Health Beliefs and Regimen Adherence in Minority Adolescents with Type 1 Diabetes

Anna Maria Patino, PhD, Janine Sanchez, MD, Margaret Eidson, MD, and Alan M. Delamater, PhD
University of Miami

Objective To examine the appraisal of short- and long-term diabetes health risk and adherence, determine whether health risk predicts adherence and glycemic control in an ethnic minority sample, and determine whether perceptions of personal risk differ from risk to others. Methods Seventy-four youths with type 1 diabetes (ages 11–16) completed measures of risk perception and regimen adherence during their clinic visit; parents completed a measure of their children’s adherence. Glycosylated hemoglobin A1c level was measured as part of the clinic visit. Results Regression analyses predicting parental report and self-reported adherence from appraisal of risk yielded nonsignificant results; perceived short-term complications to self predicted glycemic control. Appraisal of risk was higher for short- and long-term complications occurring to someone else with diabetes than to self. Greater risk for short-term complications than for long-term complications to self and other was found. Conclusions The distinction between long-term and short-term complications and complications occurring to one’s self or someone else with diabetes was supported. Assessment of perceived risks for short-term complications is important for this age group and should be addressed in interventions to improve adherence.

Key words adolescence; health beliefs; risk perceptions; type 1 diabetes.

Type 1 diabetes mellitus (T1DM) is a chronic disease that requires daily self-management. Optimal diabetes management includes adherence to specific recommendations regarding daily insulin injections, blood glucose monitoring, dietary intake, and physical exercise. Regimen adherence poses a unique challenge for diabetic children and adolescents. Adherence to all aspects of the diabetes regimen is necessary to avoid both short-term complications, such as ketoacidosis and hypoglycemia, and long-term complications, such as kidney disease, vision impairment, and nerve damage. According to Glasgow and Anderson (1995), many studies have documented that diabetes adherence is not a unitary construct and in fact varies across different components of the regimen. Therefore, relationships between adherence and other variables may not be observed when using a unitary measure of self-management behaviors (Glasgow, 1991).

The Health Belief Model (HBM; Janz & Becker, 1984) is a framework for understanding patient adherence to health behaviors. The HBM focuses on two aspects of a person’s conceptualization of health and health behavior: threat perception, dependent on perceived susceptibility to illness and anticipated severity of the consequences; and behavioral evaluation, which concerns the benefits of a health behavior and the barriers to enacting the behaviors (Sheeran & Abraham, 1996).

Therefore, according to HBM, the likelihood of individuals with T1DM adhering to their regimen is determined by five factors. The first variable, susceptibility, refers to the perception of vulnerability to diabetes and its complications. This includes what chance persons
perceive they may have for developing problems due to diabetes. The second factor, severity, is the perception of diabetes as a serious illness, ranging from perceiving few complications to viewing diabetes as a life-threatening disease. The third variable, benefits, concerns the perception that the regimen is effective, such that the individual physically feels better from taking action. The fourth factor, barriers, refers to the perceived costs of adhering to the regimen. This variable taps into how inconvenient the regimen is perceived to be. Lastly, cues to action concerns either external (e.g., time of day, reminders from family) or internal (e.g., feeling high and low blood sugars) cues the individual associates with taking action.

It is possible that each of the five dimensions operates independently and a deficit in one may lead to failure to perform the health behaviors or that interactions among components contribute to an individual's perception of risk. Inconsistent results have been obtained in several studies that have investigated risk perception and adherence to recommended diabetes management activities in adults (Becker & Janz, 1985; Harris & Linn, 1985; Woolridge, Wallston, Graber, Brown, & Davidson, 1992). These findings highlight the importance of examining the individual components of health beliefs, rather than only assessing an individual's overall health beliefs.

Few studies have examined the applicability of the HBM to pediatric populations. The Diabetes Health Beliefs Questionnaire (DHBQ) (Brownlee-Duffeck et al., 1987) has been utilized in two studies to examine health beliefs pertaining to the HBM model. One study investigated the role of health beliefs in the regimen adherence and metabolic control of adults and adolescents with diabetes mellitus (Brownlee-Duffeck et al., 1987). The HBM accounted for 52% of the variance in self-reported adherence for the younger sample (mean age 18 years), with costs predicting adherence and perceived severity and susceptibility predicting metabolic control. Bond, Aiken, and Somerville (1992) extended the above investigation to a younger sample of adolescents with diabetes (mean age 14.2 years). As predicted by the HBM, benefit costs and cues to action were both associated with adherence. In addition, children's perception of threat to diabetes was positively related to adherence only when the participants also reported low benefit costs to following the recommended regimen. Bond et al. (1992) found that metabolic control was poorest when both threat and cues were high, but was best when threat was low and cues were high. Studies with even younger, 6- to 9-year-old, children have also shown that their health beliefs were related with adherence and glycemic control (Charron-Prochownik, Becker, Brown, Liang, & Bennett, 1993).

Perception of risk is at the root of determining whether the individual will engage in appropriate health behaviors. Beyond the HBM, separating the assessment of perceived risks into long-term and short-term complications is important in that it may be difficult for children to foresee potential long-term problems. Short-term complications, such as hypoglycemia and hyperglycemia, may be experienced daily, thus making the immediate complications more salient and the adolescent feel vulnerable on a regular basis. On the other hand, the appreciation of long-term consequences is dependent on higher-level cognitive skills, such as planning and organization, which many adolescents are only in the process of developing. Thus, youth may not have the cognitive maturity to anticipate long-term consequences (Ingersoll, Orr, Vance, & Golden, 1992). The need for the distinction has also been noted in examining T1DM adolescents' appreciation for treatment effectiveness because their frame of reference is short term and perceived treatment effectiveness includes both the short-term (avoidance of complications) and long-term (better quality of life) goals (Skinner, Hampson, & Fife-Schaw, 2002).

The differentiation between the perceived likelihood for self and other is also important because individuals generally underestimate their risk, compared with that of another person (Frey, Guthrie, Loveland-Cherry, Park, & Foster, 1997; Greening & Chandler, 1997). Research with healthy children has shown that they estimate their chances of developing a serious, chronic disease as much lower than other children (Whalen et al., 1994). Nevertheless, this self/other distinction has not been examined with youth with T1DM.

No studies to date have examined minority adolescents' health beliefs concerning their diabetes and its relationship to adherence. It is important to examine this issue because the risk of poor metabolic control is increased in minority youth with diabetes (Delamater et al., 1999). Few studies have examined diabetes health beliefs in minority adults. Although inferences regarding adolescents' health beliefs can be drawn from the adult literature, comparisons between the two groups are difficult because adults and adolescents differ in their perceptions of risk (Cohn, Macfarlane, Yanez, & Imai, 1995).

The purpose of this study was to examine minority adolescents' diabetes-related health beliefs and relationships to adherence and glycemic control, which no previous research has addressed. This study used an established measure of the HBM constructs to extend previous research conducted using this measure with
Caucasian samples to examine the applicability of the HBM with a minority sample. Additionally, a new measure of diabetes-specific risk perception was developed to examine perceptions of risk that have not been investigated with T1DM youths. With the creation of a new measure, the authors compare perceptions of susceptibility to short-term and long-term complications as well as examine differences between the probability estimates of complications occurring to the individual and to someone else with diabetes.

The authors hypothesized that health beliefs would predict self-reported adherence and glycemic control; risk perception for other would be greater than risk perception of self; and risk perception for short-term complications would be greater than that for long-term complications. Secondary analyses were conducted to investigate the relationships between the individual health belief components and the components of adherence. The authors were interested in exploring differences in the various components of health beliefs, to examine which adequately explain the illness beliefs of these youth. This study also examined the age of the child, gender, and ethnicity in relationship to health risk perception and regimen adherence.

**Method**

**Participants**

Seventy-four youths (36 females and 38 males) with T1DM and a disease duration of at least 6 months \( M = 4.7 \) years, \( SD = 3.2 \) were recruited from a diabetes specialty clinic. Seventy-seventy percent of youths approached agreed to participate. Participating adolescents did not differ from those who refused participation \( n = 22 \) with respect to ethnicity, gender, age, glycosylated hemoglobin A1c (HbA1c) level, duration of diabetes, or socioeconomic status (SES). The adolescents recruited were between the ages of 11 and 16 \( M = 13.6 \) years, \( SD = 1.7 \) and came from predominately lower-middle-class socioeconomic backgrounds \( M = 31.68, SD = 13.18 \), as indicated by the Hollingshead Index of Social Position (1975). The ethnic composition of the sample was 67.6% White Hispanic and 32.4% Black, including Caribbean (7.3%) and African American (25.1%) individuals.

**Measures**

Means and standard deviations of all measures are summarized in Table I.

**Health Beliefs**

**DHBQ (Brownlee-Duffeck et al., 1987).** The DHBQ, a measure utilizing the HBM constructs as its framework, consists of 27 items designed to assess (a) perceived severity of diabetes and its complications (4 items), (b) perceived susceptibility to diabetic complications (4 items), (c) perceived benefits of adherence to the diabetic regimen (7 items), (d) perceived costs of adherence (8 items), and (e) cues for adherence (4 items). Adolescents responded to each item using a five-point Likert scale, ranging from “not serious” (1) to “extremely serious” (5) on the severity subscale; “1–19% chance” (1) to “80–99% chance” (5) on the susceptibility subscale; “minor inconvenience” (1) to “terrible for me” (5) on the costs subscale; “has no effect” (1) to “extremely helpful” (5) for the benefits subscale; and “can never tell” (1) to “can always tell” (5) on the cues to action subscale.

Composites of each of these five subscales were derived by Brownlee-Duffeck et al. (1987), by summing the raw ratings of all items in each subsection. The internal reliability estimates of each of the health belief subscales from that study were sufficient (\( \alpha = .66–.78 \)), with the exception of the cues to action subscale (\( \alpha = .10 \)), suggesting the latter is not a homogeneous construct. A total score comprised of the sum of the five subscales as well as the individual scores of the five subscales were used in this study. For this study, internal reliability estimates of each of the subscales are summarized in Table II.

**Diabetes-Related Health Problems.** The Diabetes-Related Health Problems (DRHP) was developed for this study and designed to examine a youth’s perception of the likelihood of specific long-term and short-term complications occurring to someone else with diabetes and to themselves. The items, similar to the DHBQ with high face and content validity, were generated by senior

### Table I. Mean ± Standard Deviation of all Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Health Beliefs Questionnaire (total score)</td>
<td>76.89</td>
<td>±11.00</td>
</tr>
<tr>
<td>Susceptibility</td>
<td>3.68</td>
<td>±0.73</td>
</tr>
<tr>
<td>Severity</td>
<td>1.87</td>
<td>±1.05</td>
</tr>
<tr>
<td>Benefits</td>
<td>3.50</td>
<td>±0.84</td>
</tr>
<tr>
<td>Costs</td>
<td>2.22</td>
<td>±0.77</td>
</tr>
<tr>
<td>Cues to action</td>
<td>3.70</td>
<td>±0.75</td>
</tr>
<tr>
<td>Diabetes-Related Health Problems (total score)</td>
<td>53.25</td>
<td>±12.11</td>
</tr>
<tr>
<td>Short-term complications to self</td>
<td>2.61</td>
<td>±0.75</td>
</tr>
<tr>
<td>Short-term complications to other</td>
<td>3.12</td>
<td>±0.79</td>
</tr>
<tr>
<td>Long-term complications to self</td>
<td>1.96</td>
<td>±0.84</td>
</tr>
<tr>
<td>Long-term complications to other</td>
<td>2.88</td>
<td>±0.79</td>
</tr>
<tr>
<td>Self Care Inventory (total score)</td>
<td>48.27</td>
<td>±8.52</td>
</tr>
<tr>
<td>Insulin dietary adherence</td>
<td>3.91</td>
<td>±0.68</td>
</tr>
<tr>
<td>Blood glucose testing</td>
<td>3.26</td>
<td>±0.88</td>
</tr>
<tr>
<td>Exercise</td>
<td>3.11</td>
<td>±1.23</td>
</tr>
<tr>
<td>Emergency precautions</td>
<td>3.24</td>
<td>±0.88</td>
</tr>
</tbody>
</table>

**Diabetes-Related Health Problems.** The Diabetes-Related Health Problems (DRHP) was developed for this study and designed to examine a youth’s perception of the likelihood of specific long-term and short-term complications occurring to someone else with diabetes and to themselves. The items, similar to the DHBQ with high face and content validity, were generated by senior...
investigators who are experienced in clinical care of and research with youth who have T1DM. The DRHP is administered in the form of an interview and contains 20 close-ended questions and two open-ended questions (see Appendix). Each question was rated on a five-point Likert scale ranging from “not at all likely/0–19% chance” (1) to “very likely/80–99% chance” (5). Four summary scores were created for perceptions of short-term complications to self, short-term complications to other, long-term complications to self, and long-term complications to other. There are eight questions referring to long-term complications, with four questions that refer to self and the same four questions that refer to other. There are 12 questions referring to short-term complications, 6 questions that refer to self and the same 6 in reference to other. The open-ended questions were used for qualitative purposes only. Internal consistency for each of the four scales, as well as for the total score, was calculated using Cronbach’s alpha, which ranged from .63 to .86 (Table II).

The construct validity of the DRHP was established through correlational analyses with the perceived susceptibility and severity scales of the DHBQ. Table III summarizes the correlations between all the DHBQ and the DRHP scales. The severity scale correlated with the total score of the DRHP ($p = .014$), and with the short-term and long-term complications to self scale ($p = .024$ and $p = .027$, respectively). The susceptibility scale of the DHBQ correlated with the short-term complications to self scale ($p = .004$). There were no significant correlations with the “other” scales. Discriminant validity between the long-term and short-term complication scales was established through paired $t$-tests for self ($t = -6.95$, $p < .001$) and other ($t = -2.47$, $p < .001$). For both self and other, adolescents perceived significantly greater risk for short-term complications than that for long-term complications. These findings provide preliminary support for the reliability and validity of the DRHP.

**Adherence**

*Self Care Inventory (SCI; La Greca, Swales, Klemp, & Madigan, 1988).* The SCI is a five-point Likert scale (1, complete nonadherence; 5, complete adherence) used for the assessment of diabetes-specific adherence behaviors (Greco et al., 1990). It consists of 14 items that measure self-reported adherence to the diabetes regimen over the past month. The SCI measures various aspects of diabetes self-management, including glucose testing and recording, administration of insulin, maintenance of a regular meal plan, exercise, and emergency precautions. An overall adherence score was obtained as well as subscale scores for blood glucose testing, insulin/dietary adherence, exercise, and emergency precautions. Higher scores on the SCI indicate greater adherence. The SCI has been reported to have adequate internal consistency (Cronbach’s alpha = .87) and test–retest reliability (La Greca et al., 1988). More recent support for this measure comes from Wysocki et al. (2000), who reported adequate internal consistency for adolescent
Health Beliefs in Adolescents

report (α = .76) as well as mother (α = .81) and father (α = .82) report. The SCI is well correlated with analogous measures derived from a 24-hr recall interview method (Greco et al., 1990). In this study, this inventory was administered separately to both parent and child. Both the child report of the SCI and the parent report of child’s adherence demonstrated adequate internal consistency for the overall adherence score (α’s = .78 and .79, respectively). However, a closer review of the subscales (Table II) revealed that the emergency precautions subscale showed low internal consistency scores for both the child and parent reports (.20 and .24, respectively). Given the low reliability of the emergency precautions subscale, it was excluded from the analyses examining the individual SCI subscales.

Glycemic Control
HbA1c. The level of HbA1c reflects the mean blood glucose concentration during the 2–3 months preceding measurement. Higher values indicate higher blood glucose levels and, therefore, more poorly controlled diabetes.

Procedure
Adolescents were recruited during their regularly scheduled clinic visits. Written informed consent was obtained from the parents and assent from the youth before their participation. Parents provided information regarding their ethnicity, education, and occupation. Trained graduate students administered the questionnaires. Adolescents completed the DRHP, DHBQ, and SCI, and the parents completed a parent report of the SCI. Laboratory results for blood samples for HbA1c assays, which are conducted as part of the patients’ regular outpatient visit, were obtained from the medical chart.

Results
Descriptive Findings
DHBQ
Table I summarizes the means and standard deviations of the three measures (and subscales) completed by the adolescents. As shown for the DHBQ, adolescents’ mean scores for susceptibility were fairly high, corresponding to a 40–59% chance that they feel susceptible to complications from diabetes. However, mean scores for severity were low, corresponding to a response between “diabetes is not a serious illness at all” and “diabetes is not a very serious illness.” Mean scores for benefits were also fairly high, indicating that, for the most part, adolescents in this sample believed that following adherence recommendations would lead to benefits, such as “decreasing the chance of having serious complications later in life” and “feeling better physically.” In contrast, adolescents’ mean scores for costs were fairly low, indicating moderate inconveniences to following adherence recommendations. Lastly, cues to action scores were fairly high, signifying that subjects were experienced in recognizing symptoms of high and low blood sugar as well as remembering the various aspects of their regimen.

Paired t-tests were conducted to identify significant differences in risk appraisal in the areas of the HBM. As shown in Table IV, adolescents in this sample perceived significantly greater susceptibility to complications, benefits to adherence, costs, and cues to action than to perceived severity. Furthermore, adolescents perceived significantly greater susceptibility and greater benefits than they did costs. In addition, the youths in this sample perceived significantly greater cues to action than costs to adherence and benefits to adherence.

DRHP
As shown in Table I, the DRHP mean scores for short-term complications to self revealed that subjects believed that they had less than a fifty-fifty chance of experiencing short-term complications, whereas they believed that others had more than a fifty-fifty chance. On the long-term complication scales, adolescents reported that they perceived slightly less than a 20–39% chance of experiencing long-term complications, whereas they believed that someone else with diabetes would have close to a fifty-fifty chance. Qualitatively, it

### Table IV. Paired t-Tests Between Subscales of the Diabetes Health Beliefs Questionnaire (DHBQ)

<table>
<thead>
<tr>
<th>Subscale</th>
<th>M</th>
<th>SD</th>
<th>Susceptibility</th>
<th>Severity</th>
<th>Benefits</th>
<th>Costs</th>
<th>Cues to action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susceptibility</td>
<td>3.68</td>
<td>0.73</td>
<td></td>
<td>11.63**</td>
<td>1.58</td>
<td>14.95**</td>
<td>–0.21</td>
</tr>
<tr>
<td>Severity</td>
<td>1.87</td>
<td>1.0</td>
<td>–10.37**</td>
<td></td>
<td>–2.51*</td>
<td>–11.51**</td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td>3.50</td>
<td>0.84</td>
<td>–9.05**</td>
<td></td>
<td>–2.25*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>2.22</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td>–12.43**</td>
<td></td>
</tr>
<tr>
<td>Cues to action</td>
<td>3.70</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05. **p < .01.
was noted that on the open-ended question “… kinds of health problems a person with diabetes might have 10 years from now,” adolescents had difficulty verbalizing possible long-term complications of diabetes.

Paired t-tests were conducted to identify differences in risk appraisal in the different areas of the DRHP (Table V). As expected, adolescents’ perceptions of both long- and short-term complications were significantly higher for complications to someone else with diabetes than to self. Results revealed that adolescents perceived significantly greater risk for short-term complications than for long-term complications to themselves and others.

SCI
As shown in Table VI, approximately 49% of adolescents reported significant nonadherence to insulin and diet recommendations, 75% reported nonadherence to blood glucose testing, and approximately 64% reported nonadherence to exercise recommendations. Approximately 42% of parents reported that their children are nonadherent to insulin and diet recommendations, 36% reported nonadherence to blood glucose recommendations, and 66% reported that their children were nonadherent to exercise recommendations. Overall, parents’ and child’s responses to the SCI were correlated with each other (r = .60, p < .001), as were their responses on the individual subscales.

HBM, Adherence, and HbA1c
Linear regression analysis by using the total score of the DHBQ to predict regimen adherence (as measured by the total score of the child-report SCI) was not significant (β = –.027, p = .822). Furthermore, the subscales of the DHBQ did not predict regimen adherence. Regression analysis to predict HbA1c was nonsignificant (β = .087, p = .459), although analyses with the DHBQ subscales revealed that perceived costs to adherence approached significance in predicting regimen adherence (p = .055).

Additional analyses were conducted to examine the relationship among the total score of the DHBQ to the specific areas of child-reported adherence (subscale scores for blood glucose testing, insulin/dietary adherence, and exercise). Correlational analyses revealed no significant associations between health beliefs and the subscales of adherence. Furthermore, the DHBQ subscales did not predict any of the three areas of regimen adherence, as measured by the child self-report SCI. The same analyses were conducted utilizing the parent report of adherence as the outcome variable. There were no significant findings.

DRHP, Adherence, and HbA1c
Results from separate regression analyses, using the total score (β = .378, p = .707) as well as the subscale scores for the short-term and long-term complications for self and other, to predict overall adherence (as measured by the total score of the child-report SCI), were not significant. Regression analyses predicting HbA1c were only significant for perceived short-term complications to self (β = .252, p = .037), such that greater perceived risk was associated with higher HbA1c levels. Analyses by using the total score to predict HbA1c approached significance (β = .235, p = .052), indicating that greater risk was associated with higher HbA1c levels.

Additional analyses were conducted to examine the relationship among the total DRHP scale score and its subscales to the specific areas of child-reported adherence (subscale scores for blood glucose testing, insulin/dietary

---

### Table V. Paired t-Test Between Subscales of the Diabetes-Related Health Problems (DRHP)

<table>
<thead>
<tr>
<th>Subscale</th>
<th>M</th>
<th>SD</th>
<th>Long-term complications to other</th>
<th>Short-term complications to self</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term complications to other</td>
<td>2.88</td>
<td>0.80</td>
<td>–2.45***</td>
<td>5.97***</td>
</tr>
<tr>
<td>Short-term complications to other</td>
<td>3.10</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term complications to self</td>
<td>1.96</td>
<td>0.84</td>
<td>9.19***</td>
<td>–6.95***</td>
</tr>
<tr>
<td>Short-term complications to self</td>
<td>2.61</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p < .001.

### Table VI. Response Frequency (%) and Correlations for Parent and Child Self Care Inventory (SCI)

<table>
<thead>
<tr>
<th>SCI subscales</th>
<th>Never/mostly not</th>
<th>Sometimes</th>
<th>Fifty-fifty</th>
<th>Usually/always</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin/diet</td>
<td>0/1.3</td>
<td>15.6/5.3</td>
<td>26.0/42.1</td>
<td>58.4/51.3</td>
<td>.25*</td>
</tr>
<tr>
<td>Blood glucose testing</td>
<td>11.7/7.9</td>
<td>24.7/23.7</td>
<td>0/43.4</td>
<td>63.6/25.0</td>
<td>.60**</td>
</tr>
<tr>
<td>Exercise</td>
<td>15.6/18.4</td>
<td>23.4/18.4</td>
<td>27.3/27.7</td>
<td>33.7/35.5</td>
<td>.67**</td>
</tr>
</tbody>
</table>

Values are those for parent/child.

*p < .05. **p < .001.
adherence, and exercise). Correlational analyses revealed no significant associations. Similar analyses were conducted utilizing the parent report of adherence as the outcome variable, revealing no significant findings.

Demographic and Illness Factors

Correlational analyses for health beliefs and adherence, conducted with age, SES, and duration of diabetes, revealed no significant relationships, with the exception of duration of diabetes. Duration was significantly associated with adherence to youth-reported blood glucose testing, such that youth with a longer duration of diabetes reported greater adherence in this area ($r = .29, p = .01$).

Significant ethnicity (Black and Hispanic) or gender differences were not found on the health belief measures. Although ethnicity effects also were not found on the adherence measure, gender differences were observed. Specifically, females reported less frequently following recommendations to exercise than males ($M = 2.6$ vs. $3.8$; $t = –4.19, p < .001$). Ethnicity differences were found with glycemic control, such that Blacks compared with Hispanics had greater HbA1c levels ($M = 11.9$ vs. $10.0$; $t = –2.491, p = .015$). There were no gender differences in HbA1c.

Discussion

The main findings of this study show that although health beliefs of minority youths with T1DM did not predict regimen adherence or glycemic control, their perceived risk of short-term diabetes-related complications was significantly greater than perceived risk of long-term complications and their perceived risk of complications occurring to others was significantly greater than perceived risk to self. The findings indicated relatively high rates of regimen adherence problems and poorer glycemic control in Black as compared with Hispanic youth, a finding consistent with that of previous studies (e.g., Delamater et al., 1999).

Risk Perception

This study provides preliminary support for the internal consistency and validity of the DRHP, a measure of risk perception developed for this study. Previous research (Frey et al., 1997; Greening & Chandler, 1997) has indicated that the distinction between the perceived likelihood for complications to self is likely to be underestimated compared with individuals’ perceived likelihood for problems occurring to someone else. The results of this study support those findings. Adolescents reported greater perceived risk for complications to other, than to self, for both short-term and long-term complications. Additionally, adolescents perceived greater risk for short-term complications than for long-term complications occurring to themselves and to someone else with diabetes. Because adolescents face short-term health risks such as hyperglycemia and hypoglycemia on a day-to-day basis, and it may be difficult for them to imagine long-term complications, short-term risks appear much more salient. Previous research examining illness beliefs in adolescents with T1DM suggests the need to distinguish between short-term and long-term beliefs in treatment effectiveness (Skinner et al., 2002).

This study examined the ability of the DRHP to predict parent report and child report of adherence and glycemic control. Findings revealed that perceived risk for short-term or long-term complications to self or other did not predict parent report or child report of adherence. However, greater perceived short-term complications to self did predict glycemic control. The association between greater perceived risk and higher HbA1c values may be due to knowledge of prior HbA1c values, thereby influencing the reporting of greater perceived short-term complications. Additionally, youth with poorer glycemic control may be more frequently exposed to educational interventions about their increased risk of health problems. This finding may indicate that adolescents with increased HbA1c values are accurately estimating the short-term complications to which they are susceptible. Overall, the results from the DRHP reveal the importance of separately assessing adolescents’ perceptions of short-term and long-term complications, as both may further our understanding of adolescents’ risk appraisal.

HBM

Because this study utilized the same measure of health beliefs as that utilized by Brownlee-Duffeck et al. (1987) and Bond et al. (1992), the discussion focuses on the findings reported in those studies. In this study, neither the total score nor the DHBQ subscores predicted parent or child report of adherence or glycemic control. In contrast, Brownlee-Duffeck et al. (1987) found that perceived costs predicted self-reported adherence, accounting for 23% of the variance. These investigators found that perceived severity and susceptibility accounted for 8 and 11%, respectively, of the variance in glycemic control. Additionally, the results of Bond et al. (1992) revealed that benefit cost was positively associated with adherence.

The findings from the present study are in contrast to the results of previous studies for several reasons,
including differences in age range and race and ethnicity. The sample characteristics of Bond et al. (1992) and Brownlee-Duffeck et al. (1987) differ significantly from those of this study, which included Hispanic and Black youths, and included adolescents of younger ages (13.6 vs. 18 and 14.2 years). Age may be a proxy variable for factors such as maturation and developmental stage. As Irwin and Millstein (1986) argue, biopsychosocial developmental factors may be critical variables affecting the onset and prevalence of risk-taking behaviors. In addition, it is possible that health beliefs change over time and/or course of the disease (Lewis & Bradley, 1994). Therefore, it may be that the HBM is a more useful tool in addressing diabetes management issues in older adolescents because health beliefs may be a less relevant issue for younger children.

It may also be that the DHBQ is an inappropriate measure of health beliefs for a minority sample. As Steers et al. (1996) suggest, the HBM targets health beliefs better suited to predict Euro-Americans’ behaviors rather than the behaviors of Black and Hispanic individuals. Notably, the Hispanic and Black participants in this study did not differ significantly in their appraisal of health risk or self-reported adherence. However, in comparing the DHBQ subscale means of this study with those from Bond et al. (1992), the authors found that perceived susceptibility was much higher in the present sample (3.68 vs. 1.88) and perceived severity lower (1.87 vs. 3.35). Although mean scores for perceived benefits, costs, and cues to action were similar across studies, it appears that for this sample the beliefs assessed by the HBM are not the ones associated with their level of self-care or glycemic control. Future research aimed at studying the health beliefs of varying ethnic groups is warranted, with a focus on measures that are specifically designed for beliefs espoused by each group.

Also of interest was the finding that the youth in this study perceived greater costs to adherence than benefits and that of all the HBM subscales, perceived susceptibility to complications was the health belief with the highest risk rating. Although this information may be specific to the sample under study, findings such as these are helpful when designing interventions.

**Demographic and Illness Factors**

Of the sample characteristics examined in this study, age and SES did not correlate significantly with self-reported adherence or health beliefs. Duration of diabetes was associated with self-reported adherence, in that youth who have had diabetes for a longer period had greater adherence in the area of blood glucose testing. Individuals with a longer duration may feel more comfortable checking their blood glucose and also may feel more at ease checking in public places, as is necessary at times.

Although Brownlee-Duffeck et al. (1987) found no relation between gender and self-reported regimen adherence, in this study differences were observed such that females when compared with males reported adhering less frequently to recommendations to exercise. This is consistent with the literature on physical activity in youth, which indicates that boys report spending significantly more time in moderate-to-vigorous physical activity (Simons-Morton et al., 1997).

**Limitations and Future Directions**

Several limitations of this study should be noted. First, generalizations of these findings are limited to the ethnic groups and age ranges represented in the sample. Because no ethnic differences were discovered, these results may be generalizable to Black and Hispanic adolescents with T1DM. Nevertheless, future studies would benefit by inclusion of culturally diverse youths to increase the generalizability of the results. Second, this study did not consider other predictors of regimen adherence (e.g., family functioning, social support, self-efficacy, and cognitive maturity) that may interact with health beliefs to predict levels of adolescents’ adherence. Future research examining these factors may lead to a greater understanding of adherence behaviors and allow for the tailoring of more specific interventions.

The cross-sectional design used in this study impedes drawing clear inferences regarding the directionality of the relationships between variables. Prospective studies would help determine developmental trajectories of health beliefs, risk perception, and adherence behaviors. Lastly, self-report measures are subject to possible inaccuracy and response biases (e.g., social desirability). However, anonymous reporting and relatively high agreement between adolescents and parents concerning adherence to their diabetic regimen provides some support for the validity of the adolescents’ self-report of adherence.

**Clinical Implications**

These findings indicate that the assessment of perceived risks for short-term complications is important for this age group and suggest that interventions to improve diabetes management include a focus on risk perception of short-term complications. Additionally, it may be helpful to increase adolescents’ awareness and risk perception of long-term complications, as they perceived...
less long-term than short-term risk and had difficulty verbalizing possible long-term problems.

**Conclusions**

This study did not provide support for the use of the HBM to predict adherence or glycemic control with an ethnic minority sample of adolescents with T1DM. However, the study did provide support for the distinction between long-term and short-term complications and complications occurring to one's self or someone else with diabetes. Youth with T1DM report greater short-term than long-term health risks and perceive less risk to themselves than to others.

**Acknowledgment**

This research was supported by grant T32 HD07510 from the National Institutes of Health.

**References**


**Appendix**

**Diabetes-Related Health Problems**

<table>
<thead>
<tr>
<th>ID</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, not at all likely</td>
<td>20–39%</td>
</tr>
<tr>
<td>3, fifty-fifty</td>
<td>4, pretty likely</td>
</tr>
<tr>
<td>5, very likely</td>
<td></td>
</tr>
</tbody>
</table>

I. Tell me what kinds of health problems a person with diabetes might have on a daily basis, like today or tomorrow.

1. ___________________________________________________________________
2. ___________________________________________________________________
3. ___________________________________________________________________

II. What is the likelihood that someone with diabetes would __________________________________?

1. feel symptoms of low blood sugar
2. have low blood sugar leading to loss of consciousness
3. have high blood sugar
4. have such high blood sugar leading to ketoacidosis
5. go to the hospital for high blood sugar
6. go to the hospital for low blood sugar

III. What is the likelihood that you would __________________________________?

1. feel symptoms of low blood sugar
2. have low blood sugar leading to loss of consciousness
3. have high blood sugar
4. have such high blood sugar leading to ketoacidosis
5. go to the hospital for high blood sugar
6. go to the hospital for low blood sugar

IV. Tell me what kinds of health problems a person with diabetes might have 10 years from now.

1. ___________________________________________________________________
2. ___________________________________________________________________
3. ___________________________________________________________________
4. ___________________________________________________________________

V. What is the likelihood that someone with diabetes would have __________________________________?

1. kidney disease
2. eye disease
3. amputation
4. sexual dysfunction

VI. What is the likelihood that you would have __________________________________?

1. kidney disease
2. eye disease
3. amputation
4. sexual dysfunction