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Prediction of Adherence and Control in Diabetes

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This study aims to predict adherence to diabetic treatment regimens and sustained diabetic control. During two clinic visits that were 2 months apart, 63 adult outpatients completed measures of diabetic history, current treatment, diabetic control, adherence, and self-efficacy about adherence to treatment. Results showed that self-efficacy was a significant predictor of later adherence to diabetes treatment even after past levels of adherence were taken into account. Posttest levels of adherence in turn were significantly associated with posttest %HbA$_{1}$c after control for illness severity. A stepwise multiple regression to predict %HbA$_{1}$c at post entered pretest measures of diabetic control, treatment type, and self-efficacy, which together predicted 50% of the variance. Results are related to self-efficacy theory and implications for practice are discussed.

KEY WORDS: adherence; control; diabetes; self-efficacy.

INTRODUCTION

A serious problem in the management of chronic illness is the low level of adherence to the treatment schedules that are prescribed by health care workers (Epstein and Cluss, 1982). A major task for researchers is to predict the people who are most likely to continue adhering to treatment and to understand the processes that lead to maintenance (Epstein and

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Cluss, 1982; Glasgow and McCaul, 1982). This information can then be used to design strategies that will lead to better adherence.

The management of chronic illness entails a protracted process of behavior change (DiNicola and DiMatteo, 1984). In diabetes, patients are asked to perform blood glucose tests, administer insulin, make dietary changes, and introduce an exercise regimen (Glasgow *et al.*, 1987). Training in the correct performance of these behaviors initially occurs within health education programs, but the primary responsibility for maintaining treatment objectives rests with the patient (Glasgow *et al.*, 1987). If we are to increase adherence, it is critical that we identify variables that affect the person's ability to maintain the treatment objectives after the initial education program.

Over recent years, self-efficacy has received considerable attention as a predictor of treatment adherence (O'Leary, 1985). There is a growing body of evidence to support the utility of self-efficacy in predicting sustained behavior change across a range of problem areas, including alcohol abuse (Sitharthan and Kavanagh, 1990), smoking (Condiotte and Lichtenstein, 1981; Kavanagh *et al.*, 1993) and depression (Kavanagh and Wilson, 1989; Yusaf and Kavanagh, 1989). These self-efficacy judgments reflect individuals' beliefs about their ability to maintain their behavior change successfully in the face of the situational challenges that may occur in the follow-up period (Bandura, 1982; O'Leary, 1985).

At present there is very little work on the application of self-efficacy to the management of diabetes. An exception is the study by McCaul *et al.* (1987), which examined the association between self-efficacy and adherence to treatment regimens within a sample of 107 insulin-dependent diabetes patients. They found that self-efficacy predicted adherence both concurrently and prospectively. That study was constrained by two factors. First, the self-efficacy measure that the authors developed did not differentiate efficacy expectations of adherence for the separate regimens that are involved in management of diabetes. It is not therefore possible to determine separately the association between efficacy expectations and adherence for each component of the treatment schedule. Second, the sample was restricted to insulin dependent subjects. The current study examined the separate predictive contributions of self-efficacy for glucose testing, diet, and exercise within a sample of diabetic subjects that included both insulin-dependent and non-insulin-dependent patients.

The current study also attempted to compare two rival theoretical models of diabetic control. Social cognitive theory holds that not only is self-efficacy a predictor of later behavior, but also it determines the behavior through its impact on activity selection, effort, and persistence (Bandura, 1977, 1982). From the inception of self-efficacy theory, this has been the most contentious proposition (Borkovec, 1978). One alternative view has been that it is the skills that people have obtained, rather than their self-efficacy that is the primary determinant of their later behavior. An index of these skills may be the performance level that people have been able to attain in the past. An important focus of self-efficacy research has often therefore been the examination of the relative contribution of performance and self-efficacy in predictions of later behavior (Bandura, 1982; Kavanagh *et al.*, 1993). Past research on depression, smoking and alcohol abuse (Condiotte and Lichtenstein, 1981; Kavanagh and Wilson, 1989; Kavanagh *et al.*, 1993; Sitharthan and Kavanagh, 1990; Yusaf and Kavanagh, 1989) has provided support for the superiority of self-efficacy over performance as a predictor — results that are consistent with self-efficacy being a determinant of the later behavior (Bandura, 1982). However, up to now there has been no test of the hypothesis in diabetes. Accordingly, this study also compared the relative contributions of efficacy expectations and initial adherence levels in predicting adherence and diabetic outcome.

METHOD

Subjects were recruited from diabetes sufferers who attended the Diabetes Clinic or Education Centre at Concord Repatriation Hospital as outpatients between October and May 1989. All participants had received a diagnosis of diabetes for 3 months or more, could read, write, and speak English fluently and lived inside the Sydney metropolitan area. They did not have a history of psychiatric disorder, were not experiencing major physical complications of diabetes (e.g., retinopathy severe enough to impair eyesight or kidney dialysis), and did not suffer from any other chronic physical condition which necessitated pharmacological treatment (e.g., cardiovascular disease or severe hypertension). Eighty-two people were eligible on these criteria, and 72 agreed to participate. Sixty-three people (87.5%) completed the study, and there were no differences between completers and noncompleters on sex, age, type of diabetes or duration of the disorder.

Procedure

Subjects attended two assessment sessions which were 2 months apart (mean = 8.4 weeks) and occurred during routine visits to the Diabetes Clinic. On each occasion they were seen alone or with their partner for 30–40 min. After giving informed consent at Session 1, subjects completed the self-report instruments in the order of their description below and provided a blood sample. All of the measures were readministered at Session 2.

Measures

General Information Questionnaire. This measure was developed for the present study and was based on a questionnaire for a previous survey conducted by Concord Hospital. It covered demographic information (years of education, occupation, gender, age, marital status, country of birth), time since diagnosis of diabetes, and physical complications from the diabetes (hypoglycemia, ketosis, cardiovascular problems, retinopathy, nephropathy, neuropathy). It also assessed the type of diabetes treatment (no medication, oral hypoglycemic medication, insulin, insulin plus other medication).

Self-Efficacy. Subjects were asked to rate how confident they were that they could follow their recommended treatment programs over the next 8 weeks. The questionnaire asked about three adherence areas: (a) *Glucose Testing*—the percentage of occasions they could test their blood sugar levels as instructed, (b) *Dieting*—the number of days per week they could follow their diet as instructed, and (c) *Exercise*—the percentage of recommended occasions they could follow their exercise program. Each of these adherence areas was considered to be relevant to both Type I and Type II diabetics: Self-efficacy for insulin administration was not included because some of the subjects were not insulin dependent. For each area there were 10 performance levels that increased in difficulty. For glucose testing and exercise, these ranged from 10% of recommended occasions to 100% of occasions. In the case of their diet, the levels were from $^1/_2$ a day per week to every day over the next 8 weeks. Subjects rated their confidence in being able to perform at each level by writing a number from 0 (Can't do it) to 100 (Certain I can do it). Self-efficacy strength was computed by taking average confidence scores within each of the three areas.

Treatment Adherence Measures. Subjects also reported their adherence to the treatment regimen over the previous 8 weeks. The adherence questionnaires covered (a) *Glucose Testing,* (b) *Dieting,* and (c) *Exercise,* as in the self-efficacy measures. Subjects circled the percentage of occasions (or in the case of Dieting, the number of days per week) that they performed the behavior over the last 8 weeks.

Glycemic Control. This was assessed by a blood test taken on the same day as the self-report measures, from which a glycosylated hemoglobin assay (%HbA_1c) was obtained. This measure reflects the amount of oxygen-carrying red blood protein that has glucose tightly bound to it and provides a measure of average blood concentration of glucose during the previous two months (Goldstein *et al.*, 1982).

Mood. Subjects' moods were assessed by the Profile of Mood States (McNair *et al.*, 1971). Subjects' scores on the Tension, Depression and Anger scales were summed to form a Negative Mood score.

RESULTS

Sample Characteristics

Forty-nine males and 14 females completed the study. Their average age was 64 years (range = 32 to 82), and 81% were retired. The social status of their previous occupation averaged 4.7 (SD = 1.1), indicating low to middle class, and they had completed a mean of 10.1 years of formal education (SD = 3.2 years). Most participants were born in Australia (83%) and 64% were married. The subjects' mean duration of diabetes was 5.1 years (SD = 5.5 years). Oral hypoglycemic agents were prescribed for 38%, insulin was given to 30%, and both were prescribed for 8% of the sample. This meant that the sample comprised 38% Type I (insulin dependent) and 62% Type II diabetics. All subjects were on a meal plan and were instructed to follow regular exercise activity. At pretest, participants had been on their treatment regimen for an average of 21 months (range = 3 months to 13 years). One-third tested inside the normal %HbA$_1$c range (5.2–7.9%).

Changes from Pretest to Posttest

Mean scores for the measures at Pretest and Posttest are displayed in Table I. The number of physical complications significantly increased between assessments, [$F(1,62) = 16.74$, $p < .001$], but no other changes were significant. Since all the measures in Table I were attempting to assess state variables, we did not expect a high level of stability over time. The self-efficacy measures all had stability coefficients above .60, while the adherence measures varied from .44 to .68.

Prediction of Treatment Adherence at Post

We attempted to predict the three adherence variables at Post, from assessments taken at the Pretest. We were particularly interested in testing whether adherence at Post would be better predicted by pretest assessments

Table I. Changes in Measures Across Time

Measure	Pretest *M* (SD)	Posttest *M* (SD)	Correlation across time
%HbA1c	8.38 (1.84)	8.48 (1.33)	.48*
Management	1.22 (0.92)	1.24 (0.86)	.97*
Number of complications	0.51 (0.84)	2.70* (4.26)	.12
Adherence (0–10)			
Glucose testing	8.13 (2.98)	8.45 (2.60)	.68*
Dieting	7.28 (1.86)	7.05 (2.02)	.44*
Exercise	6.13 (3.69)	6.33 (3.70)	.52*
Self-efficacy (0–100)			
Glucose Testing	84.4 (25.0)	87.4 (18.6)	.74*
Dieting	75.4 (22.7)	78.1 (23.6)	.69*
Exercise	66.3 (30.4)	70.1 (31.2)	.62*

*Uncorrected $p < .001$.

of self-efficacy or by previous adherence attainments. Before undertaking multiple regression analyses, we examined the Pearson correlations for each variable. Predictor variables were only included where they showed a correlation with one or more of the posttest adherence variables which reached the liberal criterion of $p < .10$ (without correction for number of variables). In this way, the number of variables that were examined in the multiple regressions was minimized. This procedure resulted in the exclusion of diabetes treatment type, time in treatment, number of complications at pretest, gender, years of education, country of origin, and degree of negative mood. Stepwise multiple regressions were then employed on the remaining variables, using a criterion of .05 significance for inclusion.

The results of these analyses are shown in Table II. Self-efficacy entered each of the predictive equations, and it washed out the predictive effect of past adherence for diet and exercise. In the case of glucose testing, past adherence entered the equation first, but the effect for self-efficacy remained significant.

The robustness of these results were tested by using a hierarchical entry procedure in which %HbA_1c, the demographic variables, and pretest adherence were all forced to enter before self-efficacy. The effect for self-efficacy remained significant and the increment in R^2 was at least .05 in each case (Glucose testing—change in R^2 = .054, F change = 6.09, $p <$ .02; Dieting—change in R^2 = .168, F change = 18.19, $p < .001$; Exercise

Table II. Stepwise Multiple Regression Predicting Adherence to Treatment at Posttest from Measures at Pretest

Prediction of adherence to Glucose testing at Post	Pearson *r*	*R*	R^2 change	*F* change
Step 1. Pretest adherence	.68****	.68	.46	50.17****
Step 2. Pretest self-efficacy	.56****	.72	.06	6.83**

Prediction equation: 2.302 + 0.457 pretest adherence + 0.029 self-efficacy

Variables not in the equation	*r*	Variables not in the analysis	*r*
Pretest % HbA_1c	−.14	Diabetes treatment type	−.02
Age	.26**	Time in treatment	.08
Marital status	−.26**	Diabetes complications at pretest	.05
Occupational status	.03	Gender	−.16
		Years of education	.01
		Country of origin	−.04
		Negative mood at pretest	−.15

Prediction of adherence to Dieting at Post	Pearson *r*	*R*	R^2 change	*F* change
Step 1. Pretest self-efficacy	.60****	.60	.36	33.53****
Step 2. Occupation status	.25**	.64	.06	5.55**

Prediction equation: 1.060 + 0.053 pretest self-efficacy + 0.042 occupational status

Variables not in the equation	*r*	Variables not in the analysis	*r*
Pretest adherence	.44****	Diabetes treatment type	−.09
Pretest % HbA_1c	−.26**	Time in treatment	.03
Age	.22	Diabetes complications at pretest	.06
Marital status	−.02	Gender	.08
		Years of education	−.10
		Country of origin	−.07
		Negative mood at pretest	−.03

Prediction of adherence to Exercise at Post	Pearson *r*	*R*	R^2 change	*F* change
Step 1. Pretest self-efficacy	.54****	.54	.30	25.14****

Table II. Continued.

Prediction equation: 1.944 + 0.066 pretest self-efficacy

Variables not in the equation	r	Variables not in the analysis	r
Pretest adherence	.52****	Diabetes treatment type	−.11
Pretest % HBA1c	−.12	Time in treatment	.05
Age	.09	Diabetes complications at pretest	.14
Marital status	−.25**	Gender	−.06
Occupational status	.21*	Years of education	.05
		Country of origin	.16
		Negative mood at pretest	.07

*$p < .10$.
**$p < .05$.
***$p < .01$.
****$p < .001$.

— change in $R^2 = .067$, F change $= 5.92$, $p < .02$). These results indicate that self-efficacy is an efficient predictor of Posttest adherence, and that its predictive power is not accounted for by past performance at the task.

Concurrent Prediction of %HbA$_1$c from Adherence

While the previous analyses demonstrated an ability to predict adherence over the follow-up period, we needed to show that this was correlated with glucose levels over the period, as indicated by %HbA$_1$c at Post. Concurrent correlations of Adherence and %HbA$_1$c were significant [Glucose testing — $r = -.32$, $p < .01$; Dieting — $r = -.39$, $p = .001$; Exercise — $r = -.32$, $p < .01$], but this did not show whether the effect was due to other variables. A similar regression procedure was used as in the previous analyses. Inspection of the Pearson correlation coefficients resulted in the exclusion of time in treatment, age, years of education, country of origin, and degree of negative mood.

As Table III shows, both Diabetes Treatment Type and Adherence significantly contributed to the prediction. After Diabetes Treatment entered the equation, Adherence to Glucose Testing [$t(60) = -2.69$, $p < .01$], Adherence to Dieting [$t(60) = -3.17$, $p < .01$], and Adherence to Exercise [$t(60) = -2.31$, $p < .03$] were still significantly contributing to the equation. If a block entry of these variables was made, the joint additional contribution (16.7% of the variance) was significant and no other variables entered the equation. A hierarchical regression was also undertaken in which Diabetes Treatment Type and the demographic variables were forced to enter before adherence. The adherence variables still produced an increment of 11.1% to the predicted variance [F change = 3.36, $p < .03$].

Prediction of %HbA$_1$c at Post, from Pretest Variables

We predicted that %HbA$_1$c at Post would be predicted primarily by pretest measures of disorder severity (including %HbA$_1$c). However, we were interested to see whether self-efficacy or adherence also improved the prediction. The same set of variables was excluded as in the previous analysis. Results of the multiple regression are shown in Table IV. After the entry of the pretest measure of %HbA$_1$c and diabetes treatment type, the self-efficacy measures remained significant [Glucose testing—$t(58) = -2.26, p < .03$; Dieting—$t(58) = -2.31, p < .03$; Exercise—$t(58) = -2.39$, $p < .03$]. If these variables were allowed to enter as a group, they produced an increase of 8.6% in the predicted variance ($R = .71$). No other variables entered the equation.

A hierarchical regression was again employed to test the robustness of this prediction. When the diabetes-related variables were entered at Step

Table III. Stepwise Multiple Regression Predicting Glycosylated Hemoglobin at Posttest from Concurrent Measures

	Pearson r	R	R^2 change	F change
Step 1. Diabetes treatment type at Post	.44****	.44	.19	14.03****
Step 2. Posttest adherence		.60	.17	4.95***
Glucose testing	–.32***			
Dieting	–.39****			
Exercise	–.32***			

Prediction equation: 99.144 + 5.910 treatment type –0.891 adherence to glucose testing –1.533 adherence to dieting –0.515 adherence to exercise

Variables not in the equation	r	Variables not in the analysis	r
Gender	.18*	Time in treatment	–.00
Marital status	.29**	Age	–.13
Occupational status	–.21**	Years of education	–.01
		Country of origin	.00

*$p < .10$.
**$p < .05$.
***$p < .01$.
****$p < .001$.

Table IV. Stepwise Multiple Regression Predicting Glycosylated Hemoglobin at Posttest from Measures at Pretest

	Pearson r	R	R^2 change	F change
Step 1. % HbA1c at pretest	.48****	.48	.23	18.01****
Step 2. Diabetes treatment type at pretest	.42****	.65	.19	18.76****
Step 2. Self-efficacy at Pretest		.71	.09	3.18**
Glucose testing	–.25**			
Dieting	–.34***			
Exercise	–.35***			

Prediction equation: 64.529 + 0.347 %HbA_1c at pretest + 5.150 diabetes treatment type –0.055 pretest self-efficacy (glucose testing) –0.078 pretest self-efficacy (dieting) –0.068 pretest self-efficacy (exercise)

Variables not in the equation	r	Variables not in the analysis	r
Gender	.18*	Time in treatment	–.00
Marital status	.29**	Number of complications at pretest	–.16
Occupational status	–.21**	Age	–.13
Adherence to glucose testing	–.28**	Years of education	–.01
Adherence to dieting	–.22**	Country of origin	.00
Adherence to exercise	–.23**	Negative mood at pretest	.11

*p < .10.
**p < .05.
***p < .01.
****p < .001.

1, none of the demographic variables significantly added to the prediction. If the demographic variables were still forced into the equation at Step 2, only the effect from self-efficacy for Dieting still reached the .05 level of significance [Glucose testing—$t(55) = -1.82, p = .07$; Dieting—$t(55) = -2.35, p <$ 03; Exercise—$t(55) = -1.99, p = .052$]. If the self-efficacy variables were added as a group, they added 6.7% to the predicted variance [F change = 2.49, p = .071].

DISCUSSION

This study demonstrated the power of self-efficacy to predict adherence to diabetes management over a subsequent 8 week period. The self-efficacy prediction was not accounted for by previous adherence attainments, and it was the more powerful single predictor in two of the three adherence domains (Dieting and Exercise).

While the prediction of adherence has practical interest in itself, it achieves much greater significance if adherence to diabetes treatment is related to concurrent diabetic control (Bradley, 1985; Bradley and Marteau, 1986). Glycosylated hemoglobin is, of course, an indirect measure of the outcomes of adherence and is affected by components such as the effectiveness of the regime and the status of the disorder. Self-efficacy and adherence to appropriate use of insulin and other medication, which were not assessed in this study, are also likely to affect the physiological outcomes. Consequently, we did not expect that the correlations of %HbA_1c with adherence to glucose testing, dieting, and exercise would be as high as the relationships observed in the prediction of adherence from the corresponding pretest measures. However, adherence did have a significant relationship with concurrent %HbA_1c, even after severity of the disorder was taken into account. This provided substantial support for the validity of the adherence self-report.

Given the success in predicting adherence and in relating adherence to concurrent measures of %HbA_1c, we then attempted to predict posttest %HbA_1c from the Pretest measures. Despite the multiple determination of %HbA_1c and its indirect link with self-efficacy and adherence, the self-efficacy measures retained significance as predictors, even after the entry of glycemic control and type of diabetes treatment at pretest. Furthermore, they were clearly superior to adherence. While the predictive effect of self-efficacy lost statistical significance after the demographic variables were forced to enter the equation, this was not due to any strong predictor from the demographic variables, and the self-efficacy measures were still adding 6.7% to the predicted variance.

These results can be compared with those of a similar recent predictive study by Toobert and Glasgow (1991), in which problem-solving performance was used in an attempt to predict self-care behaviors and glucose levels in diabetes over 6 months. Problem solving showed some predictive utility with regard to maintenance of adequate diet, exercise, and glucose testing at 6 months, but there was no significant prediction of glycosylated hemoglobin. Perhaps the prediction of self-care from problem solving was insufficiently strong in that study for the effects to be reflected in glycemic control. One reason could have been that many other factors are likely to contribute to self-care — factors such as situational difficulty and skills in being able to implement the problem solving strategies. When we are predicting future performance of adherence or self-care, it will not be surprising if past performance of the same behaviors allows a stronger prediction than does any subset of contributing skills.

Self-efficacy has additional potential utility over any measure of past performance. Even if the behavior is closely related to fluctuations in blood glucose, performance will be an effective predictor of future glucose levels only if it remains stable. The additional predictive gain from self-efficacy lies in the cognitive appraisal that it involves. Self-efficacy judgments allow the person to assess a wide range of information they consider was relevant to their past adherence and to predict changes in the situation, in their skills, or in their effort that may be related to their adherence in the future (Bandura, 1982). The superiority of the self-efficacy judgment is greatest in situations where the cognitive appraisal would be likely to have the most benefit: over longer prediction periods (which allow substantial situational changes) and when the subjects have good information about the changes that may occur (e.g., Kavanagh *et al.*, 1993).

The results in the current study are highly consistent with those from previous research on the prediction of treatment outcomes in a variety of problem domains including depression (Yusaf and Kavanagh, 1989; Kavanagh and Wilson, 1989), alcohol abuse (Sitharthan and Kavanagh, 1990), and smoking (Kavanagh *et al.*, 1993). The most impressive aspect of these data may be the ability to predict behavior over an extended period of time, from 8 weeks in the current study up to a year in Kavanagh and Wilson's (1989). As would be expected, the relative predictive strength of self-efficacy and past performance varies across studies. In some analyses, self-efficacy is a more powerful predictor than past performance. In others, past performance enters the prediction equation first, but self-efficacy retains its significance as a predictor. As in the current study, the unique variance contributed by self-efficacy over past performance is usually between 5 and 15% of the predicted variance.

The self-efficacy results are consistent with the view that it is a determinant of later performance by having an impact on the effort people expend in their attempt and the degree to which they persist in the face of setbacks (Bandura, 1982). However there are disadvantages to this paradigm as a test of self-efficacy having a causal role. It may be argued that the test is weighted against self-efficacy theory, since within the theory the initial performance already is affected by the immediately preceding self-efficacy judgment (Bandura, 1991; Wood and Bandura, 1989). To the extent that the situation remains unchanged and the self-efficacy judgment is stable, taking away the effect of past performance from the self-efficacy prediction could also be reducing a true self-efficacy effect. However, the same argument could also be raised about that self-efficacy judgment, since performance even further in the past is likely to have affected it. There is a potential for regress, and any predictive study needs to determine where the prediction will begin. It could also be argued that the paradigm in our study underestimates the true contribution of the person's skills, in that the initial adherence demonstrates the person's skills only within the particular range of situations they had encountered during the initial assessment period. Whether or not these points are sustained, the current data seem to favor the self-efficacy hypothesis over the alternative of "current performance attainment."

In contrast to the relative success of self-efficacy, negative emotional states had little predictive utility over time. In retrospect, the measurement of longer term mood changes might have provided a better measure of the true impact of moods on diabetic measurement. However, their inclusion in the current study was able to demonstrate that the predictive effects of other self-report variables including self-efficacy could not have been due simply to differences in negative mood.

There are some limitations to the generalizability of the results from the current study. This sample was predominantly composed of Type II diabetics, and these subjects therefore had a greater influence over the results than did the insulin dependent subjects. Although Diabetes Type was given an opportunity to enter each of the prediction equations, it is possible that type of diabetes may interact with other predictor variables. Given the sample sizes, it was not possible to undertake separate regression analyses for Type I and Type II diabetes or enter interaction terms for each predictor. An inspection of the separate correlation matrices did not suggest any major changes to the results. Among the exceptions were that diabetic complications appeared to have a greater role as a predictor of both adherence and glycemic control in insulin-dependent subjects (e.g., complications at pretest correlated $-.40$, $p < .05$, for Type I, but only $-.03$, ns, for Type II). In contrast, past glycemic control appeared to be a weaker predictor of later control in those subjects ($r = .22$, ns, for Type I and $r = .69$, $p < .001$, for Type II). However, any apparent differences between the correlation matrices have to be interpreted in the context of the large number of correlations being examined and the relatively small sample sizes in the subgroups. In order to establish the applicability of the results in the current study to both diabetes populations, an attempted replication of this study within substantial samples of Type I and Type II subjects will clearly be required. If that study also examined the application of the results to subjects with more severe physical complications, the generalizability of the results could be further extended.

From the practitioner's point of view, this study suggests that self-efficacy for adherence to diabetes management regimens should be routinely monitored and used in predictions of diabetic outcome. Further, this study supports the idea that intervention aimed at enhancing the person's self-efficacy may be an important component in the overall management of diabetes. Intervention studies are required in order to verify the benefits of enhancing self-efficacy for diabetes management.

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