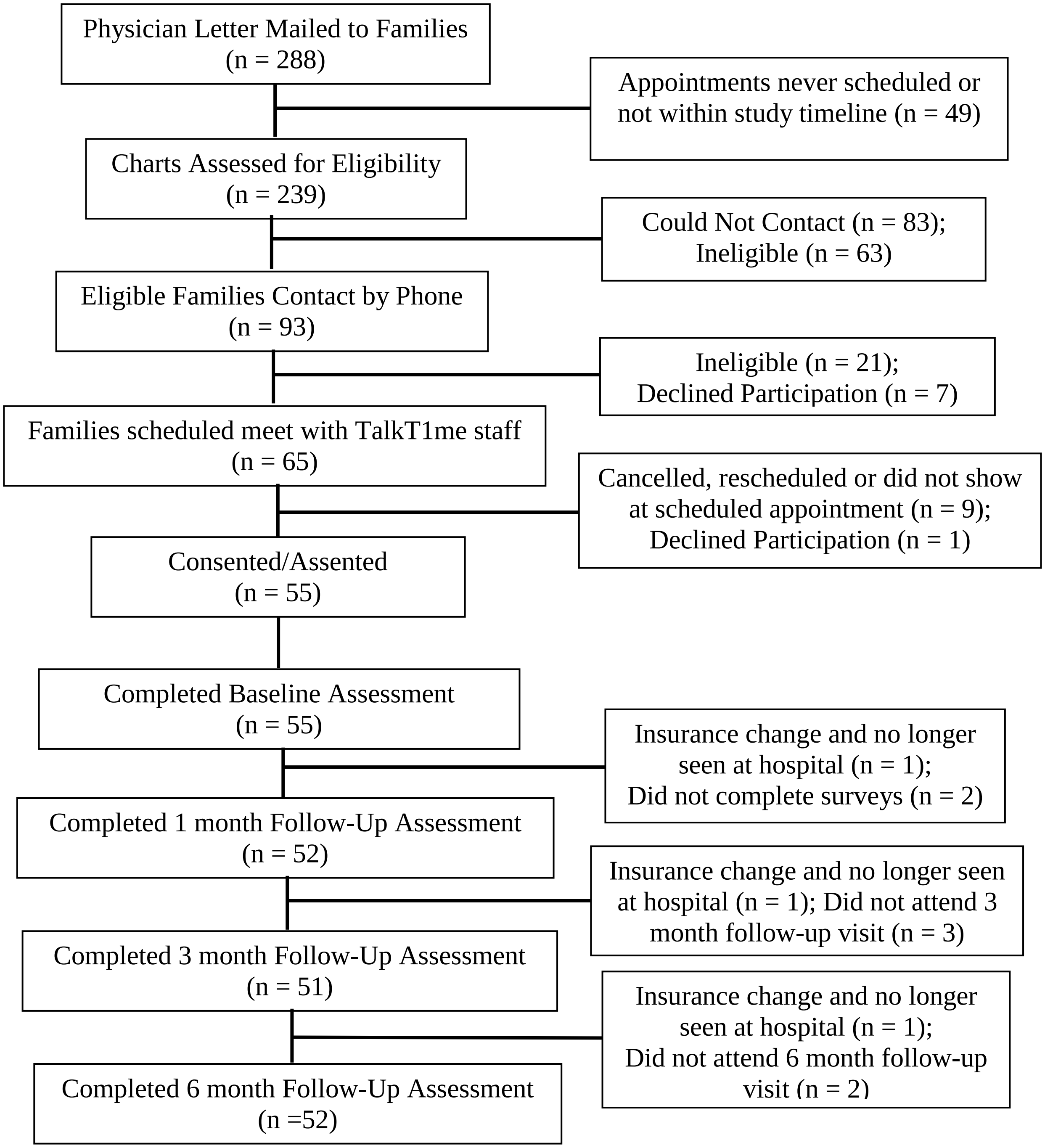

Figure 1. Participant Flow. Consolidated Standards of Reporting Trials (CONSORT) diagram with participant flow through recruitment and study progress.

Overview of Study Procedures. Adolescents with T1D have routine quarterly endocrinology visits during which they meet with their provider and obtain a point of care HbA1c measurement. Adolescents and parents who wished to participate were instructed to arrive 30 to 45 minutes prior to their appointment to meet with a study staff member, complete informed assent and consent (respectively), and baseline assessments (adolescents who were 18 years of age completed their own informed consent). Patient encounters were audio-recorded via digital voice recorders (DVR) in the exam room. Following the medical visit, adolescents completed a brief measure of autonomy support (see Measures). Audio-recordings were uploaded to a secure computer and prepared for coding. One month after their baseline visit, parents were emailed a link for them and their adolescent to complete follow-up study measures via REDCap. About one week before the adolescent's subsequent endocrinology visit (approximately three months post-baseline), parents were again emailed a link to complete study measures via REDCap. If the family had not completed these measures online, the study team met with them before the adolescent's clinic visit to administer them. After the medical encounter, adolescents repeated a brief measure of autonomy support. Medical data and HbA1c were obtained via chart review at each time point (baseline, three months, and six months).

Assessment of Medical Encounters. Trained, independent raters, blind to study hypotheses, coded randomly selected 20 minute segments of each audio-recorded visit using the Motivational Interviewing Treatment Integrity Code (MITI 4.1; Moyers, Manuel, & Ernst, 2014). Independent coders were trained by the study principal investigators, one an MI expert and member of the Motivational Interviewing Network of Trainers (MINT) and the other a clinical doctoral student with research and clinical experience with MI. Study coders completed 40 hours or more of training using the MITI 4.1 (Moyers et al., 2014). Consistent with the MITI

4.1 manual, both the global and behavior counts were assessed from 20 minute segments, which were identified using a random number generator to ensure that the sampling of the segments was truly random (Moyers et al., 2014). Ten percent of sessions were double coded and rater agreement was calculated using intraclass correlations (ICCs). At study onset, ICCs ≥ .80 were established and reevaluated throughout the investigation. At study conclusion, ICCs ranged from .74 to .98, with the ICC rating below .80 for one behavior count that was coded infrequently. Audio-recorded sessions were reviewed with raters in weekly supervision meetings and group ratings were conducted. These procedures helped ensure that ratings and ICCs were continuously evaluated to prevent rater drift. In addition, trained raters coded all encounters in a second pass using a rating instrument to assess which target behaviors were being discussed (e.g., blood glucose monitoring, insulin administration, diet, exercise), who the conversation was directed towards (e.g., parent or adolescent), and what percent of the time each person in the room was speaking, similar to systems developed in previous work (Bean et al., 2014). The coders also completed the Working Alliance Inventory, Observer version (Horvath, 1989).

Measures

Adolescents and parents completed measures at baseline, one month and three months post-baseline. Medical data were obtained via chart review at the adolescent's baseline, three month, and six month routine endocrinology visit. Providers completed a brief survey at study initiation (See Figure A2).

Adolescent and parent measures.

Demographics. Parents completed a demographic questionnaire at baseline. Data were collected on adolescent and parent sociodemographic data including gender, age, race, ethnicity, family income, family insurance status, family structure, parent education, parent marital status, adolescent school grade, adolescent insulin regimen, and adolescent date of diabetes diagnosis.

Diabetes adherence. The Diabetes Behavior Rating Scale (DBRS; Iannotti, Nansel, et al., 2006) assessed adolescent and parent report of frequency of diabetes care tasks across four domains (Daily Prevention Behaviors, Intervention Behaviors, Modification of Diabetes Care Plan, Diabetes Care Practices). DBRS has 36 items (37 for the insulin pump version) with items such as, “In the last seven days how often was your food weighed or measured?,” “Out of the last five times that blood sugar levels were higher or lower than usual, how often was the amount of exercise changed,” “How often is insulin correctly adjusted for meals you eat away from the home (e.g., at restaurants, parties)?” and “How often are your child’s friends, teachers, coaches and others told how to treat “low” blood sugar?” Items were rated on either a zero (never) to four (always) or zero (none) to five (five times) scale and asked about behaviors in the last seven days, last five times, or how often they occur, depending on the item. DRBS concurrent validity has been previously established with comparison to the Diabetes Self-Management Profile (DSMP), a widely used structured interview. The DBRS and DSMP were significantly related to each other for parent ($r = 0.72$, $p < 0.01$) and adolescent ($r = 0.74$, $p < 0.01$) report (Iannotti, Nansel, et al., 2006). Previous studies have demonstrated good internal consistency ($\alpha = .84$) and test-retest reliability ($r = .71$) (Iannotti, Nansel, et al., 2006). In the current study, adolescent and parent DBRS scales had good internal consistency ($\alpha = .72$; $\alpha = .86$, respectively).

Self-efficacy for diabetes self-management. To assess confidence in completing diabetes tasks, adolescents completed the Self-efficacy for Diabetes Self-Management measure (SEDSM) (Iannotti, Schneider, et al., 2006). This is a 10-item self-report measure with responses denoting different levels of self-efficacy of diabetes tasks with a range from one (not sure at all) to ten (completely sure). Sample items include, "How sure are you that you can do each of the following: "Adjust your insulin correctly when you eat more or less than usual," "Choose healthful foods when you go out to eat," and "Manage your diabetes even when you feel overwhelmed." Validity of the SEDSM was established through significant correlations between the SEDSM scale and glycemic control ($r = .21$) and with the Diabetes Self-Management Survey ($r = .37$) as well as factor analysis and predictive validity (Rasbach, Jenkins & Laffel, 2015). The scale also demonstrates adequate internal consistency ($\alpha = .90$) and test-retest reliability ($r = .89$) (Iannottie, Schneider, et al., 2006). Internal consistency in the current sample was adequate ($\alpha = .69$).

Diabetes-related quality of life. The Pediatric Quality of Life- Diabetes Module (PedsQOL; Varni et al., 2003) assessed diabetes-specific quality of life (adolescent report and parent-report of adolescent's QOL were assessed). This measure has five subscales: Diabetes Symptoms, Treatment Barriers, Treatment Adherence, Worry, and Communication. There are 28 items that ask adolescents or parents to think back over the past month about how much of a problem the item has been, if they (or their adolescent) completed diabetes tasks independently, and about their worries. Response options range from zero (never a problem) to four (almost always a problem). Sample items include "I feel hungry," "It hurts to prick my finger or give insulin shots," "I worry about long-term complications from diabetes," "Getting embarrassed about having diabetes," and "Telling the doctors and nurses how he/she feels." This measure is validated for use in an adolescent T1D population, correlations between the PedsQOL Generic Core Scales total score and the Diabetes Module were in the medium-to-large effect size range, for adolescent report (r = 0.66) and parent report (r = 0.54). The PedsQOL diabetes module also demonstrates adequate internal consistency across all subscales (Diabetes Symptoms $\alpha = .81$, Treatment Barriers α = .66, Treatment Adherence α = .66, Worry α = .63 and Communication α = .77) (Varni et al., 2003). In the current study, an overall PedsQOL score was created and adolescent and parent PedsQOL scales demonstrated good internal consistency (α = .90; α = .89).

Diabetes-related family conflict. Parents and adolescents each completed the Diabetes Family Conflict Scale, Revised (DFCS; Hood et al., 2007), a measure of diabetes-related conflict. The DFCS consists of 19 items that assess the frequency of conflict surrounding diabetes-related management tasks, using a five point scale from 'never' to 'almost always; (scale range of 19, no conflict, to 57, high conflict). The DFCS includes two subscales: direct management and indirect management. Responses were averaged for a final diabetes-related conflict score. Items asked participants to rate during the past month how often they have argued with their parent/adolescent about items such as "Remembering to give shots or to bolus," "Remembering to check blood sugars," and "Telling friends about diabetes." The DFCS has demonstrated validity and reliability (Hood et al., 2007). Both adolescent ($r = 0.27$, $p < 0.01$) and caregiver ($r = .26$, $p < 0.01$) DFCS scores were correlated with HbA1c values and subscales demonstrated appropriate internal consistency (α = .75; α = .69) (Hood et al., 2007). Internal consistency in the current study was good for adolescent and parent report (α = .91; α = .72).

Diabetes family responsibility. The Diabetes Family Responsibility Questionnaire (DFRQ; Anderson et al., 1990) was administered to adolescents and parents to assess for parent and adolescent diabetes responsibility. The DFRQ is a 21-item measure with higher scores indicating the adolescent takes or initiates responsibility for the tasks almost all of the time and lower scores indicating that the parent initiates responsibility for the task almost all of the time. Response options range from one (you take or initiate responsibility of this almost all of the time) to five (your parent/adolescent takes or initiates responsibility for this almost all of the time). Example situations or tasks include “Remembering to take morning/evening injections, or pump boluses for eating,” “Noting the early signs of low blood sugar,” and “Checking expiration date on supplies.” The DFRQ has demonstrated good concurrent reliability and internal consistently (α = .85). In the current study, adolescent and parent DFRQ scales had good internal consistency (α = .85; α = .89).

Autonomy support. The Health Care Climate Questionnaire (HCCQ) (Williams, Grow, Freedman, Ryan, & Deci, 1996) is a 15-item scale used to assess patient perceptions of autonomy support from providers. Adolescents completed this measure after their baseline and three month clinic visits. Sample items include “I feel that my provider has provided me with choices and options about my diabetes management,” and “My provider listens to how I would like to do things regarding my diabetes management.” The HCCQ was adapted to assess the extent to which adolescents perceive their providers as supportive of their autonomy in enacting health behavior change related to diabetes. The HCCQ has been used extensively and has demonstrated strong internal consistency in addition to content and face validity (Williams et al., 1996). In the current investigation, the HCCQ had good internal consistency (α = .86).

Medical data. Duration of T1D diagnosis, current therapy (insulin pump, basal/bolus, multiple daily injections), and other medical conditions were obtained from parents and verified via chart review. Changes to T1D regimen or medical history during the study period were acquired via chart review. Glycemic control was measured by point-of-care HbA1c, an indicator of average blood glucose concentration from the previous three month period, obtained as part of routine care and analyzed via blood assay (DCA 2000, Bayer Inc.; Tarrytown, NY, USA); values were extracted from the medical record at baseline, three and six months. Higher HbA1c values indicate poorer glycemic control.

Provider measures.

Demographics. At baseline, providers reported their age, gender, race/ethnicity, number of years of clinical experience, and professional background (e.g., physician, NP). Prior MI training experience was also obtained.

Perceptions of behavioral counseling. At study onset, providers completed a brief 13-item self-report survey to examine perceptions of behavioral counseling in health care and providers' perceived skills and effectiveness in this domain. Items from this measure were grouped together to create three subscales: Importance of the Use of Behavioral Counseling in a Health Care Setting (4 items, e.g., "it is important for me to counsel my patients about changing diabetes-related behaviors"), Believe in Motivational Interviewing Spirit (4 items, e.g., "it is my responsibility to determine the patient's priorities for the visit"; reverse coded), and Confidence in Motivational Interviewing Skills (5 items, e.g. "I feel confident using reflective listening"). Although not formally validated, this measure has been previously used in similar investigations (Bean, Biskobing, Francis, & Wickham III, 2012). In the current study, the subscales demonstrated adequate internal consistency ($\alpha = .72$; $\alpha = .79$; $\alpha = .83$, respectively).

Helpful responses questionnaire. Providers completed the Helpful Responses Questionnaire (HRQ; Miller, 1991), designed to be adapted for the current use with relevant statements that might be stated by a patient. The original HRQ was designed as a measure of empathy and MI reflection skills with higher scores indicating greater empathy and MI reflections. After reading three hypothetical patient statements (e.g., "It's just too hard to check my sugars during school. There is no time to get to the nurse's office between when the bell rings and lunch. Plus I feel fine when I'm at school. I don't understand the big deal about checking."), providers were asked to write how they would typically respond in each situation.

Their responses were double coded by the same group of trained coders. For the original HRQ, interrater reliability coefficients for items range from .71 to .91 (Miller, 1991). In the current student, the HRQ demonstrated good internal consistency (α = .90).

Encounter rating measures.

Diabetes encounter rating instrument. Trained coders assessed which target behaviors were discussed by the patient, provider, and parent (e.g., blood glucose monitoring, insulin administration, diet, exercise). Behaviors were selected from a checklist with the option to write in other behaviors discussed. The coder noted what percent of the time each person in the session was talking and when applicable, to whom the provider's comments were directed. The coder also recorded the amount of time patients spent waiting in the exam room prior to the provider entering and the amount of time providers spent with the families.

Motivational interviewing treatment integrity. The Motivational Interviewing Treatment Integrity 4.1 (MITI 4.1; Moyers et al., 2014) was used to measure overall global ratings and behavioral counts during each encounter. Global scores capture the rater's overall impression of how well the provider meets the description of the dimension being measured on 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. Summary scores were calculated, and included technical global, relational global, reflection-to-question ratio, MI adherent, and MI non-adherent scores. Descriptions and examples of MITI Global Scores and Behavior Counts are included in Appendix Table A1.

Working alliance. The Working Alliance Inventory, Observer (WAI-O) version (Horvath, 1989) was used to assess for working alliance in the patient provider relationship during each encounter. Trained raters completed the WAI-O after listening to the complete audio-recorded encounter. The WAI-O is a 36-item measure with seven response choices for each item ranging from one “very strong evidence against” to seven “very strong evidence” with higher scores indicating greater alliance. Sample items include “The client feels that the therapist appreciates him/her as a person” and “There is good understanding between the client and therapist.” For the purpose of this study, the client was considered the patient and the therapist was considered the provider. Previous studies using the WAI-O have demonstrated appropriate internal consistency ($\alpha = .98$) and interrater reliability (ICC = .92) (Hanson, Curry, & Bandalos, 2002) and the current study demonstrated good internal consistency ($\alpha = .75$).

Preliminary Analyses

Power analyses determined that, with a sample size of 40, this study would have 80% power to detect a correlation of 0.36 between summary score of MI total adherent (from the MITI) at baseline and 6 month HbA1c, using a simple test of correlation. Analyses were performed using SPSS v24. Variables used in analyses were assessed for univariate normality and were transformed if needed. Autonomy support, measured by the Health Care Climate Questionnaire (HCCQ) was non-normally distributed, with a skewness of -1.26 (*SE* = 0.32) thus was transformed using the square root transformation (0.06, *SE* = 0.32).

Descriptive Analyses

Data were first explored with descriptive statistics and graphical techniques. To examine if there were any differences in diabetes-related discussions or use of MI based on provider characteristics (e.g., gender, age, NP/physician) the associations between patient-provider communication (based on the MITI and our additional rating instrument) and provider characteristics were explored via correlation, Chi-square and ANOVAs, as appropriate. For analyses, adolescent race was dichotomized into White (76.4%) and racial minority status (23.6%). Pearsons or point-biserial correlations among demographics, MI variables, and outcomes of HbA1c, diabetes adherence, self-efficacy for diabetes self-management, diabetes quality of life, diabetes family conflict, diabetes family responsibility, and autonomy support, were conducted. Variables with significant first order correlations were considered as covariates to include in multivariate models.

Analyses

To address the first aim, diabetes-related discussions between endocrine providers and adolescents were analyzed to examine which diabetes-related behaviors providers were discussing with adolescents and their parent(s) (e.g., blood glucose self-monitoring, insulin administration, diet, exercise), what other behavior modification tools (e.g., goal setting) were used, and to whom providers were targeting their discussions (e.g., parent, adolescent, or both) measured in minutes. Descriptive analyses also examined the naturally occurring amount of MI providers were using, level of observer-rated working alliance during the patient provider encounter, and the amount of time families spend waiting to see the provider and time spent with the provider.

The second aim was to examine whether providers’ use of MI and alliance was related to patient behavior and health outcomes. Hierarchical linear regression models were first used to examine associations of MI variables (e.g., summary scores of MI technical, MI relational, MI percent complex reflections, MI reflection-to-question ratio, MI adherent, MI non-adherent) and working alliance (WAI-O) with primary outcomes of glycemic control (HbA1c) and adherence

(DBRS). Baseline HbA1c or DBRS and covariates (adolescent age, adolescent race, provider prior MI training) were included as controls in all regression models. MI variables and working alliance were included as individual predictor variables for each model to assess the unique contribution of those communication techniques and styles on patient outcomes. Hierarchical regression models also examined associations of MI variables with secondary outcomes of self-efficacy for diabetes self-management (SEDSM), quality of life (PedsQOL), diabetes family conflict (DFCS), diabetes family responsibility (DFRQ), and patient autonomy (HCCQ). All models controlled for baseline values of the variables and covariates of adolescent age, adolescent race, and provider prior MI training. MI variables (e.g., MI Global Spirit, Empathy, Reflections, Questions, Percent MI Consistent Behaviors, MI Non-adherent Behaviors) and Working Alliance (WAI-O) were included as individual predictor variables for each model to assess the unique contribution of those communication techniques and styles on patient outcomes.

To address the final aim, a series of multivariate analyses were conducted in the general linear model framework to examine whether greater autonomy support and self-efficacy would mediate the relation between MI variables and diabetes-related outcomes (glycemic control and diabetes-related behaviors). These analyses were in accordance with the guidelines for testing mediation (Barron & Kenny, 1986; Preacher & Hayes, 2004). Specifically, the first set of models tested the effect of MI-consistent techniques on glycemic control. The second analysis tested the effect of autonomy support or self-efficacy on glycemic control. The final step tested the effect of both MI-consistent techniques and either autonomy support or self-efficacy on glycemic control. The second set of models tested the effect of MI variables on diabetes related behaviors. The second analysis tested the effect of autonomy support or self-efficacy on diabetes related behaviors. The final step tested effect of both MI variables and either autonomy support or self-efficacy on diabetes related behaviors. Full mediation was identified if the addition of self-efficacy or autonomy support to the third model eliminated the statistically significant effect of MI variables on diabetes-related outcomes (glycemic control and diabetes-related behaviors). Partial mediation occurred if the magnitude of the effect was reduced, but was still significant. The Sobel test was used to test the magnitude of the mediation effect. In other words, the Sobel test was used to measure how much of the relations among MI variables and diabetes outcomes was explained by either autonomy support or self-efficacy.

Posthoc Analyses

Correlations were used to examine session characteristics further and specifically to look at relations among time waiting to see the provider, time spent with the provider, and to whom providers were targeting discussions with adherence, glycemic control, patient autonomy, and MITI summary score variables.

Results

Descriptives

Participants. Participants were 55 adolescents with T1D (49.1% female) aged 13 to 18 (*M* age = 14.82 years, *SD* = 1.55) and their parent or primary caregiver (87.3% female; *M* age = 46.53 years, *SD* = 5.89). The majority of adolescents and parents identified as White/Caucasian (76.4% for both adolescents and parents) and non-Hispanic (92.7% of adolescents and 94.5% of parents). Most families (76.4%) had an annual income greater than $51,000. The majority of parents were married (76.4%) and 41.8% reported having a college degree. There were an average of two (*SD* = 0.61) adults and 2.15 (*SD* = 0.91) children in the household. The majority of adolescents reported use of an insulin pump (74.5%) with an average duration of T1D of 7.9

years (*SD* = 3.90). At baseline, adolescents' average HbA1c was 8.58% (*SD* = 1.44; values ranged from 6% to 13.5%), suggesting fair control (ADA, 2012). Participant sociodemographic and baseline characteristics are included in Table 1.

Three families did not complete one month follow-up assessment measures and four families did not complete three month follow-up assessment measures or attend three month clinic visit. See Figure 1. Of those families that missed their three month clinic visit, one family also did not attend their six month clinic follow-up visit and two families attended their three month but not six month clinic follow-up visit. Differences in patient demographics (e.g., gender, age, race, ethnicity, family income, insurance status, single-parent status, insulin regimen, length of diagnosis, HbA1c) and missing measure status were explored via correlations and chi-squares, as appropriate. There were no significant relations between patient demographics and whether or not patients completed one month surveys. However, adolescents that did not attend three month clinic visit were more likely to be racial and ethnic minorities X^2 (1) = 5.58, p = .018, have Medicaid insurance X^2 (1) = 8.74, p = .003, live in single-parent families X^2 (1) = 6.31, p = .012, use non-pump insulin regimes X^2 (1) = 8.18, p = .017, and have higher baseline HbA1c r = .28, p = .043.

Table 1

Sociodemographic & Baseline Characteristics of TalkT1me Family Participants

	Adolescents (*n* = 55)	**Parents (*n* = 55)**
Variable	***n (%)***	***n (%)***
Female	27 (49.1%)	48 (87.3%)
Race		
African American/Black	9 (16.4%)	9 (16.4%)
Asian	1 (1.8%)	1 (1.8%)
Caucasian/White	42 (76.4%)	42 (76.4%)
Other	3 (5.5%)	3 (5.5%)
Ethnicity Hispanic	4 (7.3%)	3 (5.5%)
Adolescent School Grade		
8th	16 (29.6%)	
9th	14 (25.9%)	
10th	9 (16.7%)	
11th	11 (20.4%)	
12th	4 (7.5%)	
Adolescent Insulin Regimen		
Insulin Pump	41 (74.5%)	
Basal/Bolus	3 (5.5%)	
Multiple Daily Injections	11 (20.0%)	
Family Income Level [a]		
$10-20,000/year		1 (1.8%)
$21-30,000/year		1 (1.8%)
$31-40,000/year		4 (7.3%)
$41-50,000/year		3 (5.5%)
>$51,000/year		42 (76.4%)
Family Insurance Status		
None		0 (0%)
Medicaid		5 (9.1%)
Private		50 (90.9%)
Parent Education		
High School Diploma		11 (20.0%)
Some College		7 (12.7%)
College Degree		23 (41.8%)
Some Graduate School		2 (3.6%)
Graduate Degree		12 (21.8%)
Parent Martial Status		
Divorced		7 (12.7%)
Married		42 (76.4%)
Separated		3 (5.5%)
Single		2 (3.6%)
Widowed		1 (1.8%)
Variable	***M (SD)***	***M (SD)***
Age (years)	14.82 (1.55)	46.53 (5.9)
Number of Adults in Household		2.0 (0.61)
Number of Children in Household		2.2 (0.91)
Adolescent T1D Duration (years)	7.88 (3.90)	
Adolescent Baseline HbA1c (%)	8.58 (1.44)	

Note. T1D = type 1 diabetes

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[a] Family income level missing for four families, total *n* = 51

Providers. Twelve providers consented to TalkT1me. However, due to scheduling and clinical specialties (e.g., some providers primarily see patients with presenting problems other than T1D), only five providers saw participating TalkT1me patients and were thus included as participants in analyses. Providers were mostly female (80%) and White/Caucasian (60%), with a mean age of 42.8 years (*SD* = 13.02). Most (80%) were attending physicians; 20% were nurse practitioners. The average number of years providing clinical services was 13.60 (*SD* = 15.23). Sociodemographic and other characteristics of providers are included in Table 2.

Table 2

Sociodemographic & Other Characteristics of Providers (n = 5)

Variable	***n (%)***
Female	4 (80.00%)
Race	
African American/Black	0 (0%)
Asian	2 (40.00%)
Caucasian/White	3 (60.00%)
Other	0 (0%)
Ethnicity Hispanic	0 (0%)
Provider Role	
Physician- Attending	4 (80.00%)
Physician- Fellow	0 (0%)
Nurse Practitioner	1 (20.00%)
Variable	***M (SD)***
Age (years)	42.80 (13.01)
Number of Years Providing Clinical Service	13.60 (15.23)

Sixty percent of providers reported attending either an introductory or advanced MI training and 40% reported either no prior MI training or only attending lectures or didactic experiences. See Table 3.

Table 3

Provider Motivational Interviewing Training Experience, Perceptions, & Skills (n = 5)

Variable	***n (%)***
Motivational Interviewing Training Experience	
No Prior Motivational Interviewing Training Experience	1 (20.00%)
Attended Lectures or Didactic Experiences	1 (20.00%)
Attended Introductory Training	2 (40.00%)
Attended Advanced Training	1 (20.00%)
Other	0 (0%)
Variable	***M (SD)***
Perceptions of Behavioral Counseling [a]	
Importance of use of Behavioral Counseling in a Health Care Setting	3.94 (0.39)
In general, it is easy to incorporate health behavior counseling in my daily practice	3.60 (0.89)
I do not have enough time to counsel patients about changing diabetes- related behaviors*	3.00 (1.00)
I need to learn new strategies to help my patients change diabetes-related health behaviors	4.60 (0.55)
It is important for me to counsel my patients about changing diabetes- related behaviors	4.00 (0.71)
Belief in Motivational Interviewing Spirit	3.03 (0.89)
It is my responsibility to determine the patient's priorities for the visit*	3.80 (1.10)
It is my responsibility to provide information to patients about the benefits of diabetes-related behavior change, regardless of their readiness to change*	3.80 (1.10)
Patients, in general, should be motivated by the desire to be healthy*	4.00 (0.71)
If my patient does not follow my advice the consultation has failed*	2.20 (0.84)
Confidence in Motivational Interviewing Skills	3.58 (0.45)
I feel confident in my ability to express empathy for my patients	4.00 (0.71)
I am confident in my ability to accurately reflect my patients' Emotions	3.40 (0.55)
I feel confident using reflective listening	2.80 (0.45)
I am a good listener	4.00 (0.71)
I am effective in helping patients change	3.00 (0.71)
Adapted Helpful Responses (HRQ) [b]	2.20 (1.02)

Note. * indicates reverse scored items

[a] Perceptions of Behavioral Counseling items assessed perception of MI skills on a scale from 1 (strongly disagree) to 5 (strongly agree) with higher scores indicating stronger agreement

[b] Adapted Helpful Responses Questionnaire is a measure of empathy and MI reflection skills with higher scores indicating greater empathy and MI reflection skills

Patient Provider Encounters. Using the diabetes encounter rating instrument, characteristics (e.g., session strategies used, behaviors addressed during the encounter) of patient provider encounters (*n* = 55) were assessed by trained research staff via audio-recording review. The top strategies used by providers included asking about the patient's typical day (76.4%, *n* = 42), using prescriptive goal setting (67.3%, *n* = 37), giving advice (65.5%, *n* = 36), problem solving (41.8%, *n* = 23) and collaborative goal setting (41.8%, *n* = 23). Checking blood sugar was the most frequent behavior addressed (78.2%, *n* = 43); insulin administration (76.4%, *n* = 42) and carbohydrate counting/diet (72.2%, *n* = 40) were also frequently addressed. Of note, more than one session strategy and behavior could be addressed in each encounter. See Table 4.

Table 4

Characteristics of Patient-Provider Endocrinology Encounters (n = 55)

Variable	***n (%)***
Session Strategies Used [a]	
Typical Day	42 (76.40%)
Prescriptive Goal Setting	37 (67.30%)
Giving Advice	36 (65.50%)
Problem Solved	23 (41.80%)
Collaborative Goal Setting	23 (41.80%)
Values/Goals Exploration	18 (32.70%)
Explored Importance	15 (27.30%)
Warning/Threatening	15 (27.30%)
Decisional Balance	11 (20.00%)
Agenda Setting	10 (18.20%)
Explored Confidence	10 (18.20%)
Developing Discrepancy	9 (16.40%)
Confronting	5 (9.10%)
Behaviors Addressed [b]	
Checking Blood Sugar [c]	43 (78.20%)
Insulin Administration	42 (76.40%)
Carbohydrate Counting & Diet	40 (72.20%)
Exercise	16 (29.10%)
Other- Pump Site Rotation	2 (3.60%)
Other- Sensor Issues	2 (3.60%)
Variable	***M (SD)***
Time Spent Waiting for Provider (Minutes: Seconds)	24:11 (10:57)
Time Spent with Provider (Minutes: Seconds)	22:31 (9:02)
Percent of Time Talking During Appointment	
Adolescent (%)	18.97 (8.26)
Parent (%)	27.45 (9.27)
Provider (%)	53.05 (7.94)
Percent of Time Provider was Directing Conversation to	
Adolescent (%)	60.84 (11.81)
Parent (%)	39.16 (11.81)
Observed Working Alliance (WAI-O) [d]	
Task	68.13 (10.52)
Bond	69.43 (12.89)
Goal	66.56 (11.28)
Total	204.12 (33.87)

[a] More than one session strategy could be used in each encounter

[b] More than one behavior could be addressed in each encounter

[c] Checking blood sugar was the most common behavior addressed across all encounters

[d] Higher scores on the Working Alliance Inventory Observer (WAI-O) indicate greater alliance; total scores ranged from 100 to 245

Encounters were rated using the MITI 4.1 (Moyers et al., 2014). Overall and individual provider MITI scores are described in the Appendix, Table A1, with higher scores indicating greater levels of each domain. Summary scores were compared to recommended MITI basic competency and proficiency thresholds for clinicians. These standards are based upon expert opinion and at this point, no recommended competency and proficiency thresholds exist for MI Adherent and MI Non-adherent summary scores. Providers' average MITI Technical summary score (*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. Providers' average 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. Lastly, providers' average MI Adherent summary score was 1.50 (*SD* = 1.50) and average MI Non-adherent summary score was 2.29 (*SD* = 3.01). See Table 5.

Table 5

Motivational Interviewing Treatment Integrity 4.1 Scores & Comparison to Basic Competency by Provider and Overall (n = 55)

	Provider 1	**Provider 2**	**Provider 3**	**Provider 4**	**Provider 5**	**Overall Mean**	**Basic Competence & Proficiency Thresholds**	
Variable	***M (SD)***						**Fair**	**Good**
Global Scores [a]								
Cultivating Change Talk	2.90 (0.97)	3.05 (1.23)	4.07 (0.93)	3.63 (1.11)	3.86 (0.80)	3.45 (1.06)		
Softening Sustain Talk	3.73 (0.46)	3.14 (0.84)	3.86 (0.38)	3.88 (0.25)	3.92 (0.69)	3.70 (0.66)		
Partnership	3.33 (0.79)	3.27 (0.79)	4.00 (0.82)	3.50 (1.08)	4.28 (0.75)	3.73 (0.89)		
Empathy	3.67 (0.82)	2.86 (1.52)	4.14 (0.90)	3.63 (1.11)	4.06 (0.64)	3.69 (1.05)		
Behavior Counts [b]								
Giving Information	9.40 (3.38)	10.55 (3.30)	12.50 (5.07)	10.88 (3.75)	9.69 (4.08)	10.23 (3.85)		
Persuade	0.33 (0.62)	1.82 (2.24)	2.86 (2.41)	3.00 (3.19)	2.33 (2.33)	1.80 (2.21)		
Persuade with Permission	0.27 (0.59)	1.59 (1.83)	2.00 (1.73)	2.63 (3.68)	0.89 (1.57)	1.23 (1.76)		
Question	16.67 (5.24)	25.55 (9.51)	32.79 (10.95)	33.25 (14.68)	33.11 (9.62)	27.08 (11.32)		
Simple Reflection	3.78 (2.43)	2.27 (2.75)	7.93 (5.28)	13.13 (8.75)	9.36 (6.82)	6.51 (6.07)		
Complex Reflection	2.87 (2.47)	3.86 (2.51)	7.00 (5.03)	9.63 (7.03)	7.78 (5.45)	5.69 (4.84)		
Affirm	1.47 (1.19)	0.09 (0.30)	0.64 (0.48)	0.13 (0.25)	0.81 (0.86)	0.77 (0.95)		
Seeking Collaboration	0.07 (0.26)	0.14 (0.32)	0.71 (0.76)	0.13 (0.25)	0.72 (0.89)	0.38 (0.67)		
Emphasizing Autonomy	0.07 (0.26)	0.27 (0.65)	1.00 (1.15)	0.38 (0.48)	0.36 (0.68)	0.35 (0.69)		
Confront	0.13 (0.35)	0.32 (0.72)	0.36 (0.48)	3.00 (6.00)	0.39 (0.70)	0.49 (1.68)		
Summary Scores								
Technical [c]	3.32 (0.60)	3.09 (0.90)	3.96 (0.59)	3.75 (0.54)	3.89 (0.61)	3.57 (0.73)	3	4
Relational [d]	3.50 (0.76)	3.07 (1.11)	4.07 (0.61)	3.56 (1.09)	4.17 (0.57)	3.71 (0.88)	4	5
Percent Complex Reflections [e]	0.42 (0.28)	0.71 (0.27)	0.45 (0.12)	0.43 (0.15)	0.46 (0.17)	0.49 (0.24)	40%	50%
Reflection-to-Question Ratio [f]	0.40 (0.24)	0.28 (0.24)	0.43 (0.18)	0.69 (0.43)	0.52 (0.28)	0.44 (0.27)	1:1	2:1
Total MI Adherent [g]	1.60 (1.18)	0.50 (0.67)	2.36 (1.84)	0.63 (0.48)	1.89 (1.78)	1.50 (1.50)	--	--
Total MI Non-Adherent [h]	0.47 (0.64)	2.14 (2.81)	3.21 (2.71)	6.00 (6.18)	2.72 (2.78)	2.29 (3.01)	--	--

[a] Global scores capture overall impression with higher scores indicating greater description of the dimension being measured

[b] Behavior counts capture specific behaviors with higher scores indicating a greater frequency of that behavior

[c] Technical Global Score (Technical) = (Cultivating Change Talk + Softening Sustain Talk) / 2; Scores ranged from 2 to 5

[d] Relational Global Score (Relational) = (Partnership + Empathy) / 2; Scores ranged from 1.5 to 5

[e] Percent Complex Reflections Score (% CR) = Complex Reflections / (Simple Reflections + Complex Reflections); Scores ranged from 0 to 1

[f] Reflection-to-Question Ratio Score (R:Q) = Total Reflections / Total Questions; Scores ranged from .03 to 1.31

[g] Total Motivational Interviewing Adherent Score = Seeking Collaboration + Affirm + Emphasizing Autonomy; Scores ranged from 0 to 6

[h] Total Motivational Interviewing Non-Adherent Score = Confront + Persuade; Scores ranged from 0 to 14

Patients were waiting in the examination room to see the provider for an average of 24 minutes (*SD* = 10:57) and providers spent about 23 ½ minutes with patients (*SD* = 9:02). Greater time waiting to see the provider was associated with poorer patient autonomy support at three months (*r* = -.385, *p* = .005). Session length was correlated with poorer baseline glycemic control and adherence (*r* = .291, *p* = .031; *r* = -.315, *p* = .019) as well as poorer glycemic control at six months (*r* = .309, *p* = .001). Longer session length was also correlated with greater use of MI non-adherent techniques (*r* = 383, *p* = .004) and a greater rating of MI Technical spirit (*r* = .286, *p* = .034). On average, adolescents spent 18.9% (*SD* = 8.26) of the encounter talking, parents spend 27.5% (*SD* = 9.27) of the encounter talking, and providers spent 53.1% (*SD* = 7.94) of the encounter talking. When the providers were talking, they spent an average of 60.8% (*SD* = 11.81) of the time directing the conversation to the adolescent and 39.2% (*SD* = 11.81) of the time directing the conversation towards the parent. Greater percentage of time provider was talking was correlated with a lower MI reflection-to question ration (*r* = -.352, *p* = .015). A greater percentage of the time the parent was talking during the encounter was associated with lower MI Technical spirit (*r* = -.332, *p* = .013). Greater percentage of the time adolescents were talking during the encounter was associated with stronger working alliance (*r* = .267, *p* = .049).

Sixty-six percent (*n* = 35) of adolescents saw the same provider at all three visits and 76.4% (*n* = 42) saw the same provider at their baseline and three month visit. Consistency of provider at all three visits was not significantly correlated with three or six month HbA1c or diabetes adherence at one or three months (*p* > .05)

Provider Perceptions of Behavior Change and MI in Patient-Provider Communication

Correlations among providers' perceptions of importance of behavioral counseling in health care, belief in the spirit of MI, and confidence of MI-related skills were examined with MI global scores (via MITI 4.1). Perceptions of the importance of behavioral counseling in healthcare and confidence in MI-related skills were not associated with MI summary scores. However, a greater belief in MI spirit was negatively associated with the use of MI non-adherent behaviors (r = -.896, p = .040).

Exploration of Patient and Provider Demographics, Session Characteristics and Outcomes

Correlations among patient and provider sociodemographic variables and outcomes were examined to identify potential covariates at the patient and provider level to include in multivariate analyses. Adolescent racial minority status was associated with poorer glycemic control (r = .304, p = .024) and adolescents who were younger were more adherent to diabetes behaviors (r = -.271, p = .045).

Associations among provider demographics, outcomes, and use of MI techniques were examined. However, due to the small number of providers (n = 5), generalizability is limited and results should only be viewed as descriptive for this sample. Less MI provider training was associated with patient poorer glycemic control at baseline (r = -.270 p = .046). There were no other significant correlations among provider demographics and main outcomes.

Associations among provider demographics and the use of individual MI techniques and MI summary scores were examined. Providers with less MI training were less likely to use reflections (r = -.292, p = .031) and MI non-adherent behaviors (r = -.325, p = .016; e.g., confronting, persuading) in communication with patients. Providers who were younger, had fewer years of clinical experience, and less MI training experience were more likely to use reflections (r = -.331, p = .014; r = -.426, p = .001; r = -.338, p = .012), questions (r = -.556, p <. 001; r = -.598, p < .001; r = -.458, p < .001), and MI non-adherent behaviors (r = -.367, p = .006; r = -.366, p = .006; r = -.364, p = .006). Providers who had more years of clinical experience had lower MI technical scores (*r* = -.282, *p* =.037). Finally, providers in this sample who identified as White/Caucasian were less likely to use reflections (*r* = -292, *p* = .031) and MI non-adherent behaviors (*r* = -.325, *p* = .016). Correlations among predictor MI summary score variables, working alliance and outcomes were also examined. See Tables 6 and 7.

At the provider-level, previous MI training was identified as a covariate to include in the models. Due to the limited variability in some of the provider-level variables and high correlations among them (e.g., gender, race, ethnicity, age, and years of clinical experience) these variables were not included as co-variates in the models. At the patient-level, age and race (categorized as White/Caucasian and Racial Minority) were included as covariates in all models.

Table 6

Correlation Matrix with MI Variables and Primary Study Variables at Baseline

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. MITI Technical	---	.716**	.065	.162	.442**	.164	.239	.317*	-.213	.170	.032	-.134	.069	-.092
2. MITI Relational		---	-.094	.238	.361**	-.241	.446**	.211	-.005	.121	.210	.060	-.069	-.164
3. Percent Complex Reflections			---	-.110	-.040	-.092	-.010	-.079	.131	.251	.228	.104	-.021	-.056
4. Reflection-to-Question Ratio				---	.211	-.082	.257	.044	.078	.018	-.059	-.120	-.003	-.204
5. Total MI Adherent					---	-.021	.290*	.275*	-.251	.038	-.089	.026	-.008	.097
6. Total MI Non-Adherent						---	-.659**	.199	-.316*	.052	-.206	-.213	.0129	.068
7. Working Alliance							---	-.087	.262	-.018	.393**	.265	-.271*	-.037
8. HbA1c Baseline								---	-.270*	-.139	-.189	-.055	.210	.173
9. DBRS Baseline									---	.107	.566**	.299*	-.360**	-.098
10. HCCQ Baseline										---	.215	.246	-.115	-.065
11. SEDSM Baseline											---	.445**	-.401*	-.096
12. PedsQOL Baseline												---	-.618**	-0.67
13. DFCS Baseline													---	-.004
14. DFRQ Baseline														---

Note. *p < .05, **p < .01, ***p < .001; MI = Motivational interviewing; HbA1c= Hemoglobin A1c; DBRS= Diabetes Behavior Rating Scale; HCCQ= Health Care Climate Questionnaire; SEDSM= Self-Efficacy for Diabetes Self-Management Scale; PedsQOL= Diabetes Pediatric Quality of Life; DFCS= Diabetes Family Conflict Scale; DFRQ= Diabetes Family Responsibility Questionnaire

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.	MITI Technical	-	.716**	.065	.162	.442**	.164	.239	.173	.130	-.156	-.167	.234	-.022	-.034	-.018	.054	.017	.173	-.221	-.130
2.	MITI Relational		---	-.094	.238	.361**	-.241	.446**	-.041	-.071	.169	.102	.241	.236	.168	.153	.175	-.142	-.068	-.322*	-.298*
3.	% Complex Reflections			---	-.110	-.040	-.092	-.010	-.200	-.277*	.083	-.002	.207	.159	.174	-.009	.078	-.155	-.069	.005	.156
4.	Reflection-to-Question Ratio				---	.211	-.082	.257	.004	.009	-.098	.002	-.021	-.134	-.064	-.041	-.065	.094	.088	-.065	.012
5.	Total MI Adherent					---	-.021	.290*	.038	-.081	-.161	-.212	.226	.059	-.102	.266	.206	-.106	.135	-.045	.060
6.	Total MI Non-Adherent						---	-.659**	.457**	.401**	-.487**	-.351*	.152	-.490**	-.412**	-.218	-.116	.147	.305*	-.046	-.050
7.	Working Alliance							---	-.588**	-.551**	.388**	.348*	.044	.385**	.403**	.345*	.294*	-.265	-.334*	.150	.248
8.	HbA1c 3 months								---	.853**	-.424*	-.417**	.005	-.413**	-.457**	-.299*	-.258	.408**	.364**	-.103	-.121
9.	HbA1c 6 months									---	-.375**	-.359*	-.096	-.471**	-.381**	-.482**	-.391**	.477**	.309*	-.259	-.240
10.	DBRS 1 month										---	.697**	.028	.492**	.585**	.211	.249	-.353*	-.540**	-.054	-.063
11.	DBRS 3 months											---	.008	.497**	.651**	.131	.226	-.351*	-.509**	-.087	-.072
12.	HCCQ 3 months												---	.240	.149	.272	.434**	-.158	-.011	-.260	-.165
13.	SEDSM 1 month													---	.788**	.533**	.524**	-.434**	-.526**	-.182	-.180
14.	SEDSM 3 months														---	.336*	.448*	-.454**	-.596**	-.147	-.086
15.	PedsQOL 1 month															---	.884**	-.649**	-.577**	.008	.136
16.	PedsQOL 3 months																---	-.673**	-.560**	-.136	.011
17.	DFCS 1 month																	---	.660**	-.003	-.162
18.	DFCS 3 months																		---	-.109	-.102
19.	DFRQ 1 month																			---	.656**
20.	DFRQ 3 month																				---

Hypothesis 1: Greater use of MI-consistent techniques and less use of MI non-adherent behaviors will predict better diabetes-related and psychosocial outcomes.

It was hypothesized that a greater use of MI-consistent techniques and less use of MI non-adherent behaviors would be associated with: a) lower HbA1c (better glycemic control) at three and six months post-baseline and better diabetes adherence at one and three months post-baseline and b) greater QOL, self-efficacy, patient responsibility for diabetes tasks and lower diabetes-related family conflict at one and three months post-baseline, and greater patient autonomy at baseline and three months post-baseline. All models controlled for covariates and baseline values of variables of interest.

Hierarchical multiple regressions revealed that provider use of MI non-adherent behaviors (e.g., confronting, persuading) was associated with 1) poorer HbA1c at three months, $F(5,45) = 11.19$, $p < .001$; $R^2 = .554$ and 2) worse adolescent diabetes adherence at one month, $F(5, 46) = 9.86$, $p < .001$; $R^2 = .517$. MI non-adherent behavior emerged as a significant predictor in each model ($\beta = .242$, $p = .038$ and $\beta = -.300$, $p = .021$, respectively). Use of MI non-adherent behaviors was also associated with poorer HbA1c at six months, $F(5,46) = 8.20$, $p < .001$; $R^2 = .471$; non-adherent behaviors was a significant predictor in the model ($\beta = .236$, $p = .052$). Additional models predicting three and six month HbA1c found that working alliance was a significant predictor for three month HbA1c $F(5,45) = 11.73$, $p < .001$; $R^2 = .566$ and six month HbA1c $F(5,46) = 18.48$, $p < .001$; $R^2 = .485$. Specifically, lower working alliance in the patient-provider interaction was associated with worse HbA1c at three ($\beta = -.310$, $p = .020$) and six months ($\beta = -.312$, $p = .026$).

The use of MI non-adherent behaviors was also associated with secondary outcomes. Specifically, hierarchical regression models also revealed that provider MI non-adherent behaviors was associated with poorer patient self-efficacy for diabetes self-management at one month, $F(5, 46) = 6.60$, $p < .001$; $R^2 = .554$, and three months, $F(5, 45) = 4.82$, $p = .001$; $R^2 = .349$. MI non-adherent behaviors emerged as a significant predictor in each model ($\beta = -.408$, $p = .004$ and $\beta = -.358$, $p = .015$, respectively). Additionally, provider use of MI non-adherent behaviors was associated with greater diabetes related family conflict at three months, $F(5, 45) = 11.99$, $p < .001$; $R^2 = .524$, with MI non-adherent behaviors as a significant predictor in the model ($\beta = .288$, $p = .021$).

In comparison with MI non-adherent behaviors, use of MI adherent behaviors was only found to be significant in one hierarchical regression model. Specifically, use of MI adherent behaviors was associated with greater diabetes-related quality of life at one month, $F(5, 46) = 25.99$, $p < .001$; $R^2 = .739$. MI adherent behaviors emerged as a significant predictor in this model ($\beta = .216$, $p = .007$).

In additional hierarchical regression analyses, working alliance was associated with greater self-efficacy for diabetes self-management at three months $F(5, 45) = 4.23$, $p = .003$; $R^2 = .320$, with working alliance as a predictor approaching significance in the model ($\beta =.347$, $p = .05$). Working alliance emerged as a significant predictor in a model predicting diabetes-related family conflict, $F(5,45) = 10.92$, $p < .001$; $R^2 = .401$. Greater observed working alliance in the patient-provider interaction was associated with less diabetes family conflict at three months ($\beta = -.268$, $p = .048$).

Further hierarchical regression analyses revealed that when providers used a greater MI relational approach (i.e., partnership, empathy) parents took more responsibility for their adolescents' diabetes behaviors at one month, $F(5, 46) = 5.02$, $p = .001$; $R^2 = .401$, and three months, $F(5,45) = 6.6.9$, $p < .001$; $R^2 = .477$. MI relational approach emerged as a significant predictor in each model ($\beta = -.287$, $p = .022$ and $\beta = -.251$, $p = .016$). In comparison, a greater percentage of complex reflections was associated with adolescents taking more responsibility for their diabetes behaviors at three months, $F(5, 45) = 6.39$, $p < .001$; $R^2 = .446$, with percentage of complex reflections emerging as a significant predictor in the model ($\beta = .266$, $p = .027$). Finally, a greater percentage of complex reflections was associated adolescents reporting lower autonomy support at their baseline visit, $F(4, 50) = 3.70$, $p = .010$; $R^2 = .229$, with percentage of complex reflections emerging as a significant predictor in the model ($\beta = -.274$, $p = .036$). Results from all regression models are included in tables in the Appendix.

Hypothesis 2: Self-Efficacy for diabetes self-management and patient autonomy will mediate the association of MI consistent or MI inconsistent techniques and diabetes-related outcomes.

A mediation analysis determined that patient self-efficacy for diabetes self-management mediated the effect of provider MI non-adherent behaviors in patient provider communication on diabetes adherence. See Figure 2. Using the Baron and Kenny (1986) method for testing mediation, a significant positive relation between MI non-adherent behaviors and adherence, controlling for covariates, was first established, $\beta = -.383$, $p = .016$. Next, MI non-adherent behavior was found to have a significant negative relation to self-efficacy for diabetes self-management, $\beta = -.545$, $p < .001$. When both MI non-adherent behaviors and self-efficacy for diabetes self-management were entered into the model, the relation of self-efficacy for diabetes self-management to adherence remained significant, $\beta = .369$, $p = .016$, while the relation of MI non-adherent behaviors to adherence dropped to non-significance ($\beta = -.315$, $p = .059$). A Sobel test confirmed that the influence of MI non-adherent behaviors adherence was indirect, such that the relation between MI non-adherent behaviors at baseline and adherence at three months was explained by self-efficacy for diabetes self-management at one month (*z* = -2.33, *p* = .020).

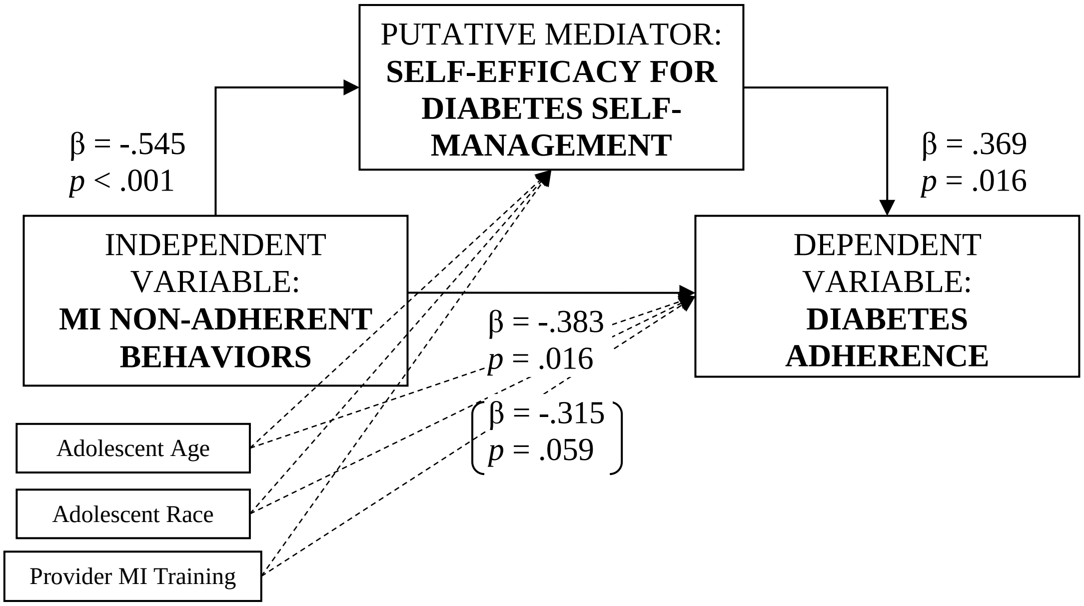

Figure 2. Mediation model with self-efficacy for diabetes self-management. Self-efficacy for diabetes self-management tested as a mediator of the relation between MI non-adherent behaviors and adherence controlling for adolescent age, adolescent race, and provider MI training experience. Values in parentheses represent the standardized relation of MI non-adherent behaviors to adherence after controlling for self-efficacy for diabetes self-management, adolescent age, adolescent race, and provider MI training experience.

In examination of the mediation between MI non-adherent behaviors and glycemic control, a significant positive relation between MI non-adherent behaviors and diabetes adherence, controlling for covariates, was first established, β = .290, *p* = .021. Next, MI non-adherent behavior was found to show a significant negative relation to self-efficacy for diabetes self-management, β = -.545, *p* < .001. However, when both MI non-adherent behaviors and self-efficacy for diabetes self-management were entered into the model, the relation of self-efficacy for diabetes self-management to adherence was not significant, β = -.140, *p* = .284, so self-efficacy for diabetes self-management was not considered as a mediator.

It was also hypothesized that greater autonomy support (HCCQ) would mediate the relation between MI techniques and diabetes-related outcomes (glycemic control and diabetes-related behaviors). However, autonomy support did not have a significant effect on glycemic control ($\beta = -.140$, $p = .741$) or adherence ($\beta = .081$, $p = .609$), so autonomy support was not considered further as a possible mediating variable.

Discussion

It is well-documented that glycemic control among patients with T1D often deteriorates during adolescence; yet little is known about the most effective way for providers to communicate with adolescents to prevent this decline. Health care providers play a significant role in assisting adolescents and their families with the multifaceted T1D disease management tasks. Given the importance of effective communication and the impact provider behavior can have on adolescent patients' motivation for change, examination of effective patient-provider communication strategies is needed. MI is a particularly promising strategy that has proven beneficial in the management of other challenging health care behaviors, including those affecting adolescents, and might enhance provider communication with adolescents with T1D. The current investigation, TalkT1me, used MI as a framework to help characterize naturally-occurring adolescent patient provider communication in medical encounters, and examined the relations between provider communication and T1D self-management and control.

In the TalkT1me study, the first hypothesis, that a greater use of use of MI consistent behaviors and less use of MI inconsistent behaviors would predict better diabetes-related and psychosocial outcomes, was partially supported. It is important to note, that providers were not trained to use MI; however, this framework was used as a structured way to evaluate communication. Because these providers were untrained, as expected, average summary scores on the MITI 4.1 ranged from below the Fair proficiency threshold to between the Fair and Good proficiency thresholds. The use of MI non-adherent behaviors (e.g., confronting, persuading) during patient provider encounters predicted worse diabetes related adherence for adolescents at one month after their initial study visit and worse glycemic control at one and three months after their initial study visit, after controlling for baseline values and patient and provider characteristics. Given the documented relation between adherence and glycemic control (Hood et al., 2009), and the negative health consequences of uncontrolled blood sugars (Springer et al., 2006), this finding is important for health care professionals to consider when working with adolescents. Results are consistent with previous research suggesting that approaches that that rely on confrontation, warning about risks of non-adherence, or giving advice without patient collaboration can have a negative impact on adolescent and adult patient readiness to change and reduce adherence (Moyers & Martin, 2006). For example, a previous study similarly found that use of MI inconsistent techniques had a negative impact on adolescent patients' engagement in weight loss behaviors (Pollak et al., 2010). Although attempting to persuade an adolescent to check her blood sugar more frequently or confronting her about her unhealthy diet might seem like logical ways to communicate concern, findings suggest that these communication strategies do not increase adherence and indeed are associated with reduced adolescent engagement in diabetes management tasks.

Results from Talk T1me also revealed that when providers used more MI non-adherent behaviors, their patients reported lower self-efficacy for diabetes self-management at one and three months after their baseline visit, and more diabetes related family conflict three months after their baseline visit. This finding is notable, because self-efficacy to complete diabetes management tasks might positively influence adherence and thus glycemic control (Iannotti et al., 2006; Ott, Greening, Palardy, Holderby, & Debell, 2000). Similarly, lower level of diabetes related family conflict is linked to greater adolescent adherence to diabetes tasks (Anderson, 2004; Hilliard, Holmes, et al., 2013). In sum, consistent with previous studies, findings from the TalkT1me study suggest that using more MI non-adherent techniques in communication can negatively impact adolescents' adherence to diabetes management behaviors, glycemic control, self-efficacy for diabetes self-management, and family conflict surrounding diabetes management.

Although providers did not reach or exceed the "good" level of basic competency and proficiency thresholds, use of MI adherent behaviors (e.g., seeking collaboration, affirming, emphasizing autonomy) was not associated with any of the primary diabetes related outcomes of adherence or glycemic control. However, the use of MI adherent behaviors in patient provider communication during encounters did predict greater diabetes related quality of life at one month after the initial encounter, after controlling for baseline values as well as patient and provider characteristics. There is a wealth of literature suggesting that greater diabetes-related quality of life is associated with improved adherence and subsequent glycemic control (Guttmann-Bauman, Flaherty, Strugger, & McEvoy, 1998; Naughton et al., 2008). When providers are using more MI consistent behaviors with their patients, such as seeking collaboration, affirming, and emphasizing their autonomy, patients report greater quality of life (e.g., fewer treatment barriers, communication problems, negative diabetes symptoms, less worry). This finding is comparable to those of other studies examining the impact of MI adherent behaviors on communication with adolescents and adults with obesity. Patients whose physicians were rated as having a higher global MI spirit score (e.g., collaborated with patients) were more successful in engaging in exercise and losing weight (Pollak et al., 2010; Pollak et al., 2009). Overall, a further look at the impact of MI adherent behaviors, within a randomized controlled trial, is needed.

The TalkT1me study also looked more specifically at the spirit of patient provider communication, using the MITI 4.1 global scores. The technical global score, which is comprised of a rating of cultivating change talk and softening sustain talk, was not associated with any outcomes. However, a greater relational global score, which is a measure of the provider's partnership and empathy during the encounter, was associated with parents taking more responsibility, as compared to adolescents, for diabetes management tasks at one and three months after the initial study visit, controlling for baseline values of family responsibility, and glycemic control and patient and provider characteristics. Perhaps hearing a provider work with an adolescent to express empathy for the difficulties associated with diabetes management influenced parents' engagement in management tasks in a positive way, increasing their involvement and responsibility. Given the complicated nature of diabetes management, parental involvement in diabetes tasks is important and research has shown that adolescents with more involved parents exhibit better glycemic control (Anderson et al., 2009; Silverstein et al., 2005). Although research shows that parent involvement outside of the medical encounter is important, the most developmentally appropriate and effective way for parents to be involved during a medical encounter needs to be further explored. In TalkT1me, when parents spoke more than adolescents during the session, providers used less MI consistent behaviors and demonstrated lower MI spirit. Research is needed to determine the best way for providers to communicate with both parents and adolescents during an encounter to promote appropriate engagement in health behaviors. Additionally, the most effective way to communicate with adolescents and parents during encounters likely differs by the age of adolescent. Although age was controlled for in these analyses, future studies should more closely examine how to engage patients optimally as they get older, and how to alter the focus from parent to patient effectively.

When communicating with patients around behavior change, reflections are an important way for providers to convey understanding and signal that they are listening to the patients' needs. In TalkT1me, both simple reflections, in which the provider conveyed understanding or facilitated patient provider exchange but added little or no meaning to what patients said, and complex reflections, in which the provider added substantial meaning or emphasis to what the patient said in order to convey a deeper or more complex picture of what the statement, were coded and a score of the ratio of complex to simple was created. Results found that a greater percentage of complex reflections was associated with more parental responsibility for diabetes management tasks at three months post baseline and worse adolescent autonomy support at baseline, after controlling for patient and provider characteristics. This finding is surprising, given that other studies have found that the use of reflections in patient-provider communication is associated with more positive patient health behaviors such as reduced screen time (Pollak et al., 2009), weight loss (Pollak et al., 2010), and higher patient autonomy support (Pollak et al., 2011). However, it is important to note that in those studies, simple and complex reflections were combined. Further, it is also important to consider that while providers might be using complex reflections, the statements that they are choosing to reflect might not always be change talk (e.g., when the patient's language is expressing favor of the change goal and confidence in making that change). Instead, if providers are reflecting more sustain talk (e.g., patient's language focusing on the reasons against changing or for maintaining the status quo), it is possible that patients might leave the encounter with lower autonomy support or that after hearing a provider reflect an adolescents' desire not to change, parents increase their responsibility for managing diabetes care. The newest edition of MI (Moyers, Manuel, & Ernst, 2014) emphasizes the need to cultivate more change talk and selectively reduce emphasis on sustain talk during encounters with patients. Finally, it is important to note that when assessing for providers' use of reflections, there was no differentiation between whether the provider was reflecting the parent or adolescent statement. Therefore it is possible that the providers were reflecting more of the parents' statements which perhaps increased parental responsibility for diabetes management tasks at and decreased adolescent reports of autonomy support. Future studies should more carefully examine the type of statements providers are choosing to reflect and the impact on patient outcomes.

In addition to examining the use of MI consistent or inconsistent techniques during the encounters, the association of working alliance and outcomes was evaluated. A stronger working alliance was associated with better glycemic control at one and three months post baseline, after controlling for baseline values and patient and provider characteristics. Further, stronger alliance also predicted better self-efficacy for diabetes self-management and less diabetes family conflict three months after the initial study visit, controlling for baseline values and patient and provider characteristics. Studies have found that a positive working relationship between patients and providers is associated with patients' ability to manage and cope with various chronic illnesses including diabetes, hypertension, obesity, and rheumatic diseases, such as lupus (Bennett, Fuertes, Keitel, & Phillips, 2011; Ciechanowski et al., 2004; Fuertes et al., 2007). Specifically, in these studies, a stronger working alliance between patients and their providers was significantly and positively associated with various outcomes including adherence, satisfaction, and quality of life (Fuertes et al., 2007). However, these studies involved adult patients and were not specifically assessing patients with type 1 diabetes. Fewer studies have focused on working alliance in the pediatric health setting and thus, more research is needed. Significant results from

TalkT1me suggest that a positive working alliance is associated with improved health outcomes, such as glycemic control, and other psychosocial outcomes such as self-efficacy. Therefore, working on developing a positive relationship with strong working alliance between the provider and patient might be a key component in delivering effective and patient-centered care. Additional research is needed to explore this and further differentiate the relational components of MI from working alliance. There is some evidence that these are distinct constructs. Specifically, in TalkT1me, working alliance was positively correlated with a greater use of MI adherence behaviors (r = .291, p = .032) and a greater MI relational spirit (r = .446; p = .001) and was negatively correlated with MI non-adherence behaviors (r = -.659; p = .000). However it was not correlated with any of the other MI variables. Of note, in TalkT1me, the working alliance was an observed measure, rated by coders, with alliance defined as the relationship between the provider and the family (i.e., parent adolescent dyad). Future studies should examine patients' and providers' own perceptions of working alliance.

In a closer examination of the relation between the use of MI inconsistent behaviors and diabetes-related outcomes (e.g., glycemic control and adherence), patient self-efficacy for diabetes self-management emerged as significant mediator in the relation between MI non-adherent behaviors and diabetes adherence, after controlling for patient and provider characteristics. This suggests that, when providers were confronting and persuading during an encounter, patients felt less competent about their ability to manage diabetes, which led to less engagement in adherence behaviors. Consistent with developmental increases in autonomy and independence, confronting adolescents might make them more resistant and oppositional. Instead, providers should focus on increasing adolescents' self-efficacy by believing in their ability to change, building on their strengths, and promoting their sense of agency. More research is needed prior to intervention development, but creating programs that focus on building adolescents' self-efficacy for diabetes self-management, in addition to educating providers about the importance of this self-efficacy, might be important in promoting positive health behaviors.

In addition to examining communication techniques, descriptive results provided information about encounter characteristics that might inform intervention development. On average, providers spent 23.5 minutes with patients during an encounter. Longer time spent with patients was associated with poorer glycemic control. Given the fact that patients with more diabetes difficulties and higher HbA1c might require more attention and time, it is understandable that providers spend longer in these sessions. However, it might also suggest that simply spending a longer time with patients is not associated with better health outcomes, but instead, the communication strategies used might have more of an impact. Studies have shown that MI can be effectively used in brief patient health encounters (Emmons & Rollnick, 2001). In fact, spending the session using MI non-adherent behaviors such as confronting and persuading might elicit more arguments against change, leading to a less productive encounter that takes more time compared to an MI consistent approach where a provider could be more productive and efficient. In the TalkT1me study, patients waited for an average of 24 minutes before the provider entered the exam room to begin the encounter. Interestingly, greater time waiting to see a provider was associated with poorer perception of provider autonomy support. Perhaps a greater wait time impacted patients' perception of their relationship with the provider and made adolescents feel less supported by their provider. This finding certainly represents another area for further examination. Although reducing wait times in a busy clinic is sometimes difficult, if restructuring clinic schedules to allow for less wait time is feasible, results suggest that shorter wait times improve patients' perceptions of their providers' support.

As is well-documented in the literature, adolescence presents a unique developmental time period where growth in autonomy and independence is appropriate and expected. However, previous research has also demonstrated that, due to the complexity of managing a chronic illness, it is essential to keep parents appropriately involved in helping with diabetes management for adolescents with T1D (Barbara J. Anderson et al., 2009; Silverstein et al., 2005). Little research has examined the most appropriate way to include both parents and adolescents during health care visits. A closer look at young adult populations with T1D (typically ages 18-25 years) reveals continued or declining glycemic control, perhaps due in part to decreased parental involvement during this time (Monaghan, Helgeson, & Wiebe, 2015). Thus providers are challenged with a unique task of engaging both the parent and adolescent during a discussion, while also promoting an adolescent's autonomy. When embracing a patient-centered approach, it might be important for providers to allow the patient time to talk and removing themselves from the expert role. During the TalkT1me encounters, providers spent on average a little more than half of the session time talking, parents spent an average of 27.5% of the time talking, and adolescents spent an average of 18.9% of the time talking. Of the time providers were talking, they spent an average of 61% of the time directing the conversation to the adolescent and 39% of the time directing the conversation towards the parents, which suggests they are focusing attention on adolescents. As perhaps expected, sessions where adolescents spent a greater amount of time talking were rated as sessions with higher working alliance. Conversely, when parents were talking for a greater amount of the session, the providers used less MI consistent behaviors and had a lower MI spirit. For providers, talking to the adolescent and engaging her in a way that supports her, while reducing focus on the parent, might be an avenue to reduce resistance and increase alliance. This suggests that despite the central role parents might have in assisting with diabetes management for their adolescent, engaging the adolescent during an encounter and encouraging them to talk might help increase alliance between the patient and provider.

Lastly, TalkT1me examined characteristics (e.g., session strategies used, behaviors addressed during the encounter) of patient-provider encounters and found that top strategies used by providers included asking about the patient's typical day, using prescriptive goal setting, giving advice, problem solving, and collaborative goal setting. Checking blood sugar was the most frequent behavior addressed and insulin administration and carbohydrate counting/diet were also frequently addressed. The naturally occurring level of MI that providers were using was also examined. MITI 4.1 summary scores were compared to recommended MITI basic competency and proficiency thresholds for clinicians. Providers' average MITI technical summary score and percent complex reflections summary score were between the Fair and Good proficiency thresholds. Providers' average MITI relational summary score and reflection-to-question ratio summary score were below the Fair proficiency threshold. This information is useful to help better understand the content of typical medical encounters and the amount of MI that providers are using without any formal intervention. Future studies should examine session content further and use this information in the development of targeted MI trainings.

Limitations and Strengths

This study is not without its limitations and strengths. First, with a sample size of 55 adolescent-parent dyads and five providers, generalizability is limited; however, participants were demographically comparable to patients seen at this pediatric endocrinology clinic. Additionally, there were significant demographic differences in adolescents that did not attend their three month clinical follow-up visits (e.g., more likely to be racial and ethnic minorities, have Medicaid insurance, live in single-parent households, use non-pump insulin regimes and have higher baseline HbA1c values). This is consistent with literature demonstrating that for adolescents in families with these demographic characteristics, glycemic control management and regular treatment attendance are often difficult (Hilliard, Wu, Rausch, Dolan, & Hood, 2013). Another limitation is the measurement of patient autonomy. This measure was only based on adolescent report and there was little variability; nevertheless, this construct has not previously been examined in research on adolescents with T1D. Future studies should consider obtaining parent and adolescent report and examining autonomy support more extensively.

Another limitation is the fact that some adolescents saw different providers at their three month follow-up visit; however, it should be noted that this is frequently encountered in academic medical settings and group practices. Because the MI consistent behaviors were only measured at baseline, the communication style during the three month visit and the resulting impact on outcomes is unknown. It is important to also consider that some of these patients have previous working relationships with their providers; past experiences with a patient or prior knowledge of their typical adherence might have impacted the provider communication style. For example, if a patient normally has poor glycemic control, a provider might unintentionally use more MI inconsistent techniques such as persuading or confronting. However, to address this limitation to some extent, baseline levels of variables were controlled for in all regression models. Working alliance was measured as the relationship between the provider and the parent adolescent dyad. This construct was assessed via audio recordings rather than video recordings, and thus the assessment may have been somewhat limited. However, this method to measure alliance has been used in other studies (McLeod et al., 2016). Additionally, the same coder rated each session for the amount of MI and then working alliance so it is possible that their coding of

MI could have impacted their judgment of the alliance in the relationship. Finally, as can be stated for any observational study, the ability to truly determine the impact of MI-informed interactions on patient outcomes is limited without a control group. However, research on the use of MI for adolescents with T1D is still fairly limited so this study might help inform future research, particularly interventions focused on using MI in a medical setting.

However, this study also has some notable strengths. Few studies exist examining the impact of MI on health outcomes for adolescents with T1D, therefore this study helps broaden this research area. Further, TalkT1me examined patient-provider communication in a natural setting, during a medical encounter. When considering generalizability, studying communication patterns in a typical medical setting is important. Another strength of this study includes the use of a validated coding system to evaluate the naturally occurring amount of MI and audio recordings to more objectively assess session characteristics and working alliance. Finally, results have the potential to inform future interventions, clinical training for providers, and communication in clinical practice.

Conclusions and Future Directions

TalkT1me explored naturally occurring communication in diabetes-related conversations between adolescents and their endocrine providers. Specifically, using MI as a framework, the associations between communication behaviors and patient outcomes (diabetes-related adherence, glycemic control, and psychosocial outcomes) were examined. Results found that providers' overreliance on persuasion and confronting adolescents about the risks of non-adherence was paradoxically associated with poorer glycemic control and adherence. Self-efficacy mediated the relation between the use of these MI non-adherent behaviors (e.g., confronting and persuading) and lower adherence, such that when providers were using MI non-adherent techniques, patients had lower self-efficacy to manage diabetes tasks, which reduced their adherence to diabetes behaviors. Especially for adolescents, who are in a development stage characterized by an increase in independence and autonomy, it follows that use of MI non-adherent behaviors would potentially increase adolescents’ resistance and reduce their engagement in positive health care behaviors. Endocrinology providers have a significant role in promoting health behaviors for adolescents with T1D and knowing how to effectively communicate with adolescent patients in a way that will increase their engagement in positive health behaviors is important.

Future research should continue to examine different types of communication strategies and study the impact of MI on health outcomes for adolescents with T1D in a randomized controlled trial. Additionally, a greater sample size and a multisite study will allow greater generalizability of results. Clinically, findings suggest that targeted interventions for providers that focus on reducing the use of confronting and persuading patients and teaching providers other communication approaches, such as MI, that focus on the patients’ own reasons for change and highlighting patient autonomy, might have a positive impact on patient outcomes. Various types of interventions for adolescents with T1D should be examined in order to find the most effective method of providing care to these patients. For example, using MI as part of a stepped care with more involved treatment for adolescents who are at greater risk for poor adherence, might be an effective and cost-effective way to communicate with these patients to positively impact adherence. Studies should also examine how communication between providers, adolescents and parents should change as patients get older. Overall results from this evaluation of naturally occurring communication can help guide targeted training efforts and suggest a need for a further examination of effective communication strategies, such as MI, for providers of patients with T1D.

Appendix

Table A1

Description of Motivational Interviewing Treatment Integrity 4.1 Global Scores and Behavior Counts

Global Scores	**Description**	**High Global Score**
Cultivation Change Talk	Clinician actively encourages the patient's own language in favor of the change goal, and confidence for making that change	Clinician shows a marked and consistent effort to increase the depth, strength, or momentum of the patient's language in favor of change
Softening Sustain Talk	Clinician avoids a focus on the reasons against changing or for maintaining the status quo	Clinician shows a marked and consistent effort to decrease the depth, strength, or momentum of the patient's language in favor of the status quo
Partnership	Clinician conveys an understanding that expertise and wisdom about change reside mostly within the patient	Clinician actively fosters and encourages power sharing in the interaction in such a way that client's contributions substantially influence the nature of the session
Empathy	Clinician understands or makes an effort to grasp the patient's perspective and experience (i.e., how much the clinician attempts to "try on" what the patient feels or thinks)	Clinician shows evidence of deep understanding of patient's point of view, not just for what has been explicitly stated but what the patient means and has not said
Behavior Counts	**Description**	**Example Behavior Count**
Giving Information	Clinician gives information, educates, provides feedback, or expresses a professional opinion without persuading, advising, or warning	To answer your question, it is recommended that people eat at least 5 servings of fruit and vegetables each day.
Persuade	Clinician makes overt attempts to change the 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)	You can't get five fruits and vegetables in your diet every day unless you put some fruit in your breakfast.
Persuade with Permission	Clinician includes an emphasis on collaboration or autonomy support while persuading	Looking at your HbA1C level, it is apparent that you've been having some trouble controlling your blood sugar levels, despite your best efforts. My best advice at this point is for you is to switch to injectable insulin. But I don't know

		if that is something you are willing to consider. I'd welcome your thoughts.
Question	All questions from clinicians (open, closed, evocative, fact-finding, etc.)	What do you know about the importance of checking blood sugar before bed?
Simple Reflection	Clinician conveys understanding or facilitates patient-clinician exchanges; simple reflections add little or no meaning (or emphasis) to what patients have said	*Patient:* My mother is driving me crazy. She says she wants to remain independent, but she calls me four times a day with trivial questions. *Clinician:* Things are very stressful with your mother. (Simple Reflection)
Complex Reflection	Clinician 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	*Patient:* My mother is driving me crazy. She says she wants to remain independent, but she calls me four times a day with trivial questions. *Clinician:* You're having a hard time figuring out what your mother really wants. (Complex Reflection)
Affirm	Clinician accentuates something positive about the patient; the utterance must be genuine and about patients' strengths, efforts, intentions, or worth	You are the kind of person who takes her responsibilities seriously, wanting to do the right thing.
Seeking Collaboration	Clinician explicitly attempts to share power or acknowledge the expertise of the patient; genuinely seeks consensus with the patient regarding tasks, goals or directions of the session	I have your assessment results. Are you interested in going over those?
Emphasizing Autonomy	Clinician 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	You're the one who knows yourself best here. What do you think ought to be on this treatment plan?
Confront	Clinician confronts the patient by directly and unambiguously disagreeing, arguing, correcting, shaming, blaming, criticizing, labeling, warning, moralizing, ridiculing, or questioning the patient's honesty	Remember you said that your cholesterol level was a threat to your life. If you can't get your diet under control, you are risking a stroke or a heart attack.

Note. Global Score and Behavior Count descriptions and examples are from the Motivational Interview Treatment Integrity Coding Manual 4.1; HbA1c= Hemoglobin A1c

Table A2

Linear Regression Models Predicting Glycemic Control (HbA1c) at 3 months and 6 months

		HbA1c 3 months						**HbA1c 6 months**					
Models	**IV**	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***
1	MITI Technical	.512	.003	.131	.243	.060	.538	.430	.004	.183	.324	.069	.567
2	MITI Relational	.512	.002	-.088	.193	-.048	-.459	.426	.003	-.122	.262	-.054	-.465
3	Percent Complex Reflections	.513	.004	-.412	.717	-.062	-.575	.458	.033	-1.633	.979	-.190	-1.668
4	Reflection-to-Question Ratio	.519	.009	.601	.643	.103	.934	.430	.005	.496	.811	.071	.612
5	Total MI Adherent	.516	.007	.095	.121	.084	.783	.427	.001	-.048	.161	-.034	-.296
6	Total MI Non-Adherent	.554	.050	.130	.061	.242	2.132*	.471	.046	.148	.074	.236	1.993*
7	Working Alliance	.566	.056	-.015	.006	-.310	-2.419*	.485	.059	-.017	.008	-.312	-2.300*

Note. All models controlled for baseline HbA1c, adolescent age, adolescent race, and provider MI training experience in step 1. Coefficients shown are for the HbA1c variable in each model. SE = standard error; HbA1c = Hemoglobin A1c; MI = Motivational Interviewing; *$p < .05$, **$p < .01$, ***$p < .001$

Table A3

Linear Regression Models Predicting Adherence (DBRS) at 1 month and 3 month

		DBRS 1 month						**DBRS 3 months**					
Models	**IV**	**R^2**	**Δ R^2**	**B**	**SE**	**β**	***t***	**R^2**	**Δ R^2**	**B**	**SE**	**β**	***t***
1	MITI Technical	.458	.000	-.114	3.151	-.004	-.036	.629	.000	.023	2.465	.001	.009
2	MITI Relational	.484	.026	3.735	2.453	.162	1.522	.639	.010	2.172	1.949	.100	1.114
3	Percent Complex Reflections	.459	.002	-3.364	9.411	-.041	-.357	.655	.026	-13.395	7.306	-.171	-1.833
4	Reflection-to-Question Ratio	.490	.033	-13.793	8.033	-.191	-1.717	.630	.001	-2.080	6.681	-.030	-.311
5	Total MI Adherent	.459	.001	-.555	1.639	-.039	-.339	.630	.002	-.549	1.273	-.041	-.431
6	Total MI Non-Adherent	.517	.060	-1.96	.827	-.300	-2.389*	.639	.010	-.773	.681	-.121	-1.134
7	Working Alliance	.482	.025	.123	.083	.207	1.480	.645	.017	.100	.069	.174	1.448

Note. All models controlled for baseline DBRS, adolescent age, adolescent race, and provider MI training experience in step 1. Coefficients shown are for the DBRS variable in each model. SE = standard error; DBRS = Diabetes Behavior Rating Scale; MI = Motivational Interviewing; *$p < .05$, **$p < .01$, ***$p < .001$

Table A4

Linear Regression Models Predicting Self-Efficacy for Diabetes Self-Management (SEDSM) at 1 month and 3 months

		SEDSM 1 month						**SEDSM 3 months**					
Models	**IV**	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***
1	MITI Technical	.302	.000	.173	3.261	.007	.053	.256	.000	-.279	3.656	-.010	-.076
2	MITI Relational	.318	.016	2.729	2.664	.128	1.024	.260	.004	1.516	3.040	.066	.499
3	Percent Complex Reflections	.303	.000	1.616	10.126	.021	.160	.259	.003	5.120	11.609	.061	.441
4	Reflection-to-Question Ratio	.321	.018	-9.591	8.675	-.143	-1.106	.258	.002	-3.948	10.245	-.053	-.385
5	Total MI Adherent	.308	.005	.999	1.678	.075	.596	.260	.004	-.974	1.874	-.068	-.520
6	Total MI Non-Adherent	.418	.115	-2.495	.828	-.408	-3.014**	.349	.093	-2.440	.964	-.358	-2.532*
7	Working Alliance	.323	.021	.105	.088	.190	1.187	.320	.064	.212	.103	.347	2.051*

Note. All models controlled for baseline SEDSM, adolescent age, adolescent race, and provider MI training experience in step 1. Coefficients shown are for the DBRS variable in each model. SE = standard error; SEDSM= Self-efficacy for Diabetes Self-Management; MI = Motivational Interviewing; **p* < .05, ***p* < .01, ****p* < .001

Table A5

Linear Regression Models Predicting Pediatric Quality of Life (PedsQOL) at 1 month and 3 months

		PedsQOL 1 month						**PedsQOL 3 months**					
Models	**IV**	**R^2**	**Δ R^2**	**B**	**SE**	**β**	***t***	**R^2**	**Δ R^2**	**B**	**SE**	**β**	***t***
1	MITI Technical	.705	.012	10.232	7.602	0.114	1.346	.708	.015	.296	.194	.152	1.526
2	MITI Relational	.703	.010	7.388	6.087	.098	1.214	.697	.021	12.547	7.141	.152	1.757
3	Percent Complex Reflections	.700	.006	-21.755	22.498	-.081	-.967	.688	.013	7.842	5.813	.113	1.349
4	Reflection-to-Question Ratio	.694	.000	-2.210	20.610	-.009	-.107	.676	.676	-7.013	22.216	-.028	-.316
5	Total MI Adherent	.739	.045	10.192	3.620	.216	2.816**	.676	.000	3.026	20.424	.014	.148
6	Total MI Non-Adherent	.694	.001	-.756	2.039	-.035	-.371	.676	.001	.573	1.994	.028	.287
7	Working Alliance	.708	.015	.296	.194	.152	1.526	.684	.008	.215	.201	.117	1.069

Note. All models controlled for baseline PedsQOL, adolescent age, adolescent race, and provider MI training experience in step 1. Coefficients shown are for the DBRS variable in each model. SE = standard error; PedsQOL= Pediatric Quality of Life; MI = Motivational Interviewing; *p < .05, **p < .01, ***p < .001

Table A6

Linear Regression Models Predicting Diabetes Family Conflict (DFCS) at 1 month and 3 months

		DFCS 1 month						**DFCS 3 months**					
Models	**IV**	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***
1	MITI Technical	.467	.001	-.270	.986	-.031	-.273	.519	.012	.803	.756	.115	1.063
2	MITI Relational	.473	.008	-.649	.792	-.088	-.819	.507	.000	-.128	.621	-.022	-.207
3	Percent Complex Reflections	.486	.020	-3.854	2.865	-.146	-1.345	.508	.001	.708	2.341	.033	.302
4	Reflection-to-Question Ratio	.484	.018	3.282	2.589	.142	1.267	.524	.017	2.645	2.062	.140	1.283
5	Total MI Adherent	.469	.003	-.259	.504	-.056	-.513	.545	.038	.730	.374	.199	1.951
6	Total MI Non-Adherent	.469	.003	.134	.259	.063	.517	.571	.065	.502	.193	.288	2.609**
7	Working Alliance	.474	.009	-.022	.025	-.116	-.867	.548	.042	-.042	.021	-.268	-2.036*

Note. All models controlled for baseline DFCS, adolescent age, adolescent race, and provider MI training experience in step 1. Coefficients shown are for the DFCS variable in each model. SE = standard error; DFCS= Diabetes Family Conflict Scale; MI = Motivational Interviewing; *$p < .05$, **$p < .01$, ***$p < .001$

Table A7

Linear Regression Models Predicting Diabetes Family Responsibility (DFRQ) at 1 month and 3 months

		DFRQ 1 month						**DFRQ 3 months**					
Models	**IV**	**R^2**	**Δ R^2**	**B**	**SE**	**β**	***t***	**R^2**	**Δ R^2**	**B**	**SE**	**β**	***t***
1	MITI Technical	.371	.045	-1.321	.733	-.233	-1.803	.412	.010	-.592	.669	-.111	-.884
2	MITI Relational	.401	.075	-1.365	0.573	-0.287	-2.380*	.477	.075	-1.262	.502	-.281	-2.512*
3	Percent Complex Reflections	.326	.000	.138	2.155	.008	.064	.466	.064	4.311	1.879	.266	2.295*
4	Reflection-to-Question Ratio	.325	.000	-.015	1.956	-.001	-.007	.402	.000	.118	1.812	.008	.065
5	Total MI Adherent	.353	.028	-.516	.372	-.173	-1.385	.403	.001	-.106	.335	-.038	-.317
6	Total MI Non-Adherent	.326	.000	.029	.190	.021	.153	.402	.000	.000	.176	.000	.001
7	Working Alliance	.326	.000	-.003	.019	-.023	-.149	.405	.003	.009	.018	.073	.480

Note. All models controlled for baseline DFRQ, baseline HbA1c, adolescent age, adolescent race, and provider MI training experience in step 1. Coefficients shown are for the DBRS variable in each model. Lower scores indicate more parental responsibility for diabetes care, higher scores indicate more adolescent responsibility for diabetes care and mid-range scores indicate shared responsibility. SE = standard error; DFRQ= Diabetes Family Responsibility Questionnaire; MI = Motivational Interviewing; *$p < .05$, **$p < .01$, ***$p < .001$

Table A8

Linear Regression Models Predicting Patient Autonomy (HCCQ) at Baseline and 3 months

		HCCQ Baseline						**HCCQ 3 months**					
Models	**IV**	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***	**R^2**	**ΔR^2**	**B**	**SE**	**β**	***t***
1	MITI Technical	.158	.001	-.018	.088	-.027	-.203	.657	.014	-.077	.057	-.123	-1.349
2	MITI Relational	.162	.004	-.037	.072	-.067	-.514	.659	.016	-.067	.046	-.126	-1.433
3	Percent Complex Reflections	.229	.071	-.549	.255	-.274	-2.152*	.647	.004	.131	.185	.069	.709
4	Reflection-to-Question Ratio	.177	.020	-.259	.237	-.148	-1.094	.652	.008	.165	.160	.098	1.027
5	Total MI Adherent	.157	.000	.005	.042	.017	.127	.668	.025	-.053	.029	-.161	-1.847
6	Total MI Non-Adherent	.164	.007	.015	.023	.093	.649	.650	.007	-.014	.016	-.093	-.933
7	Working Alliance	.163	.006	-.001	.002	-.098	-.593	.645	.001	-.001	.002	-.046	-.399

Note. All models controlled for adolescent age, adolescent race, and provider MI training experience in step 1 and the second model additionally controlled for baseline HCCQ. Coefficients shown are for the HCCQ variable in each model. SE = standard error; HCCQ= Health Care Climate Questionnaire; MI = Motivational Interviewing; **p* < .05, ***p* < .01, ****p* < .001

Before Family Visit	Baseline (Before Visit)	Baseline (After Visit)	1 month	3 months (Before Visit)	3 months (After Visit)	6 months
Provider Survey						
	DBRS-A		DBRS-A	DBRS-A		
	SEDSM- A		SEDSM- A	SEDSM - A		
	PedsQOL-A		PedsQOL-A	PedsQOL-A		
	DFCS-A		DFCS-A	DFCS-A		
	DFRS-A		DFRS-A	DFRS-A		
		HCCQ- A			HCCQ- A	
	Demographic Questionnaire- P					
	DBRS-P		DBRS-P	DBRS-P		
	PedsQOL-P		PedsQOL-P	PedsQOL-P		
	DFCS-P		DFCS-P	DFCS-P		
	DFRS-P		DFRS-P	DFRS-P		
Medical Chart Review		Medical Chart Review			Medical Chart Review	Medical Chart Review
		Transcription of all encounters				
		MI Coding & WAI-O				

Figure A1. Timeline of measures. MI = Motivational interviewing; A= Adolescent measure; P= Parent measure; DBRS= Diabetes Behavior Rating Scale; HCCQ= Health Care Climate Questionnaire; SEDSM= Self-Efficacy for Diabetes Self-Management Scale; PedsQOL= Diabetes Pediatric Quality of Life; DFCS= Diabetes Family Conflict Scale; DFRQ= Diabetes Family Responsibility Questionnaire; WAI-O= Working Alliance Inventory Observer Version

References

Amiel, S. A., Sherwin, R. S., Simonson, D. C., Lauritano, A. A., & Tamborlane, W. V. (1986). Impaired insulin action in puberty. *New England Journal of Medicine, 315*(4), 215-219. doi:10.1056/NEJM198607243150402

Anderson, B., Ho, J., Brackett, J., Finkelstein, D., & Laffel, L. (1997). Parental involvement in diabetes management tasks: Relationships to blood glucose monitoring adherence and metabolic control in young adolescents with insulin-dependent diabetes mellitus. *The Journal of Pediatrics, 130*(2), 257-265. doi:10.1016/S0022-3476(97)70352-4

Anderson, B. J. (2004). Family conflict and diabetes management in youth: Clinical lessons from child development and diabetes research. *Diabetes Spectrum, 17*(1), 22-26. doi:10.2337/diaspect.17.1.22

Anderson, B. J., Holmbeck, G., Iannotti, R. J., McKay, S. V., Lochrie, A., Volkening, L. K., & Laffel, L. (2009). Dyadic measures of the parent-child relationship during the transition to adolescence and glycemic control in children with type 1 diabetes. *Families, Systems & Health : The Journal of Collaborative Family Healthcare, 27*(2), 141. doi:10.1037/a0015759

Armstrong, M. J., Mottershead, T. A., Ronksley, P. E., Sigal, R. J., Campbell, T. S., & Hemmelgarn, B. R. (2011). Motivational interviewing to improve weight loss in overweight and/or obese patients: A systematic review and meta-analysis of randomized controlled trials. *Obesity Reivew, 12*(9), 709-723. doi:10.1111/j.1467-789X.2011.00892.x

American Diabetes Association. (2012). Executive summary: Standards of medical care in diabetes—2012. *Diabetes Care, 35*(1), 4-10. doi:10.2337/dc12-s004

Bean, M. K., Biskobing, D., Francis, G. L., & Wickham III, E. P. (2012). Motivational interviewing in health care: Results of a brief training in endocrinology. *Journal of Graduate Medical Education, 4*(3), 357-361. doi: 10.4300/JGME-D-11-00166.1

Bell, R. A., Mayer-Davis, E. J., Beyer, J. W., D'Agostino, R. B., Jr., Lawrence, J. M., Linder, B., . . . Dabelea, D. (2009). Diabetes in non-Hispanic white youth: Prevalence, incidence, and clinical characteristics the SEARCH for Diabetes in Youth Study. *Diabetes Care, 32*(2), 102-111. doi:10.2337/dc09-S202

Bennett, J. K., Fuertes, J. N., Keitel, M., & Phillips, R. (2011). The role of patient attachment and working alliance on patient adherence, satisfaction, and health-related quality of life in lupus treatment. *Patient Education and Counseling, 85*(1), 53-59. doi:10.1016/j.pec.2010.08.005

Berg, C. A., Wiebe, D. J., Beveridge, R. M., Palmer, D. L., Korbel, C. D., Upchurch, R., . . . Donaldson, D. L. (2007). Mother–child appraised involvement in coping with diabetes stressors and emotional adjustment. *Journal of Pediatric Psychology, 32*(8), 995-1005. doi:10.1093/jpepsy/jsm043

Brown, R. T., Wiener, L., Kupst, M. J., Brennan, T., Behrman, R., Compas, B. E., . . . Zeltzer, L. (2008). Single parents of children with chronic illness: An understudied phenomenon. *Journal of Pediatric Psychology, 33*(4), 408-421. doi:10.1093/jpepsy/jsm079

Bryden, K. S., Dunger, D. B., Mayou, R. A., Peveler, R. C., & Neil, H. A. (2003). Poor prognosis of young adults with type 1 diabetes: A longitudinal study. *Diabetes Care, 26*(4), 1052-1057. doi:10.2337/diacare.26.4.1052

Bryden, K. S., Peveler, R. C., Stein, A., Neil, A., Mayou, R. A., & Dunger, D. B. (2001). Clinical and psychological course of diabetes from adolescence to young adulthood: A longitudinal cohort study. *Diabetes Care, 24*(9), 1536-1540. doi:10.2337/diacare.24.9.1536

Caccavale, L. J., Nansel, T. R., Quick, V., Lipsky, L. M., Laffel, L. M., & Mehta, S. N. (2015). Associations of disordered eating behavior with the family diabetes environment in adolescents with type 1 diabetes. *Journal of Developmental and Behavioral Pediatrics, 36*(1), 8-13. doi:10.1097/dbp.0000000000000116

Carroll, A. E., & Marrero, D. G. (2006). The role of significant others in adolescent diabetes: A qualitative study. *The Diabetes Educator, 32*(2), 243-252. doi:10.1177/0145721706286893

Centers of Disease Control and Prevention. (2011). National diabetes fact sheet: National estimates and general Information on diabetes and prediabetes in the United States, 2011. Retrived from: https://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf.

Channon, S., Smith, V. J., & Gregory, J. W. (2003). A pilot study of motivational interviewing in adolescents with diabetes. *Archives of Diseases in Childhood, 88*(8), 680-683. doi: 10.1136/adc.88.8.680

Ciechanowski, P., Russo, J., Katon, W., Von Korff, M., Ludman, E., Lin, E., . . . Bush, T. (2004). Influence of patient attachment style on self-care and outcomes in diabetes. *Psychosomatic Medicine*, *66*(5), 720. doi: 10.1097/01.psy.0000138125.59122.23

Croom, A., Wiebe, D. J., Berg, C. A., Lindsay, R., Donaldson, D., Foster, C., . . . Swinyard, M. T. (2011). Adolescent and parent perceptions of patient-centered communication while managing type 1 diabetes. *Journal of Pediatric Psychology, 36*(2), 206-215. doi:10.1093/jpepsy/jsq072 de Ferranti, S. D., de Boer, I. H., Fonseca, V., Fox, C. S., Golden, S. H., Lavie, C. J., . . . Eckel, R. H. (2014). Type 1 diabetes mellitus and cardiovascular disease: A scientific statement from the American Heart Association and American Diabetes Association. *Circulation, 130*(13), 1110. doi:10.1161/cir.0000000000000034

Deci, E. L., & Ryan, R. M. (2002). *Handbook of Self-determination Research*. Rochester: University of Rochester Press.

Emmons, K. M., & Rollnick, S. (2001). Motivational interviewing in health care settings: Opportunities and limitations. *American Journal of Preventive Medicine, 20*(1), 68-74. doi:10.1016/s0749-3797(00)00254

Erickson, S. J., Gerstle, M., & Feldstein, S. W. (2005). Brief interventions and motivational interviewing with children, adolescents, and their parents in pediatric health care settings: A review. *Archives of Pediatrics & Adolescent Medicine, 159*(12), 1173-1180. doi:10.1001/archpedi.159.12.1173

Fuertes, J. N., Mislowack, A., Bennett, J., Paul, L., Gilbert, T. C., Fontan, G., & Boylan, L. S. (2007). The physician-patient working alliance. *Patient Education and Counseling, 66*(1), 29. doi: 10.1016/j.pec.2006.09.013

Gayes, L. A., & Steele, R. G. (2014). A meta-analysis of motivational interviewing interventions for pediatric health behavior change. *Journal of Consulting and Clinical Psychology, 82*(3), 521-535. doi:10.1037/a0035917

Guttmann-Bauman, I., Flaherty, B. P., Strugger, M., & McEvoy, R. C. (1998). Metabolic control and quality-of-life self-assessment in adolescents with IDDM. *Diabetes Care, 21*(6), 915-918. doi:10.2337/diacare.21.6.915

Ha, J. F., & Longnecker, N. (2010). Doctor-patient communication: A review. *The Ochsner Journal, 10*(1), 38. doi: 10.1016/0277-9536(94)00155-M

Hannon, T. S., Janosky, J., & Arslanian, S. A. (2006). Longitudinal study of physiologic insulin resistance and metabolic changes of puberty. *Pediatric Research, 60*(6), 759-763. doi:10.1203/01.pdr.0000246097.73031.27

Hanson, W. E., Curry, K. T., & Bandalos, D. L. (2002). Reliability generalization of working alliance inventory scale scores. *Educational and Psychological Measurement, 62*(4), 659-673. doi: 10.1177/001316402128775076

Heisler, M., Bouknight, R., Hayward, R., Smith, D. M., & Kerr, E. (2002). The relative importance of physician communication, participatory decision making, and patient understanding in diabetes self-management. *Journal of General Internal Medicine, 17*(4), 243-252. doi: 10.1046/j.1525-1497.2002.10905.x

Helgeson, V. S., Honcharuk, E., Becker, D., Escobar, O., & Siminerio, L. (2011). A focus on blood glucose monitoring: relation to glycemic control and determinants of frequency. *Pediatric Diabetes, 12*(1), 25. doi:10.1111/j.1399-5448.2010.00663.x

Helgeson, V. S., Siminerio, L., Escobar, O., & Becker, D. (2009). Predictors of metabolic control among adolescents with diabetes: A 4-Year longitudinal study. *Journal of Pediatric Psychology, 34*(3), 254-270. doi: 10.1093/jpepsy/jsn079

Hettema, J., Steele, J., & Miller, W. R. (2005). Motivational Interviewing. *Annual Review of Clinical Psychology, 1*(1), 91-111. doi:10.1146/annurev.clinpsy.1.102803.143833

Hilliard, M. E., Holmes, C. S., Chen, R., Maher, K., Robinson, E., & Streisand, R. (2013). Disentangling the roles of parental monitoring and family conflict in adolescents' management of type 1 diabetes. *Health Psychology, 32*(4), 388-396. doi:10.1037/a0027811

Hilliard, M. E., Wu, Y. P., Rausch, J., Dolan, L. M., & Hood, K. K. (2013). Predictors of deteriorations in diabetes Management and control in adolescents with type 1 diabetes. *Journal of Adolescent Health, 52*(1), 28-34. doi:10.1016/j.jadohealth.2012.05.009

Holmbeck, G. N. (1996). A Model of family relational transformations during the transition to adolescence: Parent-adolescent conflict and adaptation. In J. A. Graber, J. Brooks-Gunn, & A. C. Petersen (Eds.), *Transitions through adolescence: Interpersonal domains and contexts*, 167-199. Mahwah: Erlbaum.

Hood, K. K., Peterson, C. M., Rohan, J. M., & Drotar, D. (2009). Association between adherence and glycemic control in pediatric type 1 diabetes: A meta-analysis. *Pediatrics, 124*(6), 1171. doi:10.1542/peds.2009-0207

Horvath, A. O., Greenberg, L. S. . (1989). Development and validation of the working alliance inventory. *Journal of Counseling Psychology, 36*(2), 223-233. doi:10.1037/0022-0167.36.2.223

Iannotti, R. J., Schneider, S., Nansel, T. R., Haynie, D. L., Plotnick, L. P., Clark, L. M., . . . Simons-Morton, B. (2006). Self-efficacy, outcome expectations, and diabetes self-management in adolescents with type 1 diabetes. *Journal of Developmental and Behavioral Pediatrics 27*(2), 98-105. doi: 0196-206X/06/2702-0098

Maher, K., & Bean, M. K. (2014). Treatment of children and adolescents with type 1 diabetes. In L. Grossman & S. Walfish (Eds.), *Translating Research into Practice: A Desk Reference for Practicing Mental Health Professionals*. New York: Springer.

Martins, R. K., & McNeil, D. W. (2009). Review of Motivational Interviewing in promoting health behaviors. *Clinical Psychology Review, 29*(4), 283-293. doi:10.1016/j.cpr.2009.02.001

McLeod, B., Jensen-Doss, A., Tully, C., Southam-Gerow, M., Weisz, J., & Kendall, P. (2016). The Role of Setting Versus Treatment Type in Alliance Within Youth Therapy. Journal of Consulting and Clinical Psychology, Journal of Consulting and Clinical Psychology, 2016. doi: 10.1037/ccp0000081

Menke, J. A., Orchard, M. T., Imperatore, C. G., Bullard, C. K., Mayer-Davis, C. E., & Cowie, C. C. (2013). The prevalence of type 1 diabetes in the United States. *Epidemiology, 24*(5), 773-774. doi:10.1097/EDE.0b013e31829ef01a

Miller, W. R., & Rollnick, S. (2004). Talking oneself into change: Motivational Interviewing, stages of change, and therapeutic process. *Journal of Cognitive Psychotherapy, 18*(4), 299-308. doi:10.1891/088983904780944306

Miller, W. R., & Rollnick, S. (2012). Meeting in the middle: Motivational interviewing and self-determination theory. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 25. doi:10.1186/1479-5868-9-25

Miller, W. R., & Rollnick, S. (2013). *Motivational Interviewing: Helping People Change* (Third ed.). New York: Guilford.

Miller, W. R., Yahne, C. E., Moyers, T. B., Martinez, J., & Pirritano, M. (2004). A randomized trial of methods to help clinicians learn motivational interviewing. *Journal of Consulting and Clinical Psychology, 72*(6), 1050-1062. doi:10.1037/0022-006X.72.6.1050

Monaghan, M., Helgeson, V., & Wiebe, D. (2015). Type 1 diabetes in young adulthood. *Current Diabetes Review, 11*(4), 239-250. Retrived from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4526384/pdf/nihms692733.pdf

Moyers, T. B., Manuel, J., & Ernst, D. (2014). *Motivational Interviewing Treatment Integrity Coding Manual 4.1. Unpublished manual*. Retrived from: http://www.motivationalinterviewing.org/sites/default/files/miti4_2.pdf

Moyers, T. B., & Martin, T. (2006). Therapist influence on client language during motivational interviewing sessions. *Journal of Substance Abuse Treatment, 30*(3), 245-251. doi:10.1016/j.jsat.2005.12.003

Moyers, T. B., Martin, T., Christopher, P. J., Houck, J. M., Tonigan, J. S., & Amrhein, P. C. (2007). Client language as a mediator of motivational interviewing efficacy: Where is the evidence? *Alcoholism: Clinical and Experimental Research, 31*, 40-47. doi:10.1111/j.1530-0277.2007.00492.x

Mullins, L. L., Wolfe-Christensen, C., Chaney, J. M., Elkin, T. D., Wiener, L., Hullmann, S. E., . . . Junghans, A. (2011). The relationship between single-parent status and parenting capacities in mothers of youth with chronic health conditions: The mediating role of income. *Journal of Pediatric Psychology, 36*(3), 249-257. doi:10.1093/jpepsy/jsq080

Naar-King, S., & Suarez, M. (2010). *Motivational Interviewing with Adolescents and Young Adults* New York: The Guilford Press.

Naughton, M. J., Ruggiero, A. M., Lawrence, J. M., Imperatore, G., Klingensmith, G. J., Waitzfelder, B., . . . Loots, B. (2008). Health-related quality of life of children and adolescents with type 1 or type 2 diabetes mellitus: SEARCH for diabetes in youth study.

Archives of Pediatrics & Adolescent Medicine, 162(7), 649. doi:10.1001/archpedi.162.7.649

Ng, J., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts. *Perspectives on Psychological Science, 7*(4), 325-340. doi:10.1177/1745691612447309

Ott, J., Greening, L., Palardy, N., Holderby, A., & Debell, W. K. (2000). Self-Efficacy as a mediator variable for adolescents' adherence to treatment for insulin-dependent diabetes mellitus. *Children's Health Care, 29*(1), 47-63. doi:10.1207/S15326888CHC2901_4

Pollak, K. I., Alexander, S. C., Coffman, C. J., Tulsky, J. A., Lyna, P., Dolor, R. J., . . . Ostbye, T. (2010). Physician communication techniques and weight loss in adults: Project CHAT. *American Journal of Preventative Medicine, 39*(4), 321-328. doi:10.1016/j.amepre.2010.06.005

Pollak, K. I., Alexander, S. C., Ostbye, T., Lyna, P., Tulsky, J. A., Dolor, R. J., . . . Bravender, T. (2009). Primary care physicians' discussions of weight-related topics with overweight and obese adolescents: Results from the Teen CHAT Pilot study. *Journal of Adolescent Health, 45*(2), 205-207. doi:10.1016/j.jadohealth.2009.01.002

Pollak, K. I., Alexander, S. C., Tulsky, J. A., Lyna, P., Coffman, C. J., Dolor, R. J., . . . Ostbye, T. (2011). Physician empathy and listening: associations with patient satisfaction and autonomy. *Journal of the American Board of Family Medicine, 24*(6), 665-672. doi:10.3122/jabfm.2011.06.110025

Powell, P., Hilliard, M., & Anderson, B. (2014). Motivational interviewing to promote adherence behaviors in pediatric type 1 diabetes. *Current Diabetes Reports, 14*(10), 1-8. doi:10.1007/s11892-014-0531-z

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behavior Research Methods, Instruments, & Computers, 36(4), 717- 731.doi: 10.3758/BF03206553

Prochaska, J. O., & Diclemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice, 19*(3), 276-288. doi:10.1037/h0088437

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47*(9), 1102-1114. doi:10.1037/0003-066x.47.9.1102

Reeves, G., Dolan, L., Drotar, D., Rausch, J., Hood, K., Delamater, A., . . . Rohan, J. (2012). Changes in treatment adherence and glycemic control during the transition to adolescence in type 1 diabetes. *Diabetes Care, 35*(6), 1219-1224. doi: 10.2337/dc11-2163

Rewers, M., Pihoker, C., Donaghue, K., Hanas, R., Swift, P., & Klingensmith, G. J. (2007). Assessment and monitoring of glycemic control in children and adolescents with diabetes. *Pediatric Diabetes, 8*(6), 408-418. doi:10.1111/j.1399-5448.2007.00352.x

Robling, M., McNamara, R., Bennert, K., Butler, C. C., Channon, S., Cohen, D., . . . Gregory, J. W. (2012). The effect of the Talking Diabetes consulting skills intervention on glycaemic control and quality of life in children with type 1 diabetes: Cluster randomised controlled trial (DEPICTED study). *British Medical Journal, 344*, 2359. doi:10.1136/bmj.e2359

Rollnick, S., Miller, W. R., & Butler, C. C. (2008). *Motivational Interviewing in Healthcare: Helping Patients Change Behavior*. New York: The Guilford Press.

Sherbourne, C., Hays, R., Ordway, L., DiMatteo, M., & Kravitz, R. (1992). Antecedents of adherence to medical recommendations: Results from the medical outcomes study. *Journal of Behavioral Medicine, 15*(5), 447-468. doi:10.1007/bf00844941

Silverstein, J., Klingensmith, G., Copeland, K., Plotnick, L., Kaufman, F., Laffel, L., . . . Clark, N. (2005). Care of children and adolescents with type 1 diabetes: A statement of the American Diabetes Association. *Diabetes Care, 28*(1), 186-212. doi:10.2337/diacare.28.1.186

Simon, H., & Zieve, D. (2013). Type 1 Diabetes: University of Maryland Medical Center Retrieved from http://umm.edu/health/medical/reports/articles/diabetes-type-1

Springer, D., Dziura, J., Tamborlane, W. V., Steffen, A. T., Ahern, J. H., Vincent, M., & Weinzimer, S. A. (2006). Optimal control of type 1 diabetes mellitus in youth receiving intensive treatment. *Journal of Pediatrics, 149*(2), 227-232. doi:10.1016/j.jpeds.2006.03.052

Standards of Medical Care in Diabetes—2014. (2014). *Diabetes Care, 37*(1), 14-80. doi:10.2337/dc14-S014

Suarez, M., & Mullins, S. (2008). Motivational interviewing and pediatric health behavior interventions. *Journal of Developmental and Behavioral Pediatrics, 29*(5), 417. doi:10.1097/DBP.0b013e31818888b4

The Diabetes Control and Complications Trial Research Group (1993). The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus.. *The New England Journal of Medicine, 329*(14), 977-986. doi:10.1056/NEJM199309303291401

Van Servellen, G. M. (1997). *Communication skills for the health care professional : Concepts and techniques*. Gaithersburg, Md.: Aspen Publishers.

Viinamaki, H., Niskanen, L., Korhonen, T., & Tahka, V. (1993). The patient-doctor relationship and metabolic control in patients with type 1 (insulin-dependent) diabetes mellitus. *International Journal of Psychiatry in Medicine, 23*(3), 265-274. doi: 10.2190/GLKJ-1G71-NCD6-DP6K

Visentin, K., Koch, T., & Kralik, D. (2006). Adolescents with type 1 diabetes: Transition between diabetes services. *Journal of Clinical Nursing, 15*(6), 761-769. doi:10.1111/j.1365-2702.2006.01347.x

Weissberg-Benchell, J., Wolpert, H., & Anderson, B. J. (2007). Transitioning from pediatric to adult care: A new approach to the post-adolescent young person with type 1 diabetes. *Diabetes Care, 30*(10), 2441-2446. doi:dc07-124910.2337/dc07-1249

Willi, S. M., Miller, K. M., DiMeglio, L. A., Klingensmith, G. J., Simmons, J. H., Tamborlane, W. V., . . . Network. (2015). Racial-ethnic disparities in management and outcomes among children qith type 1 diabetes. *Pediatrics, 135*(3), 424-434. doi:10.1542/peds.2014-1774

Wills, C. J., Scott, A., Swift, P. G., Davies, M. J., Mackie, A. D., & Mansell, P. (2003). Retrospective review of care and outcomes in young adults with type 1 diabetes. *British Medical Journal, 327*(7409), 260-261. doi:10.1136/bmj.327.7409.260327/7409/260

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