Purpose: The purpose of this study was to assess the feasibility of a three-session computer intervention to improve diabetes management among African-American youth with type 1 diabetes. Methods: The 3 Ms (Medication, Meter, and Meals) intervention was based on the Information-Motivation-Behavioral Skills model of health behavior change and Motivational Interviewing approaches. Feasibility was assessed based on rates of intervention participation and intervention satisfaction using a mixed-methods approach. Participants included 23 youths aged 10–13. Results: Mean satisfaction rates from questionnaires were high across ratings for both general satisfaction and helpfulness of the intervention for improving diabetes care. Intervention participation rates were also high, with 87% completing all three sessions. Thematic analyses suggests that adolescents found the intervention helpful for changing their diabetes management behaviors, their thoughts about the importance of diabetes care, reminding them to complete care, feeling empowered about diabetes management feeling supported by family. Conclusion: Adolescents found The 3 Ms computer-delivered intervention to be helpful in improving diabetes care and completed a high percentage of sessions. The delivery of motivation-building interventions that do not require a highly trained human interventionist during routine diabetes clinic visits has the potential to improve adolescent health at reduced costs-savings.

Keywords: diabetes; quality of life; mixed-methods research; children and adolescents

An estimated 18.2 million Americans have diabetes, with an estimated 1 in every 600 children having Type 1 diabetes (T1D) (American Diabetes Association, 2005). T1D management is complex and time consuming, and requires the completion of several regimen components. For example, frequent administration of insulin, checking blood glucose levels, incorporating physical activity, and counting carbohydrates are all a necessary part of daily management of T1D.

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Adolescence is a period when children are at elevated risk for poor diabetes management (Helgeson, Siminerio, Escobar, & Becker, 2009; Wiebe et al., 2014). Lack of adequate completion of daily diabetes care is a significant cause of high blood glucose; a pattern of chronic high blood glucose, in turn, leads to both short- and long-term diabetes complications (American Diabetes Association, 2005). African-American adolescents in particular are at increased risk for poor illness management and metabolic control as compared to white adolescents (Ellis, Templin, Naar-King, & Frey, 2008; Hilliard, Wu, Rausch, Dolan, & Hood, 2013). In one of the only prospective studies of African-American youth with T1D, the disparity in metabolic control between black and white youths was evident as early as six months after diagnosis; metabolic control was significantly poorer for African-Americans by 18 months after diagnosis (Delamater, Albrecht, Postellon, & Gutai, 1991).

Although interventions have been developed that have been shown to be efficacious in improving illness management in adolescents with T1D (Ellis et al., 2008; Nansel, Iannotti, & Liu, 2011; Wysocki et al., 2007), most of these are lengthy, complex and relatively challenging to implement in real-world settings. In addition, there are also no studies thus far that have specifically targeted African-American youth.

The Information-Motivation-Behavioral Skills (IMB) model of behavior change suggests that behaviors such as improved diabetes management result from the joint function of three critical components: accurate information about risk behaviors (e.g. skipping insulin doses) or their replacement health behaviors (e.g. bolusing accurately for carbohydrates consumed), the motivation to change behavior, and the behavioral skills necessary to perform the behaviors. Behavioral skills are defined as both objective abilities (e.g. counting carbohydrates) and as perceived abilities (i.e. self-efficacy for illness management (Fisher, Amico, Fisher, Harman, 2008; Fisher, Fisher, & Harman, 2003)).

Motivational Interviewing (MI) is a client-centered, directive method for enhancing intrinsic motivation for changing behavior such as diabetes management by exploring and resolving ambivalence (Miller & Rollnick, 2012). Therefore, MI interventions can be used to support adolescents in making positive changes consistent with their personal values and goals; skills and strategies are offered when the adolescent is ready to make change (Naar-King & Suarez, 2010).

MI is consistent with several theories of health behavior change, including the IMB model. MI has been widely adapted to the treatment of behavioral health difficulties such as obesity (Smith, Heckemeyer, Kratt, & Mason, 1997) and poor dietary practices (Resnicow et al., 2001). Two studies that examined the impact of MI on improving diabetes management and metabolic control among adolescents with T1D showed that there was a significant reduction in mean HbA1c both during (Channon, Smith, & Gregory, 2003) and after the intervention (Channon et al., 2007). In addition, there was a significant reduction in fear of hypoglycemia and improvements in quality of life, indicating that the intervention also may have had a positive impact on the emotional aspects of having diabetes. Both of these studies enrolled predominantly white youth. However, MI has been successfully utilized with diverse populations worldwide with at least one meta-analysis suggesting that MI may have even stronger effects among minorities (Hettema, Steele, & Miller, 2005). Therefore, MI may be a promising intervention for improving illness management in African-American adolescents with T1D.

Despite the evidence suggesting that MI may be an effective intervention to address poor diabetes management in adolescents, the integration of behavioral interventions into routine clinical care for youth with diabetes can be hampered by multiple factors, including time, financial and logistic obstacles as well as a lack of trained behavioral healthcare providers (Aalto, Pekuri, & Seppa, 2003; Beich, Gannik, & Malterud, 2002). Computer-delivered interventions may be more easily streamlined into routine diabetes clinic visits by reducing the number of clinic visits.
staff and fewer restrictions on office space that are required with face-to-face interventions. Furthermore, information provided during computer-based interventions, such as educational vignettes or patient testimonials, can be easily tailored for cultural relevance for minority populations (e.g. using race concordant actor in the video). In addition, computer-delivered interventions can be easily replicated across persons and settings with a high degree of fidelity. Furthermore, a single computer can easily intervene with many persons yearly, with little time investment from medical staff.

Although there have been other computer interventions that have addressed management of adolescent T1D (Grey et al., 2013; Mulvaney, Rothman, Wallston, Lybarger, & Dietrich 2010; Whittemore et al., 2012), these interventions neither used MI, targeted parental monitoring behaviors related to diabetes care, nor focused on minority youth. Furthermore, in clinical trials, these interventions were not found to be more efficacious than a control intervention in improving diabetes management or HbA1c.

The present study sought to assess the feasibility of a three-session, computer-delivered intervention based on the IMB model that used MI approaches to improve diabetes management among young African-American adolescents with T1D. Intervention feasibility was assessed through evaluation of: (1) rates of participation in the intervention and (2) participant satisfaction using a mixed-methods research design.

**Method**

**Participants**

Data for the present study were drawn from a larger study comparing a three-session, computer-delivered motivational intervention to an attention control intervention among youth with T1D. In order to be eligible, participants had to be adolescents aged 10–13 years, and to be diagnosed with T1D for a minimum of six months. Participants were also required to be fluent in English and to self-identify as African-American. Participants were recruited from an endocrinology clinic located in an urban tertiary care children’s hospital via medical chart review. Potential recruits were mailed a letter of introduction about the study, which was followed up by phone calls to provide additional information regarding the study. Participants were consented at the first visit prior to the first data collection.

**Design**

In the parent study, adolescents were randomly assigned to one of three study arms: (1) separate three-session computer-delivered motivational interventions for both parent and youth; (2) computer-delivered motivational intervention for parent only, with youth receiving an attention control intervention consisting of diabetes educational information; or (3) diabetes educational information only for both parent and youth. Randomization was stratified by the age of the youth (10.0–11.9 vs. 12.0–13.9). Within these strata, participants were randomly assigned to conditions in a 1:1:1 ratio to ensure equivalence in each condition. For the purpose of this study, only data from 23 youths, a subsample of the larger sample of 60 participants, randomized to receive the motivational intervention were included (arm 1).

Youths received three intervention sessions at 3–4 month intervals, as this time frame coincided with standards for frequency of diabetes clinic visits for youth with T1D as recommended by the American Diabetes Association (2005) and the recruitment sites’ typical diabetes clinic follow-up recommendations. Quantitative questionnaires assessing satisfaction were collected immediately following each of the three treatment sessions. Qualitative interviews
assessing satisfaction with the intervention were conducted at a follow-up visit that took place one month after the completion of the last intervention session.

Data collection sessions were conducted at the same time as the intervention was delivered. These were conducted by research assistants who were not affiliated with the diabetes clinic staff and took place either at a space nearby the diabetes clinic or at adjacent research offices. Participants used touch screen computers to complete all assessment measures guided by an animated character (or avatar) that read all the questions to the participant and, if requested, the response options. Headphones were used to maintain participant privacy. Participants were provided with $50 for each completed data collection, a $15 meal voucher and reimbursement for transportation as incentives.

Quantitative data were available from 23 youths, with qualitative data being available for 15 of these 23. Eight youths did not have qualitative data available for the following reasons: three did not have audio recordings of their interviews available, three were treatment dropouts and therefore were not interviewed regarding their impressions of treatment, one did not complete the specific data collection visits when the interview was conducted and one was not able to do the interview due to time constraints.

3Ms intervention

Three motivational sessions were delivered using a software intervention authoring tool. This software has been successfully used in previous research (Ondersma, Chase, Svikis, & Schuster, 2005) and has yielded high satisfaction ratings amongst African-American populations (Carcone et al., 2014; Outlaw, Naar-King, Tanney et al., 2014). The avatars’ communication style was designed to be consistent with principles of MI, suggesting that factors such as empathy, optimism and congruence are strongly related to more client behavior change. Throughout the intervention, the adolescent’s responses were reflected back by the avatar with affirmations to boost self-efficacy and statements emphasizing personal choice.

Session content

In Session 1, participants begin with psychoeducation about how daily diabetes care relates to blood glucose levels and what steps can be taken to be sure that all diabetes care was completed. According to the IMB model, behavior change results from the joint function of three critical components: accurate information about risk behaviors or their replacement health behaviors, motivation to change the behavior, and the perceived behavioral skills necessary to perform the behavior. The three targeted health behaviors (taking insulin or ‘medicine’, ‘monitoring’ blood glucose and counting carbohydrates at ‘meals’) were called the ‘3Ms’ of diabetes care, to provide youth with a mnemonic or memory aide to prompt with remembering necessary diabetes care. This psychoeducation was provided via a video clip of an African-American physician talking about the importance of good diabetes care for health. To reinforce the importance of these key behaviors, a peer testimonial was also presented. In this video clip, an African-American adolescent with diabetes talked about his experiences with completing diabetes care, including difficulty remembering to give all his insulin shots, test his blood sugar before he ate, and counting carbohydrates in his food as well as related experiences such as feeling different from his peers, diabetes-related conflict with his mother, and strong desire to complete all his diabetes care and develop independence. In order to increase cultural competency, the script for these video clips was reviewed and tailored for appropriate language, communication style and content by a minority pediatric health behavior researcher with expertise in developing interventions for African-American adolescents.
Racially congruent actors were selected to further enhance the intervention’s cultural competency.

After the psychoeducation, the avatar delivered the intervention in a way that had high congruence with MI treatment principles. The three key components of each session were: (1) feedback regarding the youth’s readiness to commit to recommendations for daily diabetes care completion; (2) decisional balance, or pros and cons of completing diabetes care and (3) a summary and query regarding youth’s interest in completing all recommended components of achieving daily monitoring of youth diabetes care/ youth’s interest in improving diabetes care, followed by optional goal setting. A letter reminding the adolescent of the goal they had selected was sent between each session to remind the youth of the goal set during the session. The session lasted approximately 15–20 minutes.

At the second and third visits, the youths completed an intervention session that began with a query regarding if a goal had been set for changing diabetes management and if so, what the goal had been. The adolescent was then branched to feedback arms regarding readiness and or decisional balance/ goal setting arms depending on whether a goal had been set in the first session. Each session lasted about 5–10 minutes.

**Measures**

**Satisfaction questionnaire**

The Motivation-Enhancement System (MES) Satisfaction Survey is an investigator-developed measure that assesses participant satisfaction with the 3Ms intervention (Appendix 1). Three domains of questions were asked: overall satisfaction with the intervention, satisfaction specific to the diabetes content (whether the intervention was helpful in improving diabetes care), and whether the youths would recommend the intervention to a peer with diabetes. Response options for each question ranged from 1 (lowest satisfaction) to 4 (highest satisfaction).

**Participation rate**

Participation rate was operationalized as the number of treatment sessions each youth received. Since all youths received the first session immediately after the baseline data collection visit, the number of sessions ranged from 1 to 3.

**Exit interview**

At Session 3, an exit interview was completed with each adolescent to solicit feedback regarding their impressions of and satisfaction with the 3Ms program. This semi-structured interview was audio-recorded and transcribed; transcripts were analyzed both quantitatively and qualitatively. Participants were asked to reflect upon their experience with the 3Ms across all sessions they received. Questions specifically focused on the most/least helpful aspects of the intervention, enjoyable aspects and specific feedback on the video clips (Appendix 2).

**Data analyses**

The quantitative data were analyzed using descriptive statistics to find the average level of satisfaction.

For the qualitative component, the data were analyzed using thematic analysis. Thematic analysis is an analytic strategy to organize qualitative data, in this case, exit interview comments, into themes that summarize individuals’ experiences. This process involves the identification of
themes through ‘careful reading and re-reading of the data’ (Rice & Ezzy, 1999, p. 258). Thematic analysis was accomplished through the steps outlined by Fereday and Muir-Cochrane (2006). First, two coders independently coded each transcript by using the questions used in the interview. Coders met weekly to compare their coding and reconcile any discrepancies. Each discrepancy was resolved, through discussion, resulting in a final transcript that was coded to consensus. Together, the coders identified emergent themes and crafted a description of all themes identified in 15 interviews.

Results

Demographics

A total of 23 youths completed the quantitative assessments. More female (61%) youth participated. The mean youth age at the time of diagnosis with diabetes was 6.9 years (SD = 4.13), with a mean duration of illness of 5.4 years (SD = 3.8). The mean HbA1c at the time of the first session was 9.4% (SD = 1.70), indicating that the sample was in poor metabolic control overall; 8.7% used a conventional insulin therapy (2–3 doses of combined short and intermediate acting insulin per day) and 91.3% used basal-bolus injection therapy or an insulin pump.

Quantitative analyses

Table 1 summarizes adolescents’ report of satisfaction with each intervention session across three domains: overall satisfaction, diabetes-specific satisfaction and likelihood of recommending the program to a peer. Satisfaction was assessed on each scale at T1 (after one session), T2 (after two sessions) and T3 (after three sessions).

At T1, adolescents’ overall satisfaction with the computer intervention was high. Mean satisfaction (3.45) equates to a rating of ‘Good-Excellent’ on the questionnaire. The lowest overall satisfaction level (2.60) was equivalent to a ‘Fair-Good’ on the questionnaire. Not only were adolescents satisfied with the computer intervention overall, but similar rates of satisfaction were reported with regard to how helpful it was for improving diabetes care. Mean satisfaction with the degree to which the intervention was felt to be helpful with improving diabetes care was 3.37 which equivalent to ‘Good’ or ‘Excellent’. Additionally, when asked if the participants would recommend this intervention to a friend with diabetes, the mean score of 3.35 indicated that, on average, participants answered ‘Yes, I think so’ and ‘Yes, definitely’.

Rates of participation in the intervention

Of the 23 total participants, 18 adolescents (78%) completed all 3 sessions, 3 adolescents completed 2 sessions (13%) and 2 adolescents completed only 1 session (8.7%). When comparing

| Table 1. Satisfaction of participants with each intervention session across three domains. |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Overall satisfaction | Diabetes satisfaction | Friend recommendation |
| T1 | T2 | T3 | T1 | T2 | T3 | T1 | T2 | T3 |
| N | 20 | 18 | 15 | 20 | 18 | 15 | 20 | 18 | 15 |
| Min–Max | 2.60–4.00 | 2.20–4.00 | 2.80–4.00 | 2.50–4.00 | 1.50–4.00 | 2.50–4.00 | 1.00–4.00 | 2.00–4.00 | 3.00–4.00 |
| Mean (SD) | 3.45 (.46) | 3.43 (.50) | 3.63 (.38) | 3.37 (.48) | 3.36 (.66) | 3.43 (.50) | 3.45 (.83) | 3.50 (.62) | 3.87 (.35) |

Note: SD, Standard Deviation and N, number of participants.
the dropouts to completers based upon their age and gender, there were no significant differences between these groups.

**Qualitative analyses**

*Most helpful theme*

Interview questions that asked the participant about the aspects of the program that were ‘most helpful or not helpful’ or a ‘key part of the intervention’ led to discussions describing how the intervention helped or did not help participants. Five sub-themes were identified within data: ways in which youths changed their diabetes management behavior (Diabetes Care), how the intervention affected their thoughts about the importance of diabetes care (Heightened Awareness), how the program served as a useful reminder to complete care (Reminder), feeling empowered when their thoughts/opinions about how to improve their own diabetes care were solicited (Autonomy Support) and the manner in which the intervention impacted their perceptions/elicitation of support from friends and family around them (Social Support).

**Diabetes care.** Nine youths described how participating in the program changed how they actually cared for their diabetes. These nine youths stated that they made specific changes to their daily diabetes care behaviors as a result of participating in the intervention. These activities included checking their blood glucose more frequently, taking their insulin more regularly, using their pump to administer insulin and counting carbohydrates more frequently. One youth stated that the 3Ms mnemonic helped her to complete the three key components of the diabetes regimen: medicine, meals and meter. Other youth found The 3Ms to be helpful in remembering to complete a specific step of their diabetes care routine. For example, one youth found the meter step the most helpful:

I started checking more frequently and sometimes I will go to my mom with my <blood glucose> number.

Every time I wake up I make sure I check my sugar and I take my medicine right before I eat anything.

I was checking my blood sugar a lot more afterward … I just needed to check my blood sugar more so I could stay on top of it .. so that was my main problem.

**Heightened awareness or attention.** Seven youths spoke of the program making them think more about their diabetes, thereby increasing their awareness of the importance of taking adequate care of their diabetes:

I’ve become more aware that I am a diabetic and that I have to do more things that other people don’t have to.

Additionally, five youths reported that the intervention made them realize how important diabetes care was. A sixth youth said that he was ‘more careful’ about what he eats and a seventh said that it gets him ‘thinking’ about what could happen if diabetes care was not properly implemented. Also, two youths talked about the importance of monitoring blood sugar and counting carbohydrates while eating.

**Reminder.** Five youths specifically mentioned how the program was a useful reminder to do their daily diabetes care, how to properly complete diabetes care and/or the complications associated
with not completing diabetes care. These participants reported being more aware of the consequences of neglecting their diabetes care such as losing limbs, losing eyesight and kidney failure after participating in the program. Three youths discussed that the knowledge and reminder of complications was a key part of the program by helping them to ‘think about what could happen’:

> Like, last time they showed me pictures of what can happen and I saw all the diseases and, like, the fingers cut off if you do not take care of yourself.

**Autonomy support.** Self-Determination Theory posits that communication approaches like MI successfully increase patient intrinsic motivation because of the human need for autonomy, particularly during adolescence. When individuals feel a sense of control over their behavior, their intrinsic motivation for engaging in that behavior is enhanced, whereas limiting personal freedom elicits resistance. In health care, autonomy-supportive environments are those where providers elicit patient perspectives, provide information and opportunities for choice, and encourage patient responsibility.

Four youths discussed how having their opinion solicited was a key part of the program. These adolescents appreciated having their input solicited regarding how well they were managing their diabetes care and their opinion of the critical areas for improvement:

> Asking how I am doing and how my schedule is with my blood sugar and glucose.

One youth also mentioned that he liked how the questions asked him about areas of diabetes care he usually is not involved in because his mother does not tell him everything he needs to do.

**Social support.** Five youths mentioned how participating in the program helped them to recognize sources of support from friends and family for their diabetes care. For example, one youth described that if he spent the day at a friend’s house, there was always someone checking on him to make sure he was checking his blood sugar and taking his insulin. He found this helpful because wherever he went, ‘someone could help him with his diabetes’. Another youth stated that he liked the program because he recognized that ‘family and friends can help me’ if he ever needed help. Finally, one youth stated that he started checking more frequently and going to his mom with the results of his blood glucose testing. This youth found that drawing in help from parents, family members and friends as an additional source of support helped him to complete his diabetes care.

**Meeting adolescent’s needs**

Interview questions also asked if the program changed how the participants personally took care of diabetes, if it had affected their health in any way, and if there was any change in the way the participant and their family changed their care of diabetes. This gave rise to two main themes: an improved effort in their care (Improved diabetes care and metabolic control) and additional support from family members (Increased Family Support).

**Improved diabetes health status.** Nine youths attributed improvements in their metabolic control to their participation in the program. When asked if the program changed how the youths and their family took care of diabetes, three participants stated that they noticed an improvement in glycated hemoglobin levels. A theme about improved diabetes care also emerged. Particularly,
one participant reported that she had ‘gotten more in control over diabetes’ and had ‘felt better’ after her enrollment in the intervention:

I do not really know how to elaborate on it but since I have been doing this my A1C did go down.

Now that I am taking my stuff right my blood sugar and counting my carbs, my numbers are being better.

My sugars have been under more control and haven’t been as high as they were before the program.

Increased family support. When asked if the program changed how the youths and their family care for diabetes in any way, six youths reported that they received increased support from family members after participating in the program. One participant stated that ‘more’ people help out with diabetes care at home. The following excerpts from some of the participants illustrate the increased family support youth perceived:

My mama stays up and watches me take my sugar and take my medicine before going back to sleep.

My mom and grandma help me more. (Can you tell me more about how they help you?) Sometimes if I do not feel like taking my insulin, they will do it for me.

Recommended to friend

Interview questions that asked if the youth would recommend the program to another adolescent with diabetes gave rise to themes around how the program could help another kid better care for their diabetes by increasing their awareness about diabetes care and consequences. Nine youths reported that it was ‘very likely’ that they would recommend the program to another adolescent with diabetes. Reasons provided included that they believed that the program would help the peer better care for their diabetes and/or increase their awareness of the importance of proper diabetes care:

Most of the questions applied to most of the things I do and I have troubles with. So it might help anyone else that has the same problems or questions.

It is really helpful. It gives you something to think about and actually makes you want to care more.

Because at first I could really care less, I was like oh well.

I think it would help them to check their blood sugar more and take the right amount of insulin.

Some expressed the idea that since they found it helpful, they believed that others might also:

Because I know people with diabetes that don’t take care of themselves and think it’s going to be ok.

Liked or disliked theme

Interview questions that asked participants about the aspects of the intervention that were liked or disliked led to five themes that emerged from the data: the educational components of the program
Psychoeducation, a sense of community (Shared Experience), the design of the program (Structure) and the characters which read out the questions to the youths (Avatars).

**Psychoeducation.** Eleven youths reported liking the video clip-delivered psychoeducational aspects of the program. Specifically, two areas were cited: (1) information explaining the importance of doing diabetes care and (2) information about diabetes complications. Two participants stated that the doctor video covered all the psychoeducational components that were necessary for diabetes care:

It told me like what would happen to me … give me more of a reason to actually do everything, like check my sugar, take my medicine and stuff. Although I was going to do that in the beginning but I didn’t really have a reason. I was just doing it because I was told so.

The videos served as a reminder about the negative consequences of improper diabetes care. These images gave participants insights into the reality of the long-term complications they might experience if they did not implement proper diabetes care into their daily lives:

I liked how they showed like what can result if you have really bad and high sugar: you can die, you can get your leg chopped off, and you can go blind. This makes me want to do what I’m supposed to do.

If you don’t take care of your blood sugar, things could just happen to you. You could lose a limb or something or you could be on dialysis or something like that.

She told me what could happen if you do not take care of yourself. And she showed pictures. (So what could happen in the pictures? Anything else you liked about it?) Getting their toes chopped off.

**Shared experience.** Nine youths reported how they could ‘relate to’ the peer testimonial video clip. It gave them a sense of ‘I am not alone’, that they were not the only teen with diabetes. Youth responded to the actors’ perceived struggle with diabetes care and experience of having gone through a time where he did not care for his diabetes. Four youths discussed how they ‘connected’ with the adolescent portrayed in the video and how his experience ‘applied’ to their own lives. The following excerpts illustrate the sense of the community that youth experienced while watching the peer testimonial:

I could relate to it because he talked about going to his friend’s house and how he really did not like to do that stuff in front of his friends. And I feel the same way because that is awkward. They say ‘oh what are you doing, does it hurt’?

It reassured me that I am not the only one out there and that there are other kids dealing with this too.

From the videos, I saw that I could relate to the other kid. I thought I was the only person in the world with this stuff. And then I saw the video, he is like in the same predicament that I am in.

**Structure.** When asked what part of the intervention they enjoyed the least or if there was any part of the intervention that they would cut or change, two youths said that the videos were ‘long’ and one youth said that they did not enjoy watching the videos. However, one participant said that the doctor video ‘was not too long to watch’. Additionally, two other participants said that that they would like to speed up the pace of speech of the avatars.
**Avatar.** Five youths mentioned the avatar when discussing the program. Out of these, 2 youths stated that if any part of the program were changed, they would like to keep the avatars. In fact, one youth found the ‘little characters’ to be the most exciting part of the program. However, two youths stated that they did not like the avatars and that if they could change any part of the program, they would change the avatars. Two youths reported that they would like to change the voice of the characters to be ‘more like real life’ because they ‘sounded really like a computer’.

**Discussion**

The primary purpose of the present study was to assess the feasibility of a three-session, computer-delivered intervention to improve motivation for diabetes management among young African-American adolescents with T1D. A mixed-methods approach was used to assess rates of participation and satisfaction with the program content. Quantitative methods were used to analyze data from satisfaction surveys and to evaluate how many sessions were completed while qualitative methods were used to analyze data from exit interviews regarding participants’ experiences with the intervention, including both preferred and non-preferred aspects.

With 78% of adolescents completing all three intervention sessions, completion rates in this study were very high. These rates suggest delivering a computer intervention at the time of diabetes clinic visits is a feasible, acceptable strategy. This is a promising finding, given the high dropout rates observed when brief motivational interventions have been delivered by human interventionists outside of routine medical appointments (MacDonell, Naar-King, Murphy, Parsons, & Huszti, 2011; Naar-King, & Suarez, 2010).

In addition, results from the quantitative analyses showed that the adolescents were highly satisfied with the intervention initially and after three intervention sessions. Participants rated their overall satisfaction with the intervention as ‘Good-Excellent’ for all three sessions and across all three domains assessed, that is, overall satisfaction, helpfulness with diabetes management and likelihood of recommending the program to a peer with diabetes. Quantitative ratings of satisfaction were not associated with participation rates. However, this could have been due to ceiling effects on the satisfaction measure, as ratings of satisfaction were uniformly high. In addition, adolescents were brought to study visits by parents; therefore, low satisfaction may have been less likely to manifest as low session attendance.

The results of the qualitative analyses also suggested high levels of satisfaction with the intervention. Themes that emerged were that the intervention resulted in an increased sense of family support, heightened awareness about the complications of improper diabetes care and the feeling of a sense of community with other youths with diabetes. High levels of satisfaction might reflect the significant effort that was dedicated to ensuring cultural competence of the intervention and its appropriateness for minority youth. In addition, the perception by youth of increased family support and connection with others with diabetes after participation is interesting in light of the individual nature of the intervention and the focus upon building intrinsic motivation for independent diabetes care.

Study findings indicated that overall, adolescents found the intervention to be enjoyable, helpful and tailored to their needs. However, a few areas for improvement were also noted. Participants mentioned that they would like to increase the pace of the avatars’ speech and change them be more human-like. While sessions were delivered by an avatar that has previously been used with high satisfaction ratings with African-American populations (Carcone et al., 2014; Naar-King et al., 2013; Ondersma, Chase, Svikis, & Schuster, 2007), the populations for which the avatar was developed were older than the present one. In addition, adolescents are ubiquitous users of technology and may be used to videogames with more life-like avatars than the
technology used in this pilot study. A handful of participants felt that the sessions were too long (despite the fact that on average they lasted about 25 minutes) and found the psychoeducational videos that were part of the intervention to be too long. In addition, one of the participants reported that the intervention might benefit from including other family members. As caregivers play an important role in successful adolescent diabetes care, ensuring that they are also targeted for increased support to youth via their own intervention appears to be warranted.

To increase the cultural competency of the intervention, the African-American physician in the psychoeducational video clip and the adolescent in the peer testimonial were selected in such a way that the target population could identify with them. A primary theme that emerged from the qualitative analysis, ‘Shared Experience’, indicated that the video clips did evoke such feelings amongst the adolescents. A meta-analysis examining the effect of culturally adapted interventions (interventions designed for a specific cultural group) found that culturally tailored intervention was four times more effective than interventions that were not culturally tailored (Griner & Smith, 2006). Additional research is needed to form a definitive conclusion about the effect of the cultural tailoring of the 3Ms intervention on participant health outcomes, but this tailoring did appear to improve satisfaction.

The finding that adolescent participants reported high levels of satisfaction with this intervention has several implications. For one, high rates of satisfaction with a computer intervention suggest that brief, motivation-building interventions to improve health-related behavior can be provided in clinical settings without requiring a highly trained (and costly) human interventionist. Adolescents, in particular, might enjoy using computerized interventions, given their high use of technology and technology applications. In addition to their ubiquitous use of technology, they may also appreciate the anonymity inherent in receiving an intervention by computer. Increased perceptions of confidentiality when interventions are delivered by computer has been shown to be associated with increased disclosure of information perceived to be sensitive (Newman et al., 2002), potentially increasing intervention acceptability. Furthermore, computers are more cost-efficient and accessible than human interventionists. If this intervention is also shown to improve diabetes care, in the future, adolescents would be able to access it on the Internet at their convenience. High satisfaction with this program is a good indicator that high-risk, minority youth would be likely to use the intervention in the future. Given the limited number of available interventions targeting this population, minimization of barriers that interfere with intervention delivery is crucial.

Limitations of the present study include the small sample size. Findings regarding level of satisfaction with the intervention require replication in a larger study. In addition, the study investigated satisfaction under research conditions. Future research would benefit from exploring satisfaction under conditions when the intervention is used in regular clinical care. For instance, if clinical support staff such as medical assistants were used to administer the intervention instead of research assistants who were present during use of the intervention to answer any questions or address technology-related problems, satisfaction might be affected. Aspects of the avatar that adolescents found less satisfying could not be compared to other studies because there are no other similar studies for adolescents with TID to which we can compare our findings. These aspects could be areas to focus on improving in the future. Due to limited variability in attendance (i.e. almost all participants completed all three session) resulting in possible ceiling effects, it was difficult to detect if a relationship existed between satisfaction with the intervention and the number of sessions attended. Additionally, adolescents’ impressions that there were improvements in their illness management and glycemic control were not assessed by objective measures. Since the adolescents’ caregivers also received an intervention, despite the fact that the adolescents were asked to comment on their own experiences, adolescent satisfaction with the intervention might also reflect changes in the caregiver’s behavior as a result of the caregiver intervention.
Finally, the present study did not examine the relationship between satisfaction and behavior change. Exploring this relationship would allow stronger conclusions about participants’ overall satisfaction with the intervention and its importance to be drawn.

In summary, a three-session computer-delivered motivational intervention was successful in generating high levels of satisfaction and high intervention participation rates among African-American adolescents. Results of the present study support the feasibility of using such interventions to improve diabetes management among minority adolescents with T1D. Optimal diabetes management can maintain both current and future quality of life for high-risk African-American adolescents with T1D.

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No potential conflict of interest was reported by the authors.

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Appendix 1. MES satisfaction survey

Overall satisfaction:

1. How would you rate the quality of today’s session?
2. Did the session meet your expectations?
3. Do you feel this session will be useful for you?
4. If you need assistance again, would you come back for another session?
5. Overall, how satisfied are you with the session?

Diabetes-related satisfaction:

1. To what extent did the session meet your needs for learning about completing your diabetes care?
2. How satisfied are you with the amount of help you received for completing your diabetes care?
3. How much did you like the video of the doctor?
4. How much did the doctor in the video tell children what to do to complete their diabetes care every day?
5. How much did the doctor encourage children to complete their diabetes care every day?

Peer recommendation satisfaction:

1. If a friend were in need of similar help, would you recommend this session to them?

Appendix 2. Exit interview

1. On a scale of 1 to 10, with 1 being not at all helpful and 10 being extremely helpful, how helpful do you think the 3Ms program was in helping you complete diabetes care every day? Why did you give that rating for the program?
2. What parts of the 3Ms program did you find the most helpful?
3. What parts of the 3Ms program did you find the least helpful?
4. What part of the 3Ms program did you enjoy the most? Find the most exciting or fun?
5. What part of the 3Ms program did you enjoy the least? Find the most dull or boring?
6. Would you cut out any part of the 3Ms program altogether? If yes, what would you cut?
7. If you could change any part of the 3Ms program, what would you change?
8. If parts of the 3Ms program were changed, what should we keep? What are the key parts of the 3Ms program?
9. If you knew another kid with diabetes, how likely would you be to recommend the 3Ms program to them on a scale from 1 to 10 where 1 is not at all likely and 10 is definitely? Why do you give that rating?
10. Did the 3Ms program change how you take care of your diabetes? Why?
11. Did the 3Ms program change how you and your family take care of your diabetes care in any way? How so?
12. Do you think that participating in the 3Ms program has affected your health in any way, either good or bad? Why?
13. Were there any other changes, either good or bad, that happened in your family as a result of your participation in the 3Ms program?
14. The 3Ms program was broken down into 3 sessions. What did you think about this number of sessions? Would you have preferred more or less sessions, or were the 3 sessions okay?
15. What did you think about the length of each session?
16. How did you like having the 3Ms sessions scheduled either before or after your diabetes clinic visits? Did you like that? If no, when would you have preferred to have the 3Ms sessions?
17. Were any of your 3Ms sessions scheduled during a home visit? If yes, what did you like/dislike about home visits? If no, would you have preferred to have the 3Ms sessions in your home?
18. What did you like about the doctor video?
19. Was there anything you did not like about the doctor video?
20. What did you like about the kid who talked about his experiences living with diabetes?
21. Was there anything you did not like about the kid video? Why?
22. Before we end, I am wondering if you have any other thoughts or ideas about the program that I did not ask?