Case Study: Feasibility of Multisystemic Therapy as a Treatment for Urban Adolescents With Poorly Controlled Type 1 Diabetes

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Objective To determine the feasibility of using multisystemic therapy (MST), an intensive, home-based psychotherapy, to improve poor metabolic control among four adolescents with type 1 diabetes. Method A multiple baseline, repeated measures design was used. Blood glucose readings were obtained every 2 weeks during a baseline period, a 7-month intervention, and a month-long postintervention period. Glycosylated hemoglobin (GHb) was measured at baseline and follow-up and was contrasted between two participants who received MST and two participants who did not receive the intervention. Results Intervention participants showed improvements in health status, as well as fewer hospitalizations and emergency room visits. Conclusions Findings from this case study suggest that MST has the potential to improve treatment adherence and metabolic control among teens with poorly controlled type 1 diabetes.

Key words treatment adherence; diabetes; multisystemic therapy.

Adherence to certain aspects of the diabetic medical regimen such as diet and exercise is less than optimal for many children and teens with type 1 diabetes. However, a subset of teens neglect multiple aspects of their self-care, including insulin injections, blood glucose monitoring, and diet (Kovacs, Goldston, Obrosky, & Iyengar, 1992). Such poor treatment adherence has serious health consequences; for instance, not taking insulin has been identified as the primary cause of hospitalization for diabetic ketoacidosis (DKA) among children with type 1 diabetes (Weissberg-Benchell et al., 1995). Even though such individuals consume a disproportionate share of health care dollars spent on diabetes (Javor et al., 1997), almost no research has focused on the etiology of such severe treatment noncompliance in the pediatric population. Glasgow et al. (1999) suggest that poor adherence results from multiple risk factors, including individual factors (e.g., child depression), family factors (e.g., lack of family routines and structure), contextual factors (e.g., unsupportive school or work environment), and cultural/community factors (e.g., poor quality of medical care).

During our work as part of a multidisciplinary team treating minority adolescents with type 1 diabetes, we became aware that our clinic treated many adolescents who had serious problems with treatment adherence and very poor metabolic control. Our clinical observations were that those adolescents with the poorest adherence had a variety of problems, including child and parent psychopathology, family disorganization and stress, limited support for diabetes care within contexts such as school and neighborhood, and poor patient–health care provider interface. However, the types of interventions that address adherence problems among adolescents with type 1 diabetes such as educational interventions (Brandt, 1998), coping skills training (Grey, Boland, Davidson, Li, & Tamborland, 2000), support groups (Satin, La Greca, Zigo, & Skyler, 1989), and family therapy (Wysocki et al., 2000) apparently were not broad enough to target all these problem areas. In addition, those children with severe adherence difficulties and their families resisted trying traditional, hospital-based treatment, such as educational interventions or outpatient psychotherapy.
and were difficult to retain in treatment when they did attend.

This study tested the feasibility of using multystemic therapy (MST; Henggeler, 1999), an innovative home-based psychotherapy, to improve the treatment adherence and metabolic control of urban adolescents with type 1 diabetes who were in poor metabolic control. We selected MST as the intervention paradigm for several reasons. First, MST has previously been used to successfully intervene with adolescents and families with serious mental health problems, including delinquent teens, teens hospitalized for psychiatric emergencies, and juvenile sexual offenders (Borduin et al., 1995; Henggeler, 1999; Henggeler et al., 1999). As a result, MST seemed likely to be effective in treating severe adherence problems. Furthermore, consistent with models of predictors of diabetes treatment adherence, MST interventions encompass the individual adolescent, the family system, and the broader community systems within which the family operates (i.e., school, hospital). Therefore, the MST treatment approach was an excellent fit with known models of diabetes treatment adherence. The community-based approach used in MST also was seen as advantageous because the intervention would be convenient for families and reduce the likelihood that treatment would be refused. In addition, use of an in-home intervention allowed us to observe daily adherence behaviors.

Aims for this case study were to determine whether participants could be recruited into a research program and subsequently retained, to establish what therapy modifications were necessary to use MST in a population with physical (rather than mental) illness, and to provide clinical data regarding the effectiveness of MST for improving health outcomes among teens with type 1 diabetes in poor metabolic control.

Method

Participants

The sample was drawn from an endocrinology clinic within a tertiary care children's hospital located in a major metropolitan area. To be eligible for the study, participants had to be diagnosed with type 1 diabetes for at least a year and have a glycosylated hemoglobin (GHb) of 14% or above (approximately equal to a mean blood sugar of 230). Since there are no consistent guidelines for defining very poor control, 14% was chosen because it marked the 90th percentile in the distribution of GHb for children seen in the participating clinic. Participants had to be between the ages of 12 and 16 and live in the metropolitan area near the hospital. All four families contacted at random from a list of 18 eligible families agreed to participate. The sample consisted of four girls ages 14 to 15 who were African American and lived in single parent households. Mean yearly family income was $20,000. GHbs for the sample ranged from 17.3% to 21.6% at study entry, with a mean of 19.0%, although the goal of diabetes management was for patients to achieve GHbs of 10% or lower. The research was approved by the institutional review board of the university affiliated with the hospital where the teens were seen for medical care; all four participants and their parents gave informed consent to participate.

All four families completed baseline data collection. Subsequent to baseline data collection, families were assigned to a therapist. However, two of the families were unwilling to make and keep initial therapy appointments and therefore received no intervention. GHbs obtained for clinical care purposes were available via chart review for the two families who received no intervention and are presented here for comparison.

Measures

Glycosylated Hemoglobin. Metabolic control was measured via GHb, an indirect and retrospective measure of average blood glucose levels over the previous 2- to 3-month period (Cohen, 1986). High levels of GHb indicate higher blood glucose levels, thus poorer metabolic control. GHb was measured using the HPLC method.

Glucose Meter Readings. All families were provided with blood glucose meters capable of storing up to 5 weeks of blood glucose readings (based on four tests per day) along with information about the date and time of testing. Glucose meters were downloaded by laptop computer in the participants' homes by a research assistant every 2 weeks to obtain objective data on mean blood glucose tested during the 14-day period prior to data collection.

Procedure

The study used a multiple baseline, repeated measures design. Blood glucose readings were obtained in the home every 2 weeks and served as the repeated measure during a baseline (pre-intervention) period lasting 4 to 6 weeks, the intervention period that lasted approximately 7 months, and a postintervention period lasting 1 month. Glucose meters and test strips were provided to families at their initial data collection visit, ensuring that the meter being used was able to store a sufficient number of glucose tests and that there would be comparability in the sensitivity and specificity of the blood glucose reading. Blood draws for measuring GHb were completed at baseline, at completion of the intervention, and 3 months after the intervention. If a GHb measure had been collected as part
of standard care within 1 month of any of these time points, it was not repeated for research purposes and the clinical data were used.

**Intervention**

MST is an intensive, family-centered, community-based treatment originally designed for use with adolescents presenting with serious antisocial behavior (Borduin et al., 1995; Henggeler et al., 1999). MST is not a typical standardized “one size fits all” psychotherapy approach where the therapist implements a set of pre-arranged interventions in a prescribed sequence. MST therapists begin by conducting a multisystemic assessment of the strengths and weaknesses of family members, then, based on this assessment, tailor interventions to each family to best treat the identified problem behavior. Subsequently, the therapist provides in-home therapy sessions. Problems identified during the assessment phase are explicitly targeted for change during the treatment phase (called “overarching goals”). Treatment is terminated when overarching goals are met. For this study, overarching goals included taking insulin as prescribed, testing blood sugars three times per day, and eating three meals and two snacks per day.

Treatment fidelity was monitored via weekly supervision sessions with the on-site supervisor and weekly phone consultations between the treatment team and an MST expert consultant. Therapists and their supervisor received formal, week-long training in MST from the developers of the program.

MST interventions targeted adherence-related problems identified within the family system, peer system, and broader community systems with which the family was involved. Therapists drew on a menu of evidence-based intervention techniques that included individual cognitive-behavioral therapy, parent training, and behavioral family systems therapy. For example, family interventions included introducing systematic monitoring, reward, and discipline systems to increase parental supervision of the diabetic regimen, developing family organizational routines such as regular meal times, teaching strategies for problem solving day-to-day conflicts, and using social support networks of friends or extended family members who could assist with diabetes care. Peer interventions included encouraging disclosure of diabetic status to peers and meeting with peers to promote active support of diabetes care when the teen was out of the house. Community interventions included developing strategies to monitor and promote the teen’s diabetes care while the teen was attending school or involved in other extracurricular activities (see Henggeler, 1999, for a complete review of MST).

At the level of the health care system, interventions included helping the family overcome any barriers to keeping outpatient appointments and improving patient-provider relationships. Individualized education sessions to address deficits in knowledge about diabetes care were also provided as needed and were conducted by a diabetes nurse educator available for outpatient appointments.

**Results**

**Treatment Modifications**

Ongoing training and quality assurance was provided via weekly phone calls with an MST expert consultant. The training was adapted by the research team to include formal diabetes education for therapists as well as education regarding factors that predict poor treatment adherence and metabolic control among adolescents with type 1 diabetes. Therapists were trained to have sufficient knowledge regarding type 1 diabetes so they could conduct certain types of basic diabetes care interventions with families (e.g., reinforce how to count carbohydrates). Therapists were also trained to download glucose meters and complete 24-hour recall interviews in the home so that quantitative evidence of improvements in adherence could be obtained.

Families were seen two to three times per week for sessions that lasted approximately an hour. Length of treatment in this study was longer than that reported in other MST research, where the mean was 4 to 6 months (Henggeler, 1999); however, frequency of contact was also somewhat lower.

**Treatment Efficacy**

**Case 1.** Participant was a 14-year-old African American girl diagnosed with type 1 diabetes for approximately 10 years who resided with her biological mother. Participant had stable, high GHbs ranging from 19.5% to 24.3% in the 2 years prior to study enrollment (GHb at study entry was 21.2% and she was taking medication to treat early renal complications). The MST assessment identified the following causes for poor treatment adherence: (a) poor family understanding of appropriate dietary management of diabetes; (b) significant parent-child conflict, with the participant using sulking and withdrawal as a strategy to punish mother when mother attempted to impose appropriate limits for misbehavior, including noncompliance with diabetes regimen; (c) lack of supervision and monitoring of the diabetes regimen by mother; (d) lack of maternal social support and presence of maternal depression; and (e) poor interpersonal relationships with the endocrinology treatment team. MST interventions included: (a) scheduling appointments with the clinic die-
titian in order to improve family understanding of dietary management; (b) using family therapy interventions to have mother take appropriate charge of participant's diabetes regimen (e.g., having participant give injections in front of mother) while improving the affective component of their relationship by increasing the frequency of enjoyable mother–daughter activities; (c) assisting mother in obtaining treatment for her depression including medication and psychotherapy; and, finally, (d) ensuring that the family kept routine clinic appointments and used daily clinic phone in–hour to get advice from diabetes nurse practitioner and having the family prepare questions for care providers in advance of clinic visits.

Examination of the mean 14-day blood glucose level over the baseline, intervention, and follow-up period show considerable improvement in health status for this participant. Mean 14-day blood glucose dropped from a high of 387 mg/dL during baseline to 249 mg/dL at her last download completed 6 weeks after the termination of therapy (change = 138 mg/dL) (see Figure 1). Frequency of participant's blood glucose testing was stable over the course of the intervention. She tested two times a day on average at baseline and 1.8 times a day on average at the time of the last download (range = 1.6 to 2.4).

Case 2. Participant was a 15-year-old African American girl diagnosed with type 1 diabetes for 5.5 years who resided with her biological mother. She had stable, high 

GHbs ranging from 16.6% to 17.3% in the 2 years prior to study entry, and her 

GHb at study entry was 17.8%. The MST assessment identified the following causes for poor treatment adherence: (a) depression and physical illness on the part of the mother who had type 2 diabetes; (b) poor overall diabetes knowledge, complicated by confounding of information about type 2 diabetes with type 1 diabetes (e.g., teen thought that she might be able to “come off insulin some day”); (c) lack of monitoring of diabetes regimen by mother; (d) poor academic achievement and school attendance by participant, so that school personnel had limited knowledge of her medical needs and did not accommodate them; and (e) poor relationships with the endocrinology treatment team, including inadequate contact and appointment adherence. MST interventions included: (a) assisting mother to improve her own health by setting visits with her own physician and accompanying her to appointments and increasing maternal social support from a family member who was a nurse; (b) scheduling appointments with the diabetes nurse educator so that family could improve their diabetes knowledge; (c) improving maternal monitoring of diabetic medical regimen by implementing a behavioral contract for taking insulin, testing blood sugars, and eating meals at the correct times; (d) working with school personnel to make school accommodations for the participant's diabetes care and improving mother's relationship with school personnel by increasing her contact and communication with them; and, finally, (e) assisting mother to keep endocrine clinic appointments and use the daily call-in phone hour run by the clinic nurse and accompanying the family to clinic appointments to improve patient–provider communication.

Examination of the mean 14-day blood glucose level...
over the baseline, intervention, and follow-up periods show modest improvement in health status for this participant. Mean 14-day blood glucose dropped from a high of 323 mg/dL during baseline to a low of 266 mg/dL at her last download 6 weeks after completion of treatment (change = 57 mg/dL) (see Figure 2). Participant’s frequency of blood glucose testing increased steadily over the course of the intervention. She tested 1.6 times per day on average at baseline and 3.4 times per day at the time of her last download (range = 1.2 to 3.4).

The following changes in GHb were documented for the four study families over the entire 10-month study period. For participant 1 (treatment family), GHb declined from a high of 21.6% at study entry to a low of 11.8% at 3 months after treatment. For participant 2 (treatment family), GHb declined from a high of 17.8% at study entry to a low of 15.5% at 3 months after treatment. For participants 1 and 2, GHb continued to improve in the 3 months after the termination of therapy. This suggests that changes in diabetes management during the course of therapy were relatively stable. Participant 3, who did not receive treatment, had a GHb of 18.3% at study entry and 18.4% 2 months later. This participant subsequently missed two clinic appointments in the following 6 months, and GHb at 9 months after recruitment is unknown. Participant 4, who did not receive treatment, had an increasingly poor GHb (17.2% to 18.7%) from the time of initial recruitment to 9 months postrecruitment.

Review of medical records showed that the two teens who received MST had a total of one visit to the emergency room and no admissions to the hospital. The emergency room visit occurred during the baseline period prior to the initiation of treatment. The two teens who did not receive treatment had a total of two emergency room visits and one hospital admission for diabetic ketoacidosis that lasted 2 days.

Discussion

The primary aim for this case study was to establish preliminary efficacy of MST as a treatment for improving health outcomes in teens whose type 1 diabetes was poorly controlled. In addition, documentation of acceptability of the intervention to families (i.e., recruitment and retention rates) was important, as was determining the ways in which the therapy would need to be modified for the current population. This study provides support for the use of MST as a systemic yet flexible intervention for improving adherence to diabetes regimen among teens who are in poor metabolic control. Of the two teens who received the MST intervention, one had significant improvement in glycemic control (9.8%), and one had modest improvement (2.3%). Reductions of even 2% in GHb are considered clinically significant in the sense that reductions in this range are associated with a 26% to 76% reduction in risk of long-term complications (Diabetes Control and Complications Trial Research Group, 1993). Although previous studies have documented approaches to improving adherence behaviors and health outcomes in teens with type 1 diabetes (Grey et. al., 2000; Wysocki et. al.,
needs appropriately, a possible concern was that families might revert to previous, nonadherent behaviors once treatment ended. In fact, one previous study using a home-based nursing intervention found that teens with poorly controlled diabetes had significantly improved blood sugars when they had weekly contact with a diabetes nurse educator, but treatment effects dissipated after the intervention (Couper, Taylor, Fotheringham, & Sawyer, 1999). MST is likely to be a costly intervention, given the frequency of therapist contacts with families and resulting low therapist caseloads (i.e., six families on average). Therefore, it is important to demonstrate both immediate cost savings via reduced hospital use and longer-term cost savings via maintenance of low blood sugars and lower rates of complications.

Since MST was originally designed to manage mental health problems as opposed to adherence problems, it was important to determine the necessary modifications when training therapists and intervening with families. First, it was vital to ensure that therapists had a detailed understanding of diabetic care needs. Other research groups working with teens in poor metabolic control (Gray, Marreno, Godfrey, Orr, & Golden, 1988) have maintained that outpatient psychotherapy with this population is successful only when the therapist has appropriate knowledge of diabetes management. Most important, therapists were trained to rely upon data from glucose meters, including daily blood glucose readings, as vital information in tracking the success of interventions to improve adherence. Since adherence behaviors are not always observable (i.e., a parent may not know if his or her child obtained a high carbohydrate snack from a vending machine during the school day), use of a reliable source of quantitative data that was a proxy for adherence was crucial.

Problems with participant retention rates could also limit generalizability of findings if they reflected lack of receptivity of families to the intervention. However, we are currently conducting a randomized controlled trial of MST versus standard diabetes care for teens in poor metabolic control; in this study, recruitment rates have been high (70% agreed to participate) and dropout rates have been low (10%). This suggests that families are open to a home-based intervention and that flexibility in therapist schedules is the key to retaining families.

As with all case reports, limitations of the study include small sample size and the lack of a control group. The teens who did not receive intervention may have differed from the successful intervention completers in unknown ways.

There is clearly a need to conduct rigorous assessment of MST for children with chronic medical illnesses in
the context of a randomized trial. It is vital that continued efforts are made to identify treatments that improve adherence behaviors among the subset of adolescents with type 1 diabetes who are in poor metabolic control. Although traditional, hospital-based care may meet with little success, this study suggests that intensive, evidence-based approaches delivered using home-based service delivery may have the potential for altering a trajectory that leads to significant health problems in adulthood.

Acknowledgments
This project was supported by a grant from the Morris Hood Comprehensive Diabetes Center at Wayne State University. We thank the research staff who gave their time and energy toward the completion of this project. We also thank Timothy Hogan, PsyD, for his assistance in implementing this initial stage of our MST program.

Received February 22, 2002; revisions received June 27, 2002, and September 9, 2002; accepted September 10, 2002

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