The Role of Compensatory Beliefs and Self-efficacy on Treatment Adherence in Adolescents with Type 1 Diabetes

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Abstract

Many adolescents suffering from type 1 diabetes have difficulty following the strict demands of their treatment, which can lead to serious health complications. Previous research has shown that self-efficacy, or the conviction that one can achieve a certain goal, has a positive effect on adherence to treatment. We propose that compensatory beliefs (CBs) also have a significant impact on the adherence to treatment which explains why diabetic teenagers fail to fully adhere to their proposed treatment. In a sample of 115 diabetic adolescents, inaccurate compensatory beliefs significantly correlated with poor glycemic control, self-reported blood-sugar monitoring and diet. However, self-efficacy did not significantly correlate with CB levels and accurate compensatory beliefs were not significantly linked of many of the measures of treatment adherence.

Introduction

Type 1 diabetes is the most common endocrine disorder in children and adolescents (Canadian Diabetes Association (CDA), 2003). The main differences between type 1 and type 2 diabetes is that the former develops during childhood and is characterized by a total lack of insulin, whereas the latter's onset is typically in adulthood and is associated with having too little insulin or failing to metabolize insulin efficiently. Patients with type 1 diabetes must get insulin injections on a regular basis because their body fails to produce this hormone, essential for the regulation of blood-sugar levels. However, insulin administrations alone are not sufficient to manage the disorder because several other behavioral variables that affect blood-sugar levels need to be monitored as well. To manage diabetes properly, patients need to watch their diet, to exercise, to control stress levels and to monitor their blood-sugar. Previous research indicates that adolescents with type 1 diabetes have special difficulty following the strict demands of the treatment; hence, they are at high risk of developing further health complications that may lead to hospitalization (Bougneres et al., 1993).

Why do diabetic adolescents have such difficulty adhering to their treatment? One possible hypothesis is that type 1 diabetic adolescents engage in compensatory beliefs (CBs). Compensatory beliefs are convictions that the negative effects of an unhealthy behavior can be compensated for by engaging in a healthy behavior (Knäuper, Rabiau, Cohen, & Patriciu, 2004). An example of a compensatory belief that is applicable to the general population is "Exercising at the gym will compensate for eating this cookie". Other CBs that are directly related to diabetes include "Taking extra insulin can make up for the increase in blood glucose caused by eating an extra snack" and "Drinking milk compensates for an increase in blood-sugar caused by eating too many sweets". Rabiau, Knäuper, and Miquelon (2005) have theorized that CBs are produced when one is in a state of discomfort because of a temptation to engage in an unhealthy behavior. This uneasy feeling is triggered by the conflict between the goal to stay healthy and a temptation (i.e. eating sweets). In order to relieve this motivational conflict, CBs are activated and allow the person to engage in the unhealthy behavior by reducing the feelings of uneasiness. Thus, CBs may prevent type 1 diabetes adolescents from fully adhering to their treatment because they reduce the patients' guilt when they engage in unhealthy behaviors (e.g. not taking their insulin).

Another important concept often associated with health behaviors is self-efficacy. Self-efficacy is the belief that one can carry out specific tasks and attain certain goals (Bandura, 1977). Previous literature has suggested that diabetic

patients with low self-efficacy will fail to handle the stresses of their illness, to administer insulin regularly, to plan their meals properly and to exercise regularly (Grossman, Brink, & Hauser, 1987). Rabiau et al. (2005) further posit that people with low self-efficacy are more likely to engage in maladaptive CBs because they lack the self-control that is necessary to follow their health goals.

Although CBs may be efficient at reducing guilt, they may harm the diabetic patient's health in two specific circumstances: (1) when a patient does not implement the compensatory behavior involved in the CB that follows treatment recommendations (i.e. a diabetic boy forgets to inject the extra insulin to make up for the rise in blood sugar caused by eating an extra snack), and (2) when a patient acts based on CBs that are in contradiction with treatment recommendations (i.e. drinking milk cannot compensate for eating too many sweets because implementation of this compensatory behavior will further increase blood sugar levels instead of decreasing them) (see Figure 1). CBs that are in accordance with treatment recommendations are called "accurate" CBs, whereas those that are in contradiction with the recommendations are appropriately named "inaccurate" CBs. Another category of CBs are sugar-testing CBs, which are beliefs related to blood-sugar monitoring (i.e. "Testing my glucose twice in the afternoon can make up for not testing my glucose in the morning"). Sugar-testing CBs are particularly interesting as they are extremely inaccurate beliefs and should, therefore, inevitably lead to poor glycemic control. In other words, they are a specific subtype of inaccurate CBs which are most likely to be used by diabetic adolescents who are most at-risk for developing heath complications.

The objective of the present study is to investigate whether CBs and self-efficacy could further explain why adolescents with type 1 diabetes have difficulty following their treatment regime. If CBs are linked with poorer treatment adherence, we might integrate them as part of the education process of diabetic patients to help improve their health. We hypothesized that (1a) lower self-efficacy will be associated with higher levels of inaccurate diabetes-specific CBs, and (2a) higher levels of inaccurate diabetes-specific CHBs will be linked with lower treatment adherence. Furthermore, we expected that (1b) higher levels of self-efficacy will be associated with higher levels of accurate diabetes-specific CBs, and (2b) higher levels of accurate diabetes-specific CBs will be linked with higher adherence to the treatment regime.

Figure 1. When Are CHBs Unhealthy?
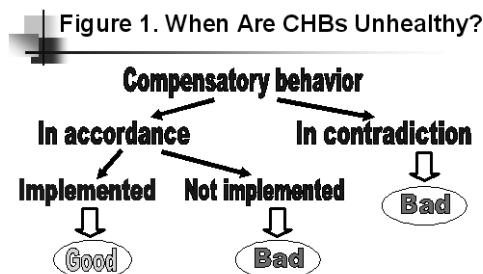
Method

In order to test our hypotheses, we administered a questionnaire to a sample of 115 adolescents aged 12 to 18 with type 1 diabetes from the Montreal Children's Hospital Diabetes Clinic. More specifically, we asked the participants to fill out the questionnaire while they waited for their appointment with the doctor at the waiting room of the clinic. The 45 minute questionnaire included: (1) the Diabetes CB scale, developed by Rabiau, Knäuper and Nguyen (2006, submitted), in which participants rated on a scale from 1 to 5 the extent to which they agreed with a certain compensatory belief (i.e. "Having a juice before exercising can make up for the decrease in blood glucose caused by the exercising"), (2) the Diabetes Self-efficacy scale, developed by Rubin and Peyrot (1989), which measures the degree of the participants' conviction that they can carry out a certain task (i.e. "How sure are you that you can judge the amount of food you should eat before activities?"), and (3) the Diabetes Self-Care Activities scale, developed by Toobert, Hampson and Glascow (2000), which is the self-reported measure of adherence to treatment and contains questions on different aspects of diabetes self-management (i.e., diet, exercise, blood-sugar testing, and smoking).

In addition to the self-reported measure of treatment adherence, we obtained the patients' glycosylated hemoglobin test results (HbA1c) from their medical files to get a physiological measure of the extent to which they follow their treatment. We used the HbA1c test result on the day that the patient participated in our study. HbA1c test results reflect the patients' average glycemic control over the past three months before the test. More specifically, the HbA1c test shows the percentage of sugar attached to hemoglobin — the substance that carries oxygen in red blood cells. The higher the amount of sugar in the bloodstream, the more sugar molecules will stick to hemoglobin and remain there for red blood cell's entire lifespan, which is normally three months. In other words, the hemoglobin gets "glycosylated". High HbA1c results suggest poor control over blood sugar and low adherence to treatment.
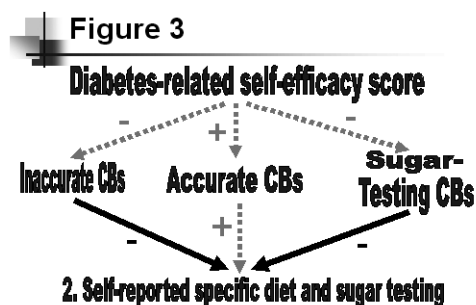
Results

To verify our predictions about the relationships between self-efficacy, CBs and treatment adherence, we correlated (1) the self-efficacy scores with the different CB subscales (i.e., accurate, inaccurate, and blood-sugar testing CBs) and (2) the different CB subscales with the measures of treatment adherence (i.e., both self-reported and glycemic control). Although we did not find significant correlations between diabetes self-efficacy and the CB subscales, they all followed the direction that we expected (i.e., high self efficacy was associated with high levels of accurate CBs and low levels of inaccurate and sugar-testing CBs).

Sugar-testing CBs were the only CBs that significantly correlated with HbA1c ($r = .27$, $p = .01$, two-tailed) (see Figure 2), which partially supports our predictions r egarding the different CB subscales and the physiological measure of treatment adherence. Remember that high levels of HbA1c indicate low glycemic control, and vice-versa. Thus, high levels of sugar-testing CBs are linked with high glycosylated hemoglobin test results, which suggest poor adherence to treatment. Despite the fact that the other CB subscales did not significantly correlate with the HbA1c test results, they all followed the expected direction of relationships (i.e., high levels accurate CBs are linked with low HbA1c, while high levels of inaccurate CBs are associated with high HbA1c).

Figure 2

Diabetes-related self-efficacy score

Inaccurate CBs   Accurate CBs   Sugar-Testing CBs

1. Glycemic control (HbA1c)
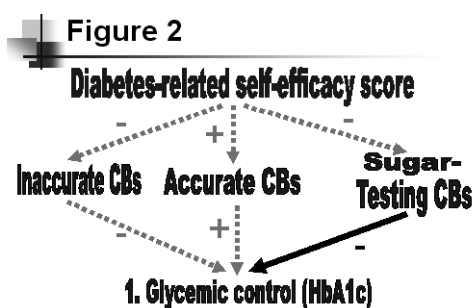
We also found that inaccurate and sugar-testing CBs had strong negative correlations with both self-reported diet and sugar-testing. In fact, the specific diet subscale significantly correlated with inaccurate CBs ($r = -.37$, $p < .01$, two-tailed) and blood-sugar testing CBs ($r = -.28$, $p < .01$, two-tailed) (see Figure 3). Self-reported blood-sugar testing significantly correlated with inaccurate CBs ($r = -.41$, $p < .01$, two-tailed) and blood-sugar testing CBs ($r = -.50$, $p < .01$, two-tailed). Contrary to our predictions, none of the CB subscales significantly correlated with self-reported exercise and smoking. Considering that only 6.1% of the participants claimed that they smoked at least one cigarette for the past seven days, it was very

Figure 3

Diabetes-related self-efficacy score

Inaccurate CBs   Accurate CBs   Sugar-Testing CBs

2. Self-reported specific diet and sugar testing

difficult to find a significant correlation for the smoking status subscale.

Contrary to our expectations, accurate CBs did not significantly correlate with any of the measures of treatment adherence. On second thought, this result may make sense because accurate CHBs can lead to both successful and unsuccessful glycemic control (refer back to Figure 1). In fact, regulation of blood-sugar levels depends on the success or failure to implement the compensatory behavior involved in the CB. If the CB in question is accurate (i.e. "Exercising can make up for the change in glucose caused by stress"), implementation of the compensatory behavior (i.e., exercising) will result in good glycemic control, while failure to implement the behavior (i.e., forgetting to exercise) leads to poor regulation of blood glucose. To put it differently, accurate CBs may have weakly correlated with physiological and self-reported measures of treatment adherence because they can result in opposite effects on health.

In summary, contrary to our predictions, self-efficacy did not significantly correlate with any of the CB subscales. This finding may be due to the fact that the participants' self-efficacy scores were high and were relatively narrow in distribution ($M = 4.29$ on a 5-point scale, $SD = 0.47$), which may suggest a ceiling effect. In fact, it is often difficult to find significant correlations when the means of the variables are extremely high or low and when the scores all concentrate around a certain value. However, in support of our hypotheses, maladaptive CBs (namely, blood-sugar testing CBs) were strongly associated with lower glycemic control and poorer habits concerning blood-sugar monitoring and specific diet. These results imply the importance of raising awareness about these maladaptive CBs (i.e., through discussions with medical professionals or through the use of pamphlets) to help type 1 diabetes adolescents improve their treatment adherence and achieve better health.

Conclusion

A limitation of the present study is that the data cannot show the direction of the relationships between the variables. For instance, we cannot prove in exact order that low self-efficacy leads to more CBs, which in turn leads to lower adherence to treatment. However, future research could deal with the problem of causal direction. As a follow-up study, type 1 diabetes adolescents who have particular difficulty adhering to the treatment (i.e. those with high HbA1c levels) could be given a portable pocket-sized computer and be asked to answer questions several times during the day. The participants could be asked to describe the most recent temptation that they encountered (i.e. not testing blood-sugar levels because of being late for school) and write about their thoughts and how they dealt with this temptation. This experience sampling method could help solve the issue of causal direction because it shows the patients' sequence of thoughts. Future research (which could use this experience-sampling method as well) could also include studying CBs in other populations, such as dieters and type 2 diabetes patients. For example, dieters may fail to lose weight because they resort on the belief that "Eating dessert can be made up by skipping the main dish". If we find that such beliefs are linked with either adverse or beneficial health effects, educating people about which CBs are adaptive or maladaptive would be important to help them achieve a healthier lifestyle.

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