Experimentally-Induced Learned Helplessness in Adolescents with Type 1 Diabetes

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Objectives To determine whether adolescents with type 1 diabetes are more at risk for learned helplessness than their healthy peers. Methods Twenty-three adolescents with diabetes and 25 controls completed a solvable or unsolvable concept formation task. All completed pre- and post-task performance and attribution ratings, and later completed an anagram-solving task to determine if perceived helplessness on the first task would negatively impact performance on the second. Results Participants in the unsolvable condition solved fewer anagrams; those with diabetes did not show weaker performance than controls. Participants in the solvable condition (diabetes and controls) showed an increase in internal attributions from before the concept formation task to after. In the unsolvable condition, only participants with diabetes made more external attributions for their failure. Conclusions Contrary to the only other controlled study to use this paradigm in youth with chronic illness, adolescents with diabetes were not more susceptible to learned helplessness.

Key words adolescents; chronic illness; diabetes.

Learned helplessness is a psychophysiological phenomenon in which an individual develops helplessness following repeated exposures to negative events over which he or she has no perception of control (e.g., Miller & Seligman, 1975). Learned helplessness is reflected by a pessimistic attributional style in which negative events are attributed to internal (i.e., related to the individual), stable (i.e., permanent), and global (i.e., pervasive) factors, as opposed to external, transient, and specific factors (Abramson, Seligman, & Teasdale, 1978). For example, given failure on a geography test, a student may attribute this to being a poor student (an internal, stable, global cause) as opposed to it being an unfair test (external cause), being ill that day (unstable cause), or having a weakness in geography (specific cause).

Learned helplessness is potentially an important construct in understanding coping with chronic illness, as individuals with a chronic illness are often confronted with repeated exposures to negative, uncontrollable disease-related events. As noted by Vallis (2001), in the case of diabetes specifically, when individuals’ efforts to maintain good blood glucose control are repeatedly met with failure (often because of elements beyond their control), learned helplessness may occur. This will be especially true if they make internal, stable, and global attributions for their inability to maintain good metabolic control (cf., Kuttner, Delamater, & Santiago, 1990). Adolescents with type 1 diabetes may be particularly vulnerable to learned helplessness because variations in glucose control frequently occur in this age group due to factors such as stress, illness, hormonal changes, and variations in insulin absorption (Heise et al., 2004; Wysocki, Greco, & Buckloh, 2003), even if they maintain adherence to a daily regimen.

A pessimistic attributional style has been linked to both psychological and physical morbidity in youth with type 1 diabetes. For example, Kuttner et al. (1990) found an association between learned helplessness, as measured by self-reported ratings on the Children’s Attributional Style Questionnaire (CASQ, Kaslow, Tanenbaum, & Seligman, 1978; Seligman, et al., 1984) and self-reported depression in a sample of youth with diabetes. They further demonstrated that higher levels of perceived helplessness were correlated with poorer metabolic control,
as measured by glycosylated hemoglobin (A1c)\(^1\) over the previous year (but not current A1c). In contrast, Brown, Kaslow, Sansbury, Meacham and Culler (1991), found that youth with an internal, global, and stable attributional style for negative events (as measured by the CASQ) had better metabolic control. Brown et al. theorized that youth with this attributional style took more responsibility for negative health outcomes. Schoenherr, Brown, Baldwin, and Kaslow (1992) subsequently studied a population of youth with acute lymphocytic leukemia, type 1 diabetes, or sickle cell syndromes and found that across illness groups, those with a pessimistic attributional style (measured with the CASQ) were more likely to report symptoms of depression.

Chaney et al. (1999) recognized that there were limitations to self-report measures for fully understanding the association between learned helplessness and chronic illness. They examined experimentally-induced learned helplessness in a laboratory setting in a population of youth and young adults with asthma and healthy controls, using an experimental paradigm that was originally developed by Levine (1971; see also Hiroto & Seligman, 1975). Participants, aged 18–24 years, completed a computerized concept formation task in which accurate feedback was necessary for task completion. A random half of the participants in each group received inaccurate (noncontingent) feedback, making the task unsolvable. The other half received accurate (contingent) feedback, making the task solvable. All participants subsequently completed an anagram-solving task to determine whether perceived helplessness on the first task caused poorer performance on the second. There were two noteworthy differences between the asthma and healthy control groups. First, although performance on the anagram-solving task was worse for all participants who had first completed the unsolvable (vs. solvable) task, the negative impact was disproportionately greater for participants with asthma. This demonstrated that individuals with asthma were more susceptible to experimentally-induced learned helplessness and the resultant impact on problem solving abilities, even when the experimental task was unrelated to disease management. Second, participants with and without asthma who completed the solvable task rated high internal attributions for their success. Among those who completed the unsolvable task, participants with asthma made more internal attributions for their failure, whereas the healthy controls made more external attributions. Chaney et al. concluded that a depressive attributional style (i.e., internal attributions for failure) may have interfered with the participants’ ability to focus on the anagram task, and further theorized that this style could also place individuals with asthma at a higher risk for depression.

Using a similar experimental paradigm, Hommel, Chaney, Wagner and Jarvis (2006) examined learned helplessness in youth (aged 9–17 years) with juvenile rheumatic disease (JRD). Hommel et al. found (similar to Chaney et al., 1999) that youth with JRD who had completed the solvable task reported high internal task attributions for their success. In contrast to Chaney et al., however, those who completed the unsolvable task made more external attributions for their failure. Hommel et al. suggested that these external attributions could represent a feeling of loss of control and maladaptive coping. It could also, however, represent an adaptive coping response to an uncontrollable negative event (e.g., Abramson et al., 1978). As Hommel et al.’s primary focus was to explore the relation between learned helplessness and other disease specific variables, there was no healthy control group in this study. The data of Hommel et al., therefore, does not permit a direct comparison with the finding by Chaney et al. that individuals with chronic illness are more adversely affected by the unsolvable concept formation task than healthy controls.

To date, learned helplessness in youth with diabetes has only been studied with self-report measures and correlational designs. We sought to replicate the intriguing findings of Chaney et al. with a population of youth with type 1 diabetes, and to determine whether adolescents with diabetes are more at risk for learned helplessness than their healthy peers. A better understanding of the construct of learned helplessness in this group could have important clinical implications, both in terms of better understanding the psychological impact of diabetes in youth, and in helping the design of cognitive interventions that would better address issues of diabetes self-management and adherence. Based on the findings of Chaney et al. (1999), we predicted that adolescents with diabetes would experience a greater performance deficit as compared to controls in response to the learned helplessness induction. Furthermore, based on Chaney et al., we expected that the youth with diabetes would make more internal attributions following failure on the unsolvable task, although we also acknowledge that Hommel et al. (2006) found the opposite pattern in their sample of youth with JRD.

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\(^1\)Glycosylated hemoglobin (A1c) is a blood test which estimates an individual’s average blood glucose control over a period of approximately 3 months (Wysocki, et al., 2003).
Method

Participants

The participants were 48 adolescents (28 females (F), 20 males (M); mean age = 14.9 years, SD = 1.4, range = 13–17 years), 23 with type 1 diabetes and 25 healthy controls (for descriptive statistics, including information regarding diabetes history, see Table I). Exclusion criteria included parental report of a history of learning disability or attention-deficit hyperactivity disorder (ADHD), parental or clinic physician report of a current diagnosis of major depression or psychosis, and composite scores in the clinically elevated range (T > 70) on the Clinical Maladjustment or the Emotional Symptoms Index of the Self Report of Personality (SRP; Reynolds & Kamphaus, 1998). All participants were reportedly able to read in English at a minimum of a grade 5 reading level and had normal or corrected-to-normal vision.

Participants with type 1 diabetes were recruited through the Diabetes Clinic Database at the IWK Health Centre, a tertiary care pediatric hospital in Atlantic Canada. The database was used to identify 142 youth with type 1 diabetes between the ages of 13 and 17 years who had been diagnosed with diabetes for at least 1 year, who were otherwise healthy (i.e., no other chronic disease, except for controlled hypothyroidism), and who were not participating in any other diabetes studies. Adolescents who started insulin pump therapy in the preceding 6 months were excluded. Information regarding the study was mailed to eligible youth and their parents, and a follow-up phone call was made 2 weeks later. Of the 142, 77 (54%) indicated that they were not interested in participating, 29 (20%) could not be reached by phone, and 13 (9%) did not meet inclusion criteria. Twenty-three (16% of the available sample) participated. As can be seen in Table 1, the study sample is similar to the population from which it was drawn, in terms of diabetes and demographic characteristics.

The healthy control group consisted of 25 youth with no history of chronic illness, recruited via public postings and word of mouth. The results of independent-samples t-tests and chi square analyses showed that the diabetes and healthy control groups did not differ statistically on demographic characteristics. All participants identified themselves as Caucasian.

| Table I. Descriptive Statistics Comparing Healthy Controls to Participants with Diabetes (and the Diabetes Clinic Population from which the Diabetes Group was Sampled) |
|-----------------|-----------------|-----------------|
|                 | Control Participants | Diabetes Participants | Diabetes Clinic |
| Mean age in years (SD) | 14.6 (1.08) | 15.2 (1.63) | 15.54 (1.44) |
| Gender           | 60%F; 40%M | 56.5%F; 43.5%M | 45.2%F; 54.8%M |
| Mean duration of diabetes in years (SD) | n/a | 6.9 (3.6) | 6.96 (4.01) |
| Mean A1c% (SD)   | n/a | 8.13 (1.27) | 8.79 (1.50) |
| (Normal 4.1–5.8%)|                |                 |                 |
| Type of therapy  | 48% pump | 43% pump | 52% injection |
|                 | 57% injection | 57% injection | |

Note. All between groups differences (control vs. diabetes participants) are nonsignificant.  
Range = 6.6–12.2.

Measures

Demographic Information Questionnaire

General information (e.g., age, gender, ethnicity) regarding the participants was collected with a researcher-compiled questionnaire.

Self-Report of Personality (SRP, from the Behavior Assessment System for Children)

This questionnaire (Reynolds & Kamphaus, 1998) asks adolescents to indicate whether each of 186 one-sentence statements is “True” or “False” for them. The statements assess school, personal, and clinical adjustments and emotional symptoms. The SRP is composed of 10 clinical scales (e.g., Depression, Locus of Control), four adaptive scales (e.g., Self-Esteem, Self-Reliance), and four composite indexes (e.g., Clinical Maladjustment, Personal Adjustment). This measure has high internal consistency and test–retest reliability, and good construct validity (Reynolds & Kamphaus, 1998). It was used as a general screen of psychological functioning, to detect youth who met the exclusion criteria.

Pre and Post Task Performance Ratings

This measure (Chaney et al., 1999) was a visual analog scale in which participants were asked to place an “X” on a 10-cm line to rate how they performed on a task. The anchors were labeled “0: much worse than most teenagers” and “10: much better than most teenagers”. This scale was administered before and after the concept formation task and was used to assess the effects of the experimental manipulation on outcome expectancies.

2Fifty-four adolescents originally participated in this study, but one male participant with diabetes and four healthy controls (2F; 2M) were excluded because they did not meet inclusion criteria. Another healthy control was also excluded from the analyses based on her performance on the concept formation task.
Pre and Post Task Attribution Ratings
Participants were asked to answer the following question: “Do you think that your level of success on the computer task (will be/was) due to something about you or due to other circumstances?” using a 7-point scale ranging from 1 (“totally due to other circumstances”) to 7 (“totally due to me”) (Chaney et al., 1999). Higher scores reflect more internal (vs. external) attributions. This scale was administered before and after the concept formation task, and was used to estimate the effects of the experimental manipulation on performance attributions.

Computerized Concept Formation Task
This computerized version of a standard concept formation task (Levine, 1971) was used as the experimental manipulation procedure (Chaney et al., 1999; Hommel et al., 2006). Participants were seated in front of a computer in a quiet room and presented with instructions on the computer screen. A series of displays with two patterns was presented. Each pattern contained one of two letters (Y or Z), surrounded by a shape (circle or square) and a background color (red or blue). Participants were told that one of the patterns (e.g., the letter ‘Y’ surrounded by a red circle) was designated as “correct” based on one of its features (e.g., the ‘Y’). Participants were instructed to indicate which pattern they guessed was correct using a mouse click, and then use the computer-generated feedback (“right” or “wrong”) to discern, over a block of 10 trials, which of the six features was “correct”. Following a practice block and the opportunity to ask questions, four blocks of 10 trials were presented, with each block having a different feature designated as correct.

Although all participants received the same instructions suggesting that the task was solvable, participants were randomly assigned to one of two conditions. Eleven participants with diabetes and 13 healthy controls were assigned to the solvable condition and received feedback contingent on their performance. Twelve participants with diabetes and 12 healthy controls were assigned to the unsolvable condition and received noncontingent (random) feedback, making the task impossible to solve. The participants’ score was displayed on the screen when the task was completed. The concept formation task was designed to experimentally manipulate the participants’ feelings of self-efficacy. Specifically, the unsolvable condition was implemented to induce learned helplessness.

Computerized Anagram-Solving Task
This task was administered to measure the impact of perceived helplessness on the concept formation task on performance on a subsequent task (Chaney et al., 1999; Hommel et al., 2006). Standardized instructions were presented on the computer screen. The goal was to unscramble the letters of 20 anagrams to form a word. Participants typed their answers using the keyboard, and if they guessed incorrectly, they were permitted to make as many attempts as they wanted within a 100-s time limit. Participants were informed that the anagrams could be solved by means of a pattern or principle. All anagrams were solvable and followed the same solution sequence (i.e., 5-3-1-2-4). The dependent variable was the number of anagrams correctly solved.

Procedure
The study protocol was approved by the hospital’s Research Ethics Board. Adolescents with type 1 diabetes and healthy controls who showed interest in participating were contacted by a member of the research team to complete telephone screening with their parent or guardian. An individual experimental session was then scheduled. Informed consent and authorization were obtained from the participants and their parent or guardian, respectively.

Participants were informed that the purpose of the study was to examine how psychological factors, such as thinking patterns when learning new or difficult tasks, are related to living with type 1 diabetes. Participants were randomly assigned to either the solvable (i.e., contingent feedback) or unsolvable (i.e., noncontingent feedback) task condition. The research assistant was not blind to condition (solvable, unsolvable) or group (diabetes, control).

Before beginning, participants with diabetes were asked to check their blood glucose, since high or low blood glucose may interfere with cognitive function (see Weinger & Jacobson, 1998). If the blood glucose level was <4 mmol/l (72 mg/dl) the participant was asked to treat the low as at home. The participant was then asked to recheck to ensure the blood glucose had risen >4 mmol/l before proceeding. If the blood glucose was >15 mmol/l (270 mg/dl), the participant was asked to give insulin to correct the high prior to proceeding.3

All participants completed the demographic information questionnaire, the SRP Behavior Assessment System for Children (BASC), the Pre-Task Performance Rating and

3The average blood glucose level prior to testing was 8.50 mmol/l (SD = 3.68; range 4.0–15.0 mmol/l) or 153 mg/dl (SD = 66.29; range 72–270 mg/dl). One participant treated a low and re-checked prior to beginning the experimental session, one participant with a level of 15.0 mmol/l had taken insulin just prior to the session and did not re-check. No one reported symptoms of hypoglycemia during the session.
the Pre-Task Attribution Rating, followed by either the Solvable or Unsolvable version of the concept formation task, and Post-Task versions of the Performance and Attribution Ratings. Finally, all participants completed the anagram-solving task. Prior to the end of the experimental session, the research assistant provided a full debriefing regarding the true purposes of the experiment, and demonstrated that for some participants, the task was impossible to solve (cf., Tennen & Gillen, 1979). Participants received $15 in recognition of their travel and time commitment to the study.

Based on the obtained sample of 48 participants, power calculations with G*Power (Faul, Erdfelder, Lang & Buchner, 2007) indicated that our sample yielded adequate statistical power to detect large effect sizes (f ≥ .41) with power set at .80 and alpha set at .05 for our primary analysis of interest (i.e., a 2 × 2 analysis of variance [ANOVA] comparing youth with diabetes and controls in response to the unsolvable and solvable tasks). The statistical analyses were performed using SPSS for Windows (version 11.5).

Results
Random Assignment
The results of independent-samples t-tests and chi-square analyses showed that participants randomly assigned to the solvable or unsolvable condition did not significantly differ in terms of age and gender ratio. Participants with diabetes in the two groups did not differ in terms of duration of diabetes, insulin therapy type, and most recent A1c. None of the participants scored in the clinical range on the Clinical Maladjustment Composite or the Emotional Symptoms Index of the SRP (BASC, Reynolds & Kamphaus, 1998). Independent-samples t-tests were conducted to evaluate whether participants with diabetes and healthy controls differed on their SRP scores, and whether SRP scores differed following random assignment. The results showed that the groups did not significantly differ on any of the 10 clinical scales, four adaptive scales, or four composite indexes.

Anagram Performance
A 2 × 2 ANOVA was conducted to evaluate the effect of group (diabetes vs. control) and condition (solvable vs. unsolvable) on the number of anagrams solved.4

The results indicated a significant main effect of condition, F(1, 43) = 6.9, p < .05, partial η² = .14. As portrayed in Fig. 1, participants in the unsolvable condition solved fewer anagrams (M = 12.26, SD = 3.3) than those in the solvable condition (M = 14.63, SD = 2.6). The main effect of group [F(1, 43) = .172, n.s., partial η² = .004] and the group × condition interaction [F(1, 43) = .153, n.s., partial η² = .004] were not significant.

Performance and Attribution Ratings
A 2 × 2 multivariate analysis of variance (MANOVA) was conducted to determine the effects of group (diabetes vs. control) and condition (solvable vs. unsolvable) on the Pre-Task Performance and Task Attribution Ratings. The results indicated no significant differences on Pre-Task measures between groups [Wilks’ Λ = .916, F(2, 43) = 1.973, n.s.], or conditions [Wilks’ Λ = .960, F(2, 43) = .900, n.s.], as well as no significant group × condition interaction [Wilks’ Λ = .966, F(2, 43) = .749, n.s.], indicating that there were no group differences following random assignment to one of the experimental conditions.

Two separate 2 × 2 × 2 repeated measures ANOVAs were conducted to evaluate the effects of group (diabetes vs. control), condition (solvable vs. unsolvable concept formation task), and time (pre- vs. post-concept formation task) on Performance and Attribution Ratings.

Performance Ratings
A significant main effect of time [F(1, 44) = 59.57, p < .001, partial η² = .58], a significant main effect of condition [F(1, 44) = 64.16, p < .001, partial η² = .59],
and a significant condition × time interaction \[F(1, 44) = 78.09, p < .001, \text{partial } \eta^2 = .64\] were found for the measure of Performance Ratings. There were no main effects or interactions involving group. The results of two paired samples t-tests indicated that participants in the unsolvable condition had significantly lower performance ratings following the experimental manipulation \[t(23) = 11.83, p < .001\], while no significant differences between the pre- and post-task performance ratings were observed for the participants in the solvable condition, \[t(23) = -.87, \text{n.s} \] (see Fig. 2a).

**Attribution Ratings**

Significant condition × time \[F(1, 44) = 6.56, p < .05, \text{partial } \eta^2 = .13\] and group × time interactions \[F(1, 44) = 6.25, p < .05, \text{partial } \eta^2 = .12\] were found for the measure of Task Attribution Ratings. The results of paired-samples t-tests indicated that participants in the solvable condition reported a significant increase in internal task attributions following the experimental manipulation \[t(23) = -2.635, p < .05\] whereas attribution ratings did not significantly change from pre- to post-task for participants in the unsolvable condition, \[t(23) = 1.354, \text{n.s} \] (Cohen’s \(d = .92\)). Internal attributions decreased from pre- to post-task in the diabetes group, but they did not change in the control group (Fig. 2b).

**Discussion**

The primary goal of this study was to determine whether adolescents with diabetes would perform differently from healthy controls when exposed to a learned helplessness induction paradigm. Participants with diabetes and healthy controls who completed an unsolvable concept formation task performed more poorly on a subsequent (anagram solving) task as compared to participants who had completed a solvable concept formation task. This overall pattern is consistent with research using similar paradigms in healthy populations (e.g., Miller & Seligman, 1975) and in young people with a chronic illness (e.g., Chaney et al., 1999; Hommel et al., 2006). Contrary to our primary hypothesis, participants with diabetes were not more susceptible to the learned helplessness induction than healthy controls. Although our sample size was smaller than that of Chaney et al., a visual inspection of Fig. 1 is in no way suggestive of a trend toward an interaction that would reach statistical significance if the sample size was increased. There were, however, important group differences with regard to participants’ attributions for the task failure. We will discuss these two findings in turn.

Our prediction that youth with diabetes would have disproportionately worse performance on the anagram task was based on the observations by Chaney et al. (1999) with youth and young adults with asthma. There may be...
several reasons for which we did not replicate the results of Chaney et al. First, because we wanted to ensure that we were studying the unique relation between learned helplessness and diabetes, as opposed to the established relation between learned helplessness and depression (e.g., Miller & Seligman, 1975), we excluded participants with clinical levels of depression from our sample. Furthermore, the adolescents in our sample all responded in the normal range on the internalizing subscales of the SRP (BASC, Reynolds & Kamphaus, 1998). Chaney et al., on the other hand, reported that 21% of their participants with asthma and 5% of those in the healthy control group met criteria for a current major depressive episode. Chaney et al. did find that the interaction between experimental condition and illness group was maintained after the linear effect of depression diagnosis was co-varied out, but since the only covariate was a depression diagnosis, it is still possible that much of the pattern observed in their study was due to greater amounts of subclinical depression or other internalizing symptoms in the asthma group (see Vila et al., 1999). Future studies on the relation between learned helplessness and chronic illness should include both participants with depression (as in Chaney et al.) and without (as in our study), and systematically explore how the factors are interrelated.

There may also be important differences between asthma and type 1 diabetes that can account for the different pattern between our study and that of Chaney et al. (1999). Schoenherr et al. (1992) did not find illness-related differences in self-reported attributional style according to whether the youth in their study had type 1 diabetes, acute lymphocytic leukemia, or sickle cell syndromes. With regard to asthma and diabetes specifically, research comparing parent- and self-report rating scales in both groups has shown that children and adolescents with asthma have higher levels of internalizing (especially anxiety) and externalizing problems than children and adolescents with type 1 diabetes (Vila et al., 1999). Vila et al. did not, however, find differences in self-reported depressive symptoms between those with asthma and those with type 1 diabetes. Hoff et al. (2005) examined the relation between control-related beliefs and depressive symptoms in children with type 1 diabetes and asthma. They found that perceived contingency (e.g., ‘Grades depend on exactly what a kid has learned’) predicted depression in children with diabetes, whereas perceived control (e.g., ‘I can get good grades if I really try’) predicted depression in children with asthma. Based on these observations, Hoff et al. theorized that because youth with diabetes need to be constantly vigilant to behavior-outcome contingencies, the value of contingencies may be particularly relevant to them. In comparison, uncontrollable environmental factors (and the perception of control or lack of control) may be more relevant to children with asthma. The findings by Hoff et al suggest that youth with asthma and diabetes may react differently in response to a task such as the concept formation task, which involves both perceived contingency and perceived control.

Other differences between our study and that of Chaney et al. (1999) are the age of the sample (the mean age of our sample was 15.2 years, whereas the mean age of the sample of Chaney et al. was 19.5 years), and related to this, duration of illness. The difference between our findings and that of Chaney et al. could be related to the developmental stage (or younger age) of our sample of adolescents, who probably share more of the illness-related responsibility with their parents than the sample of Chaney et al. comprising undergraduate students. We did not explore the effects of age within our narrow age range and moderate sample size. In their samples of children and adolescents, Hoff et al. (1995) found that age was an important predictor of control-related beliefs, whereas Hommel et al. (2006) did not find associations between age and attributional style.

Our second noteworthy finding was an important group difference with regard to participants’ attributions for failure on the concept formation task. All participants (diabetes and control) in the solvable task condition had an increase in internal attributions following success on the concept formation task; that is, they took credit for their success. In the unsolvable condition, participants with diabetes had a decrease in internal attributions (or an increase in external attributions) from pre- to post concept formation task, whereas there was no change from pre- to post-task in the healthy control group. That is, participants with diabetes were less likely to attribute the task failure to themselves, or more likely to rate their failure as “due to other circumstances”. This pattern replicates the findings of Hommel et al. (2006) in their study with children and youth with JRD, but it is not consistent with study by Chaney et al. (1999) of youth and young adults with asthma. In that study, participants in the asthma group reported more internal attributions for their task failure. The attribution pattern identified by Chaney et al. is consistent with what would be expected for participants with depression (e.g., Kaslow, Rehm, & Seigel, 1984) and depression was not used as a covariate in the analyses by Chaney et al. involving internal attributions. On the other hand, 47% of the sample of youth with JRD in Hommel et al. (2006) had elevated levels of depression as measured with the Children’s Depression Inventory (Kovacs, 1992). As with our study, those youth made more external
attributions for task failure, suggesting that this may be a common pattern among youth with chronic illness with and without high levels of depressive symptoms. Differences across studies may also be related to disease specific cognitive processes (e.g., Hoff et al., 2005) and developmental level, as indicated above.

The observation that youth with diabetes (and youth with JRD, Hommel et al., 2006) are less likely to attribute task failure to themselves is worthy of further exploration. This may suggest an important adaptive response, that these youth are able to avoid the pessimistic attributional styles characteristic of learned helplessness and depression. It may be that through their diabetes education, or through their experience, youth with diabetes learn that there are many factors (e.g., illness, hormones) that can affect blood glucose which are beyond their control. In learning not to feel personally responsible for every glucose reading that is out of range, it is possible that adolescents with diabetes have more experience than their healthy peers with putting small setbacks (such as failure on the concept formation task) into perspective, and not allowing uncontrollable negative events to influence future problem-solving behavior.

On the other hand, the tendency to attribute failure to external factors could be maladaptive with regard to diabetes management. Individuals who always attribute negative events to external factors may be less likely to view themselves as agents of change, or more likely to minimize their responsibility for their personal health. The observation by Brown et al. (1991) that youth with higher internal attributions for negative events had better metabolic control is consistent with this latter view.

Indeed, these two opposing views of the role that external attributions for negative events could play are reflected in one of the challenges of health care providers working with youth with diabetes. We need to help youth with diabetes see themselves as having a major responsibility for their short- and long-term health, while at the same time, helping them to have reasonable expectations about the degree to which this can be achieved (Vallis, 2001).

To tease apart these two interpretations of the data, future studies should examine attributional styles in response to diabetes-related scenarios to determine whether taking responsibility for a negative event is predictive of subsequent problem-solving behavior. Attributions regarding uncontrollable and controllable negative events should also be compared, because ideally, youth with diabetes would take responsibility for the controllable negative events and not the uncontrollable ones. Individuals on insulin pump therapy and insulin infusion therapy should also be compared, since individuals on insulin pump therapy may feel more of a sense of control over their illness (Rudolf et al., 1982) or differ in their vigilance to behavior-outcome contingencies. Future studies should also examine the relation between state-like attributions (as assessed here with a single item measuring attributions about the concept formation task) and trait-like attributions (as assessed more comprehensively with a measure such as the CASQ).

It is also worth noting that although we excluded adolescents with depression for an important reason (so that our results were not confounded by the relation between learned helplessness and depression), adolescents with diabetes are at higher risk for depression than their healthy peers (e.g., Grey, Whittemore, & Tamborlane, 2002). Our sample may have been more likely to display an adaptive coping style. Indeed, the average A1c of our sample (8.13%) was lower than the clinic average for this age group (8.79%). Although this difference was not statistically significant, it may indicate somewhat better average control in the study participants compared to the full clinic population. As stated above, future research should compare youth with a chronic illness with and without clinical levels of depression to determine whether depression moderates the association between chronic illness and learned helplessness.

Due to our relatively small sample size, we did not have enough power to add to the available (mixed) evidence regarding the association between attributional style and metabolic control (Kuttner et al., 1990; Brown et al., 1991), nor to look at the results separately for individuals on insulin pump therapy and insulin infusion therapy. Future work with a larger sample should be able to explore some of these potentially important variables, as well as associations between response to a learned helplessness induction and a reliable measure of adherence to treatment. Another limitation of our study is that our sample was exclusively Caucasian. Although this is largely reflective of the population from which we were sampling, it limits the generalizability of these findings to more diverse populations.

To summarize, we found that adolescents with diabetes were not more susceptible to learned helplessness induction than healthy controls, as had been hypothesized. Differences between our study and that of Chaney et al. (1999), the only other study comparing youth with and without a chronic illness in a learned helplessness induction paradigm, may be due to important differences in sample characteristics (asthma vs. diabetes, with and without comorbid depression, age). We also found that youth with diabetes, after completing an unsolvable task, were
less likely to attribute their task failure to themselves. This pattern is similar to that found by Hommel et al. (2006) in a study with children and youth with JRD. We have theorized that although this attributional style may be viewed as protective with regard to depressed mood and learned helplessness, the tendency to attribute failure to external factors is potentially maladaptive with regard to diabetes management.

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