

Relationship of Self-Efficacy and Bingeing to Adherence to Diabetes Regimen Among Adolescents

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OBJECTIVE— To test the hypothesis that poorer adherence to diabetes care is related to four variables associated with self-concept in adolescents with diabetes: self-esteem, self-efficacy, depression, and bingeing behavior. In addition, we expected adolescent females to be less adherent to diabetes care.

RESEARCH DESIGN AND METHODS— We recruited 193 consecutive patients (aged 13–18 yr) with insulin-dependent diabetes mellitus during their regular quarterly visit to a diabetes clinic in a large urban hospital. Participants completed the Rosenberg Self-Esteem Scale, the Children's Depression Inventory, an assessment of the frequency of bingeing in the past 3 mo, and parallel forms of an adherence scale and a self-efficacy scale that were developed for use in this study.

RESULTS— Adolescents who reported lower adherence tended to report lower self-esteem ($r = 0.45$, $P < 0.001$) and self-efficacy ($r = 0.57$, $P < 0.001$), more depressive symptoms ($r = -0.50$, $P < 0.001$), more bingeing ($r = -0.36$, $P < 0.001$), and had higher HbA_{1c} ($r = -0.24$, $P < 0.001$) than those with higher adherence scores. Together, the psychological variables accounted for 50% of the variance in adherence. There was no sex difference in reported bingeing, but, as expected, adolescent females reported less adherence overall ($F[7,184] = 2.5$, $P = 0.018$).

CONCLUSIONS— Treatment adherence in adolescents with insulin-dependent diabetes mellitus is associated with behavioral and psychological variables. These findings suggest that specific behavioral and cognitive interventions could be used to improve adherence in those individuals who lack confidence in their ability to perform diabetes-related tasks.

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Adherence to prescribed diabetes management practices appears to deteriorate as youngsters move from childhood into adolescence (1–3), causing difficulties for patients and their health-care providers. Problems with self-concept, a common developmental issue in adolescence, may be one factor that explains why adolescents have more difficulty with adherence. In this study, we examined the influence on adherence of four variables that relate to self-concept in young people with diabetes: self-esteem, self-efficacy, depression, and bingeing behavior.

Although recent studies suggest that most youngsters with insulin-dependent diabetes mellitus are, in fact, quite well adjusted (4–8), poorer adjustment appears to be associated with poor metabolic control (9–12) or diabetic complications (13,14). When health-care providers place a premium on good control, youngsters who do not live up to this expectation may experience lowered self-esteem and feelings of depression. Symptoms of depression and/or anxiety have been reported in 30–50% of children with poorly controlled diabetes (9,15). The degree to which adolescents follow their diabetic regimen may be influenced by self-efficacy—their level of confidence in their ability to do so (16). Among adolescents with diabetes, self-efficacy has been found to be positively related to internal locus of control and self-esteem, and negatively related to metabolic control (17).

Maintaining a balanced diet is a central component of diabetes management. Evidence is accumulating, however, that food restriction increases the likelihood of subsequent bingeing on restricted foods (18). For adolescents with diabetes, such lapses in adherence could lead to self-deprecation, manifested as lowered self-esteem or depression. Bingeing behavior may also be reflected in higher levels of HbA_{1c}, a measure of metabolic control that indicates average blood glucose over 6–12

wk (19). Because this test is often a routine part of diabetes management, poor results may lead to increased pressure on the adolescent to comply with the diabetes diet. Clearly, this is a situation in which an interactive cycle of restriction, bingeing, low self-esteem, and depression may develop. Adolescent females are especially vulnerable to societal pressures to be thin, and they consequently develop pathological eating patterns (20).

In this study, we postulate that 1) self-reported adherence would be positively related to self-esteem and self-efficacy and negatively related to depression, 2) self-reported adherence would be negatively related to bingeing behavior, 3) adolescent females would binge more and be less adherent than boys, 4) bingeing would be related negatively to self-esteem and self-efficacy and positively to depression, and 5) self-reported adherence would be negatively related to HbA_{1c} (i.e., better adherence would be related to a lower HbA_{1c} score).

RESEARCH DESIGN AND METHODS

Consecutive outpatients attending a regular quarterly appointment at the diabetes clinic at the Hospital for Sick Children in Toronto, Canada, were asked to participate. Of the 255 adolescents who were approached, 76% (103 females and 90 males) completed the study. Participants ranged in age from 13 to 18 yr (mean = 15.3). The mean \pm SD duration of insulin-dependent diabetes mellitus was 5.8 ± 3.9 yr, and the mean age of diabetes onset was 9.2 ± 3.8 yr. Examination of the hospital charts revealed that there were no differences between responders and nonresponders with respect to either age or HbA_{1c}.

A self-report questionnaire, including consent form and information letter, was completed either during the clinic visit or was taken home and returned by mail in the stamped return

envelope provided. Signed consent was obtained from all subjects and from parents of those <16 yr of age. Reminder telephone calls were made to those who had not returned their questionnaires within 2 wk. Additional information was obtained from hospital clinic charts.

We designed a seven-item measure of adherence that incorporated the four major categories of diabetes management identified in most adherence measures: diet, blood glucose monitoring, insulin injections, and exercise (2,21). In addition, we included one item on treating an insulin reaction and two questions about general diabetes management. The seven items were 1) testing your blood and urine for glucose regularly, 2) taking your insulin on schedule, 3) following your food plan, 4) keeping your blood glucose at the right level, 5) fitting exercise into your treatment plan, 6) treating a reaction, and 7) remembering to do everything every day. These items were rated on a nine-point scale in a manner designed to appeal to the experiences of adolescents. The question read, "Grade yourself! On this question you are on your honor to grade how well you manage your own diabetes. Give yourself a letter grade to show how well you do each task listed below most of the time. Give yourself 'A+' if you could not be better, 'A' if you are excellent,...'F' if you are a disaster." Scoring involved converting the letter grades for each of the items as follows: A+ = 9, A = 8,... F = 1, and averaging the values to obtain a total score. A higher score on this scale reflects better adherence.

The self-efficacy scale followed the adherence scale on the questionnaire to emphasize the task of discriminating between actual and potential behavior. It included the same seven items contained in the adherence scale and was scored similarly, such that higher scores reflected higher self-efficacy. The instructions were altered to read, "Now grade yourself on how well

you could do each of these same tasks if you got yourself as organized as you could be. Use the same letter grades."

The HbA_{1c} level reflects the adequacy of metabolic control over the preceding 6–12 wk (19) and is performed routinely in the diabetes clinic. The intra- and interassay coefficients of variation for HbA_{1c} measurement in our laboratory were 2.3 and 2.9%, respectively. HbA_{1c} was obtained from the clinic charts for the date of enrollment in the study and for a follow-up visit 6 mo later. Subjects were also asked to rate how good their metabolic control is most of the time on a five-point scale, ranging from terrible (1) to extremely good (5).

An eating binge was defined as eating a large amount of food in a short space of time. Participants were asked, "How frequently over the past 3 mo have you had an eating binge?" Possible responses included "never, never in the past 3 mo, less than once a month, about once a month, 2–3 times a month, once a week, several times a week, every day, more than once a day."

The Rosenberg Self-Esteem Scale is a reliable, well-validated self-report measure consisting of 10 items rated from 1 to 4 (22,23). Possible scores range from 10 to 40. A higher score reflects higher self-esteem.

The Children's Depression Inventory consists of 27 items, with possible scores ranging from 0 to 54. It has satisfactory internal consistency and diagnostic validity (24,25).

RESULTS— The internal consistency (Cronbach's α) of the seven-item measures of adherence (mean \pm SD 6.4 ± 1.3 , $n = 182$) and self-efficacy (7.8 ± 0.9 , $n = 177$) was 0.78 in both cases. The average interitem correlations were 0.34 and 0.35, respectively. Factor analysis revealed a single factor in each measure. Validity of the adherence scale was demonstrated by its negative corre-

Table 1—Correlations between adherence and study variables

	ADHERENCE	SELF-EFFICACY	DEPRESSION	SELF-ESTEEM
SELF-EFFICACY	0.57*			
DEPRESSION	-0.50*	-0.19†		
SELF-ESTEEM	0.45*	0.27*	-0.73*	
BINGEING	-0.36*	-0.23*	0.33*	-0.27*

*P < 0.001.

†P < 0.01.

lation with current HbA_{1c} (r = -0.24, P < 0.001), and with HbA_{1c} 6 mo later (r = -0.26, P = 0.001). Although relatively low, these correlations are in the expected direction and are in keeping with the findings of others (26). The HbA_{1c} level correlated r = 0.69 (P < 0.001) with HbA_{1c} 6 mo later. The single-item measure of metabolic control, on which participants were asked for a self-rating of their usual level of metabolic control on a five-point scale, was positively correlated with self-reported adherence (r = 0.55, P < 0.001) and negatively correlated with HbA_{1c} (r = -0.30, P < 0.001).

Table 1 shows intercorrelations among adherence and study variables. As predicted, individuals who reported poorer adherence to their diabetes treatment regimen also tended to report more bingeing behavior (r = -0.36, P < 0.001), higher levels of depressive symptomatology (r = -0.50, P < 0.001), and lower levels of self-esteem (r = 0.45, P < 0.001) and self-efficacy (r = 0.57, P < 0.001).

A standard multiple regression analysis was performed to determine the combined and unique ability of these measures to estimate self-reported adherence. Because depression and self-esteem were so highly correlated (r = -0.73, P < 0.001), and because the correlation with adherence was slightly stronger for depression (r = -0.50) than for self-esteem (r = -0.45), only depression was included in the regression model. All factors

were entered into the analysis simultaneously. Together, bingeing behavior, self-efficacy, and depression accounted for 50% of the variance in adherence. The unique contribution of each of these variables was as follows: self-efficacy estimated 20% of the variance (t = 8.57, P < 0.0001), depression 12% (t = 6.45, P < 0.0001), and bingeing 2% (t = 2.43, P < 0.02).*

Contrary to prediction, adolescent females did not report more bingeing behavior than boys. Item response totals and overall scores on the adherence and self-efficacy scales are presented in Table 2. To test the hypothesis that girls would be less adherent to diabetes care than boys, we conducted a multivariate analysis of variance, with the seven adherence items as the multivariate dependent variables (F based on Wilk's λ). The overall effect for sex was statistically significant (F[7,184] = 2.50, P = 0.018), with adolescent females less adherent than boys. On no individual item was the mean score for boys higher than that for girls. However, with two-tailed t tests, meaningful sex differences were apparent on item 2 (following food plan, t = 1.76, P = 0.08), item 4 (blood glucose level, t = 2.53, P = 0.012), and item 5 (exercise, t = 3.21, P = 0.002). To control the number of comparisons, α was set at 0.007 with the Bonferonni adjust-

*TABLES CONTAINING COMPLETE REGRESSION PARAMETER DATA ARE AVAILABLE DIRECTLY FROM THE AUTHORS.

ment (i.e., α of 0.05 was divided by 7). With this criterion, only exercise was statistically significant. There was no sex effect when the multivariate analysis was performed on the self-efficacy scale (F[7,184] = 0.81, P = 0.58).

A second multiple regression analysis was performed to determine the influence on adherence of bingeing and sex together. Bingeing, sex, and the bingeing-sex interaction were entered into the analysis simultaneously. Together, these variables accounted for 17% of the variance in adherence. The interaction between bingeing and sex contributed 2% of the variance uniquely (t = 2.1, P < 0.04), indicating that adolescent females who binged more had significantly lower adherence scores than boys who binged more.

CONCLUSIONS— In this study, the combined effects of self-efficacy, depression, and bingeing behavior accounted for 50% of the variance in self-reported adherence to diabetes regimen among 193 adolescent boys and girls. The best predictor of adherence was self-efficacy, the adolescents' level of confidence in how well they could do each of the adherence tasks under the best of circumstances. This, together with the finding that lower self-efficacy was significantly related to poorer self-esteem and more depression, suggests that all of these factors may be related to an underlying deficit in self-concept.

The amount of bingeing by subjects in our study was also predictive of overall adherence, especially for adolescent females. Because the diabetes regimen often requires the restriction of food, a factor that has been causally related to subsequent bingeing (18), adolescent females with diabetes may well be in double jeopardy regarding their risk propensity for an eating disorder (27,28). The females in this study also reported less adherence overall than the boys. Note, however, that the effect sizes of these sex findings, although in

Table 2—Individual item adherence and self-efficacy scores

ITEMS	ADHERENCE	SELF-EFFICACY
1. TESTING YOUR BLOOD AND URINE FOR GLUCOSE REGULARLY	6.1 ± 2.3	7.9 ± 1.3
2. TAKING YOUR INSULIN ON SCHEDULE	7.5 ± 1.3	8.4 ± 0.8
3. FOLLOWING YOUR FOOD PLAN	5.6 ± 2.0	7.4 ± 1.5
4. KEEPING YOUR BLOOD GLUCOSE AT THE RIGHT LEVEL	5.6 ± 2.0	7.3 ± 1.3
5. FITTING EXERCISE INTO YOUR TREATMENT PLAN	6.5 ± 2.2	7.9 ± 1.3
6. TREATING A REACTION	7.4 ± 1.6	8.1 ± 1.3
7. REMEMBERING TO DO EVERYTHING EVERY DAY	6.7 ± 2.0	8.1 ± 1.1
OVERALL SCORE	6.4 ± 1.3	7.8 ± 0.9

the predicted direction, were relatively modest.

Noncompliance with the diabetes regimen through bingeing was also significantly related to depressive symptoms and lower levels of self-efficacy and self-esteem. Although causal relationships cannot be inferred definitively from our cross-sectional data, one possible explanation is that low self-esteem and depression arise secondary to the adolescent's failure to master the demands of the illness to the satisfaction of others. With the onset of adolescence, the need to be independent may interfere with adherence to a strict diabetes routine (29).

A limitation of these results is the unknown reliability and validity of our measures of adherence and self-efficacy. It is well known that self-report measures of adherence to diabetes regimen can be unreliable, because many patients misjudge their behavior and also because of the outright fabrication of records (30–32). Our measure was a general one in which subjects were asked to give an overall estimate of how well they were performing rather than to estimate actual frequencies of regimen behaviors. Although the results were in the predicted direction, our findings may have been stronger had our measure of adherence been more reliable and had we validated the

instrument on a similar sample before using it in this study. In addition, the strength of the association between adherence and self-efficacy could have been influenced by shared-method variance, because (with the exception of the instructions) the two measures were designed to be equivalent. However, it was hoped that this similarity would facilitate the task of discriminating between actual and optimal behaviors.

These findings may have important clinical implications. Poor self-concept and low self-efficacy may be treatable causes of noncompliance. Behavioral and cognitive interventions, such as role playing and the correction of self-defeating thoughts and/or cognitive distortions, may help adolescents to feel more confident about their ability to perform illness-related tasks, and thus improve both their self-concept and level of adherence to their diabetes regimen.

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