Patient Education and Counseling 57 (2005) 39–45

Patient Education and Counseling

www.elsevier.com/locate/pateducou

Variation in perceived competence, glycemic control, and patient satisfaction: relationship to autonomy support from physicians

Geoffrey C. Williams [a,*], Holly A. McGregor [a], Diane King [b], Candace C. Nelson [b], Russell E. Glasgow [b]

[a] *Departments of Medicine and Clinical and Social Sciences in Psychology, University of Rochester, Rochester, NY 14627, USA*
[b] *Kaiser Permanente Colorado, USA*

Received 18 September 2003; received in revised form 3 April 2004; accepted 14 April 2004

Abstract

There is considerable variation in care provided to patients with diabetes related to metabolic control, preventive services, and degree of patient-centered support. This study evaluates the relation of self-determination theory (SDT) constructs of clinician autonomy support, and patient competence to glycemic control, depressive symptoms, and patient satisfaction from baseline surveys of 634 patients of 31 Colorado primary care physicians participating in a program to improve diabetes care.

Spearman correlations of autonomy support from one's clinician with patient competence, HbA1c, depressive symptoms and satisfaction were significant ($r = -0.11$ to 0.55, $P < 0.05$). Structural equation modeling demonstrated that autonomy support was significantly related to perceived competence, depressive symptoms, patient satisfaction, and indirectly to glycemic control. Perceived competence was significantly related to depressive symptoms, patient satisfaction and glycemic control. Further, the motivation constructs from SDT accounted for 5% of the variance in glycemic control, 8% of the variance in depression, and 42% of the variance in patient satisfaction.

Quality improvement efforts need to pay greater attention to patient competence, satisfaction, and depression, in addition to glycemic control. Clinician autonomy support was found to be reliably measured and moderately correlated with psychosocial and biologic outcomes related to diabetes self-management. These results suggest training clinicians to increase their support of patient autonomy may be one important avenue to improve diabetes outcomes.

Keywords: Diabetes self-management; Autonomy support; Social support; Self-efficacy; Patient satisfaction; Glycemic control

1. Introduction

Outcomes for treatment of patients with diabetes need to include patient-centered measures such as quality of life as well as physiologic measures in order to meet patients' biopsychosocial needs [1,2]. Self-determination theory (SDT) is a theory of human motivation that provides a framework to understand how practitioners, researchers, and policy makers can improve patients' biological and psychosocial outcomes. SDT researchers assume that human beings are innately oriented toward growth and health, and that humans are more motivated when they feel more autonomous, competent, and related to important others [3,4].

SDT distinguishes between autonomous and controlled motivation, and between perceived competence and perceived incompetence. Autonomy involves experiencing a sense of choice and volition when one behaves in a way that is congruent with one's deeply held values. Controlled motivation, in contrast, involves people behaving because of a demand or threat from an external agent (e.g., family member), or from a rigidly held belief that they must behave to avoid guilt or shame. People with diabetes perceive themselves to be competent when they feel personally able to control important outcomes such as maintaining their blood glucose levels in a healthy range. They perceive themselves to be incompetent when they feel they are unable to keep their blood glucose in a healthy range. Locus of control [5], on the other hand, relates to whether people believe there is a contingency between the diabetes control behaviors (checking blood glucose, physical activity, following a diabetes diet, and taking medications) and the outcome of keeping their blood glucose in a healthy range. People have an internal locus of control if they believe that can control the outcome with behavior, while people with an external locus of control

* Corresponding author. Tel.: +1-585-275-8719.
E-mail address: geoffrey_williams@urmc.rochester.edu (G.C. Williams).

0738-3991/$ – see front matter © 2004 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.pec.2004.04.001

believe that they cannot control the their blood sugar with behavior. Perceived competence assumes that a contingency between behavior and outcome does exist—that is, competence assumes that people believe that if they behave in specific ways such as eating the right foods in the right amount, being physically active, and taking medications, the outcome of stable blood sugar will be achieved. Therefore, the question that competence addresses is, does the person perceive him/herself to be competent (or able) to do those things.

Perceived competence is measured on the Perceived Competence for Diabetes Scale (PCS) [6], and it is closely related to the concept of self-efficacy [7]. Autonomy is measured on the Treatment Self-Regulation Questionnaire (TRSQ) [6]. Research has indicated that autonomy and self-efficacy are correlated with improved glycemic control and quality of life [8] suggesting that perceptions of autonomy and competence may underlie improvements in glycemic control, and be associated with a better quality of life for patients with diabetes.

According to SDT, when practitioners support patient autonomy, patients are expected to become more autonomous and to feel more competent. Autonomy support refers to the extent to which providers elicit and acknowledge patients' perspectives, support patients' initiatives, offer choice about treatment options, and provide relevant information while minimizing pressure and control. Autonomy support is measured by patient perceptions reported on the Health Care Climate Questionnaire [9]. Autonomy support is somewhat related to the concept of patient-centeredness in that in order to be autonomy supportive it is necessary for the practitioner to elicit and acknowledge patient perspective, to support patient initiatives, and to avoid being controlling or judgmental of the patient. However, the concept of autonomy support differs from patient-centeredness in that, by specifying specific human needs, it gives greater guidance for a clinician's behavior. For example, an autonomy supportive practitioner would: (1) in order to support the patients' perceived competence, offer as much structure as is needed by each patient, and (2) in order to support the patients' perceived autonomy, focus on the patient making their own choices about what to do after carefully considering their own feelings and values as well as the available options. Thus, a practitioner might provide information about the likely outcomes of various behaviors without providing pressure to do one of those behaviors. The practitioner would make a specific recommendation based on his/her best judgment for the patients' consideration. The patients' would then consider the pros and cons of each behavior from their own perspective, and the practitioner would support that process. When a patient makes a choice, the practitioner would respect the choice, asking only if he or she could revisit the issue in a future appointment to see how that has gone for the patient.

The concept of autonomy support is likely related to motivational interviewing [10]. Motivational interviewing (MI) is a directive, patient-centered counseling technique, originally developed for the treatment of addictive behavior. MI promotes a structure that focuses on minimizing practitioner behaviors that are more likely to elicit patient resistance [11], and to this end it is consistent with practitioners being autonomy supportive. However, in traditional medical settings (e.g., treatment of chronic diseases like diabetes), where the majority of patients want physicians to make direct recommendations, patients are less likely to perceive these recommendations as controlling [12]. Autonomy support allows for a structure that is optimal given the patient's knowledge and competencies. Advice in this context in not necessarily minimized, but is given as a provision of information about what outcomes are likely to follow from the patient's behaviors, and may include what the practitioner feels has worked best for patients. An example of this type of advice would be, "As your physician, I recommend that you exercise more regularly because research has shown that regular exercise contributes to maintaining a healthy glucose level". Indeed, practitioners who work to minimize the chances of eliciting patient resistance and fail to provide a recommended course of action to improve their patients' health may be experienced as controlling. Thus, autonomy support shares elements with patient-centeredness, and motivational interviewing, but differs because it is structured as the provision of information specifically aimed at bringing patients to a place where they can make an clear and informed choice about treatment (including accepting no treatment), and in supporting them in reaching their health goals.

In summary, we would expect that measures of autonomy support and measures of patient-centeredness (e.g., patient satisfaction) or of motivational interviewing would be related, but that autonomy support would be a better (i.e., more specific) predictor of motivation, behavior, and health outcomes.

Studies have shown that patient autonomy and competence in diabetes self-management are enhanced by an autonomy supportive patient/provider relationship [6,13]. Other studies of health care have shown that autonomy support by health care practitioners affected patients' motivation and health-relevant behaviors including smoking abstinence [14,15], weight loss [9], and medication adherence [16]. Thus, previous studies of health motivation have been successful in predicting health outcomes from SDT constructs of motivation.

The overall aim of this study is to confirm and extend the relations between the motivation constructs of autonomy support and competence, and glycemic control, depressive symptoms, and patient satisfaction. The current study is intended to extend findings in three ways: First, by studying a larger number of patients and physicians in different settings from those of the original SDT research; second, by assessing autonomy support in the primary care setting, where greater variation in autonomy supportiveness is expected; and third, by including a wider range of other variables and outcomes than have previous diabetes studies on SDT.

The present article tests four primary hypotheses derived from the SDT process model (see Fig. 1) and evaluated via

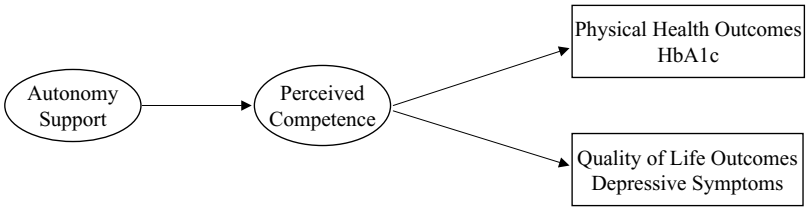

Fig. 1. The self-determination process model.

both correlational and Structural Equation Modeling (SEM) methods [17,18]: (1) autonomy support will be negatively correlated with glucose control; (2) autonomy support will correlate positively with competence; (3) autonomy support will correlate negatively with depressive symptoms; and (4) competence will correlate negatively with glucose control. In addition, the article will test three secondary hypotheses: (1) autonomy support will correlate positively with patient satisfaction; (2) competence will correlate positively with patient satisfaction; (3) competence will correlate negatively with depressive symptoms. The secondary hypotheses are so designated because they are not established relations from previously published studies. Past studies relating autonomy support to glycemic control have found support for this relation being direct [6] and in another this relation was found to be indirect [13]. In both studies, the relation of autonomy support to glycemic control was mediated by perceived competence. The use of SEM in this analysis will allow us to test direct, indirect and mediated relations between these three key variables.

SEM analyses offer two primary advantages over conventional analyses such as regression. First conventional analyses assume that measures are perfectly reliable (i.e., that scales perfectly measure concepts): so there is always unreliability due to measurement error. SEM creates a “latent” variable from multiple indicators. The latent variable is free of measurement error. For example, the four items that relate to the patients’ sense of competence in managing their diabetes, are indicators of the latent variable “perceived competence”. It is the relations of the latent variables that are tested in SEM analysis. Second, unlike conventional analyses, SEM tests complex theoretical models in toto. SEM provides a test of the overall goodness-of-fit of the model, as well as the strength and significance of individual relations between pairs of variables (e.g., the relation of autonomy support to perceived competence). SEM generates a standardized parameter estimate (SPE) to assess the strength of the relation between two concepts. An SPE is interpreted much like a standardized regression coefficient (i.e., ranges between 0 and 1).

Correlation analyses do not distinguish the direction of relation between variables. Applying an SEM framework implies a direction of the relation between two variables. If a previous study has supported a direction for that relation it can be included in an SEM model. Previous studies using the SDT model indicate that autonomy support predicts greater competence, less depressive symptoms, and better glycemic control (represented by better glycemic control), and that competence predicts less depressive symptoms and better glycemic control [6,13]. Because the secondary hypotheses have not been established yet, they were not included in the initial SEM model.

2. Methods

2.1. Description of the guidelines study

The parent randomized controlled trial tests the impact of an interactive diabetes self-management program to enhance quality of care compared with a general health risk appraisal program offered to patients during regular diabetes visits with their primary care physician [19,20]. The self-management program is designed to prompt both providers and patients with regard to key diabetes care guidelines and self-care activities [21]. Over 30 Colorado primary care practices, including two community health centers, and more than 600 adults with type 2 diabetes, are participating in this 4-year study. This paper uses data collected during baseline assessments prior to any intervention contact, and thus data are collapsed across experimental conditions.

2.2. Participants

Patients were recruited from primary care practices of 31 physicians at 21 different sites in 2001 and 2002. Patients were recruited into the study using a method detailed elsewhere [22]. In brief, a letter was sent from the primary care provider to all potentially eligible patients describing the study and inviting them to participate. Patients who did not wish to be contacted about the project could return a decliner postcard and were not contacted further. Those not declining contact were called by research staff who identified themselves and stated that they were working with ‘Dr. X’s office on a diabetes research project’. All procedures were approved by institutional IRBs and compliant with pending HIPPA regulations. As described in Amthauer et al. [22] this procedure was successful in recruiting 82.6% of eligible patients across these various practices, and these participants were very similar to those who declined. Eligibility criteria for the study were purposefully kept minimal to make the

results broadly applicable and included having type 2 diabetes, age greater than 30, able to read English, and ability to be reached by telephone. The age requirement was included because it is felt that the issues facing and treatment for young adults and adolescents are different then for those over age 30. At the time of this study, a total of 634 patients of 31 primary care providers met the criteria and gave informed consent; 591 of them (93%) provided complete data and were used in the analyses.

2.3. Procedure

At baseline, patients completed questionnaires concerning demographics, their disease and treatment, autonomy supportiveness of their primary care physician, patient satisfaction, depressive symptoms on the PHQ-9 depression scale [23], perceived competence, and other measures not related to this paper. Patients had all met with this primary care physician at least once before.

Additionally, all patients had serum drawn for HbA1c analyses. HbA1c measures the number of glucose molecules that have attached to the patients' hemoglobin in their red blood cells. Since all of human red blood cells are replaced every 120 days, HbA1c reflects the average level of glycemic control patients with diabetes have maintained over the previous 3–4 months. The HbA1c tests were analyzed at the University of Colorado Health Sciences Center using a National Glycohemoglobin Standardization Program (NGSP) certified Bio-Rad Variant 2 analyzer, correlated to an index of glycemic control established during the DCCT. Its reference range was as follows: 4.1–6.5%. Patients received US$ 25 at the completion of the study, for their effort in completing the questionnaires and in providing the laboratory tests.

2.4. Measures

2.4.1. Modified Health Care Climate Questionnaire (HCCQ)

The HCCQ [9] assesses participant perception of the degree to which their providers were autonomy supportive (versus controlling) in consulting with them at the diabetes center. Patients responded to six items on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The original HCCQ has 15 items and has been used in several studies (e.g., [9,13]), with alphas ranging from 0.92 to 0.96. Based on a factor analysis of data across previous studies ($n = 638$), we selected six items to use in this study as indicators of the latent variable "autonomy support". Alpha for the six items in the cross-study sample was 0.82. A sample item is "I feel that my health care practitioners provided me with choices and options about handling my diabetes". The 15 items of the full scale, and the 6 items of the modified scale were averaged to form two autonomy support summary scores; each of the scales exhibited good internal consistency ($\alpha = 0.93$ and $\alpha = 0.91$, respectively). Both the full scale and the modified scale will be used in the correlational analyses to demonstrate that the modified scale explains most of the variance in the full scale. Each of the six items in the modified scale served as an indicator of the latent autonomy support variable in the SEM model.

2.4.2. Perceived Competence for Diabetes Scale (PCDS)

The PCDS [6] contains four items representing the degree to which patients feel they can manage daily aspects of diabetes care. Participants indicated their level of agreement with each item on a 1 (*strongly disagree*) to 7 (*strongly agree*) scale. Each item was then used as an indicator of the latent variable. Alphas for the scale in our previous studies ranged between 0.83 and 0.86 [6,13]. The four items of the competence scale were averaged to form a perceived competence score. The scale exhibited good internal consistency, $\alpha = 0.93$. Each item served as an indicator of the latent competence variable in the SEM model.

2.4.3. Depression

The Patient Health Questionnaire (PHQ) [23] is a self-administered version of the PRIME-MD diagnostic instrument for common mental disorders. The PHQ-9 is the depression module, which scores each of the nine DSM-IV criteria on a 0 (*not at all*) to 3 (*nearly every day*) scale. The nine items were averaged to form the PHQ-9 index. The PHQ has been documented to have a sensitivity of 88% and a specificity of 88% for major depression [23]. In the present study, the scale exhibited good internal consistency, $\alpha = 0.86$.

2.4.4. Patient satisfaction

Patient satisfaction was assessed by a 5-item scale from the ADA Provider Recognition program [24]. These items asked patients to rate their providers (excellent, very good, poor) in the following areas: (1) answering questions about diabetes, (2) being available during emergencies, (3) explaining laboratory test results in an understandable way, (4) having a courteous, personal manner, and (5) their overall diabetes care. The five items were averaged to form the patient satisfaction index. The scale exhibited good internal consistency, $\alpha = 0.88$.

3. Results

Demographic characteristics of the sample are presented in Table 1. As can be seen, this sample is fairly typical of type 2 diabetes patients seen by primary care providers in terms of age, gender and other demographic factors. Amthauer et al. [22] also demonstrate that this sample is representative of adult diabetes patients in Colorado, using state BRFSS data [20]. Analyses were conducted in two stages. First, we conducted a series of bivariate correlations to assess the hypothesized relationships between patient autonomy support

Table 1
Demographic characteristics of the sample

Variables	%
Age (years)	
28–49	3.1
50–65	43.0
66–90	53.9
Education level	
Grades 1–8	5.4
Grades 9–11	6.7
Grades 12/GED	25.5
College 1–3	31.7
College/college 4+	30.7
Household income	
<US$ 10,000	8.5
US$ 10,000–29,000	27.8
US$ 30,000–49,000	27.6
≥US$ 50,000	36.0
Marital status (% married or living as married)	69.4
Sex (% female)	50.4
Race	
White/non-Hispanic	84.1
Black	2.2
Hispanic	9.1
Other	4.6

and perceived competence, depression, patient satisfaction and HbA1c, and between competence and HbA1c. Because autonomy support is typically non-normally distributed, correlational analyses were conducted using Spearman's ρ [25]. In the second stage of analyses, the above relations were submitted to a SEM [17,18,26] following the pattern of relationships established in the SDT process model [13].

Correlational analyses supported each of the primary hypotheses (see Table 2). Both the full and the modified forms of the autonomy support scale were positively associated with perceived competence ($\rho = 0.48$, $P < 0.01$ and $\rho = 0.47$, $P < 0.01$, respectively), negatively associated with depression ($\rho = -0.22$, $P < 0.01$ and $\rho = -0.21$, $P < 0.01$, respectively), and negatively associated with HbA1c ($\rho = -0.11$, $P < 0.05$ and $\rho = -0.08$, $P = 0.05$, respectively). The secondary hypotheses were also supported. Specifically, both the full scale and the modified scale forms of autonomy support were positively related to patient satisfaction ($\rho = 0.55$, $P < 0.01$ and $\rho = 0.57$, $P < 0.01$, respectively), and perceived competence was positively related to patient satisfaction ($\rho = 0.21$, $P < 0.01$) and, as predicted, negatively related to depression ($\rho = -0.31$, $P < 0.01$).

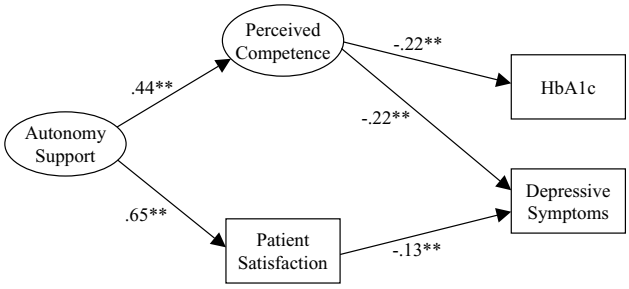

Fig. 2. The results of the SEM analyses. *Note*: Values are standardized path coefficients. The latent variables of perceived competence and autonomy support are represented by ellipses in the model (the observed indicators of these latent variables are not represented in the diagram). The observed variables of patient satisfaction, depression, and HbA1c are represented by rectangles in the model.

Next, a SEM analysis incorporating these constructs and based on the SDT process model in Fig. 1 was tested. Because autonomy support is typically non-normally distributed, an asymptotically distribution-free (ADF) [27] estimation procedure was used. The results of the SEM analyses are presented in Fig. 2. The model fit the data well, $\chi^2(56) = 98.9$, $P < 0.01$; IFI = 0.92; CFI = 0.91; RMSEA = 0.04. Autonomy support had significant direct effects on perceived competence ($\beta = 0.44$, $P < 0.01$) and on patient satisfaction ($\beta = 0.65$, $P < 0.01$), and significant indirect effects (through perceived competence) on HbA1c ($\beta = -0.10$, $P < 0.01$) and depression ($\beta = -0.18$, $P < 0.01$). Perceived competence significantly predicted both HbA1c ($\beta = -0.22$, $P < 0.01$) and depression ($\beta = -0.22$, $P < 0.01$), and, as predicted, patient satisfaction significantly predicted depression ($\beta = -0.13$, $P < 0.01$).

Table 2
Descriptive statistics, reliability estimates and Spearman ρ correlation coefficients for the variables in the model

	Variable	Mean	Standard deviation	Range	Cronbach's alpha	Variable					
						1	2	3	4	5	6
1	HbA1c	7.23	1.20	4.0–12.8	–	1.00					
2	Autonomy support full scale	5.87	0.80	2.9–7.00	0.93	−0.11*	1.00				
3	Autonomy support modified scale	5.98	0.99	2.5–7.00	0.91	−0.08*	0.97**	1.00			
4	Perceived competence	5.60	1.36	1.0–7.00	0.93	−0.20**	0.48**	0.47**	1.00		
5	Depression	4.61	4.62	0.0–27.0	0.86	0.07+	−0.22**	−0.21**	−0.31**	1.00	
6	Patient satisfaction	3.38	0.64	1.0–4.0	0.88	−0.03	0.55**	0.57**	0.21**	−0.14**	1.00

+ $P < 0.10$.
* $P < 0.05$.
** $P < 0.01$.

4. Discussion

Self-determination theory suggests physiologic outcomes, dysphoric mood and patient satisfaction will be related to the extent to which a health care environment supports patient psychological needs. In this study, the SDT model received support in that constructs of autonomy support (full and modified versions) and perceived competence significantly correlated with better glycemic control, less depressive symptoms, and greater patient satisfaction. SEM analysis replicated an earlier finding in a different laboratory and sample that again supported an indirect relation between autonomy support and improved HbA1c, through perceived competence [13]. In addition, autonomy support and competence were significantly related to less depressive symptoms in the same way that they were related to glycemic control, indicating that these variables have effects on both biochemical processes and quality of life processes. The strength of relations found varied between small moderate (SPE = 0.2) to strong (SPE 0.4 or greater). Generally, parameter estimates are clinically significant if equal or greater than 0.2, so that each of the findings presented are likely to be important on a clinical level.

These cross-sectional data do not provide causal level support for the SDT model tested in the primary care setting, but they do provide additional validity for these constructs as important biopsychosocial markers of patient-centered care for patients with type 2 diabetes. The three secondary hypotheses linking autonomy supportiveness and competence to patient satisfaction, and perceived competence to depressive symptoms received strong initial support in this analysis. They require confirmation in additional studies, and these relations need to be studied over time to confirm directionality. Nonetheless, it is interesting to note that autonomy support is correlated with glycemic control, but that patient satisfaction is not. This is consistent with the idea that autonomy support more specifically supports patients' motivational needs than does the more general patient satisfaction measure. Once these motivational needs are supported, patient competence and autonomy may energize health behaviors that result in better quality of life and improved biological markers of health [13]. Future research will have to confirm that autonomy support more strongly predicts better health outcomes relative to measures of patient satisfaction. Another limitation of the study is that, although containing a representative percentage of Latinos, the sample included few other minority patients.

Health care practitioners can be trained to be autonomy supportive [28,29] making results of this trial relevant to clinicians and administrators at medical and nursing schools, and to administrators providing continuing medical education for those already in practice. Interestingly, the same SDT model used to predict patient behavior change has also predicted how practitioners learn to change counseling behaviors (e.g., internalize tobacco dependence treatments) [30].

Diabetes self-management represents one of the most complex medical challenges in the treatment of a chronic disease. Effective management requires that the health care system and community support patients in performing multiple complex behaviors over the long-term to improve both biological and quality of life outcomes. Motivation, and the support of motivation are key elements of the chronic disease model needed to improve these outcomes [31–34]. Taken together, results from the various studies of motivation are relevant to a variety of chronic diseases [4]. Thus, we believe that policy makers that structure health care and work environments to support patient and practitioner autonomy and competence will lead to improved patient and practitioner satisfaction [35] and help to close the well documented chasm between research and practice [36].

This study leads to several conclusions. First, there was little difference in the ability of the modified HCCQ compared to the full length HCCQ to predict competence motivation, satisfaction, quality of life or glycemic control. Therefore, the brief scale can be used in future studies. Second, the self-determination model for health behavior was supported. Perceived autonomy support was significantly correlated with glycemic control and depressive symptoms, but was indirectly related to these outcomes in the SEM analysis. Third, autonomy support was directly correlated with glycemic control while patient satisfaction did not correlate with glycemic control, thus providing partial evidence for discriminant validity. This suggests that this measure of patient satisfaction may be too general to predict glycemic control. Further research is needed determine if autonomy support will predict improved glycemic control, and its maintenance.

Although having the limitations noted above, this study also has several strengths, including the relatively large and representative (of Colorado) patient sample, the analysis methods employed, the theory based measures and hypotheses, and the replication—in a different research setting and a different part of the country of previous findings in other disease areas.

Additional research is needed to develop and test interventions that would enhance diabetes patients' quality of life as well as physiologic outcomes. Presumably these interventions would include ways to improve health care practitioner autonomy supportiveness, but they could also include changes in the health care system that encourage patients to take more responsibility for their health outcomes as such systems orient more toward chronic disease management and away from acute care models [31,32].

Acknowledgements

This work was supported by grant #HS10123 from AHRQ.

References

[1] Engel GL. The need for a new medical model: a challenge for biomedicine. Science 1977;196:129–36.

[2] Glasgow RE. Translating research to practice: lessons learned, areas for improvement, and future directions. Diabetes Care 2003;26: 2451–6.

[3] Deci EL, Ryan RM. Intrinsic motivation and self-determination in human behavior. New York: Plenum Press; 1985.

[4] Sheldon KM, Williams GC, Joiner T. Self-determination theory in the clinic: Motivating physical and mental health. New Haven, CT: Yale University Press; 2003.

[5] Wallston KA, Wallston BS, DeVellis R. Development of the multidimensional health locus of control (mhlc) scales. Health Educ Monogr 1978;6:160–70.

[6] Williams GC, Freedman ZR, Deci EL. Supporting autonomy to motivate patients with diabetes for glucose control. Diabetes Care 1998;21:1644–51.

[7] Bandura A. Self-efficacy: the exercise of control. New York: Freeman; 1997.

[8] Senecal C, Nouwen A, White D. Motivation and dietary self-care in adults with diabetes: are self-efficacy and autonomous self-regulation complementary or competing constructs? Health Psychol 2000;19:452–7.

[9] Williams GC, Grow VM, Freedman ZR, Ryan RM, Deci EL. Motivational predictors of weight loss and weight-loss maintenance. J Pers Soc Psychol 1996;70:115–26.

[10] Miller WR, Rollnick S. Motivational interviewing: preparing people for change. 2nd ed. New York: Guilford Press; 2002.

[11] Miller WR, Benefield R, Tonigan J. Enhancing motivation for change in problem drinking: a controlled comparison of two therapist styles. J Consult Clin Psychol 1993;61:455–61.

[12] Schneider CE. The practice of autonomy. New York: Oxford University Press; 1998.

[13] Williams GC, McGregor HA, Zeldman A, Freedman ZR, Deci EL. Testing a self-determination theory process model for promoting glycemic control through diabetes self-management. Health Psychol 2004;23:58–66.

[14] Williams GC, Cox EM, Kouides R, Deci EL. Presenting the facts about smoking to adolescents: effects of an autonomy-supportive style. Arch Pediatr Adolesc Med 1999;153:959–64.

[15] Williams GC, Gagne M, Ryan RM, Deci EL. Facilitating autonomous motivation for smoking cessation. Health Psychol 2002;21:40–50.

[16] Williams GC, Rodin GC, Ryan RM, Grolnick WS, Deci EL. Autonomous regulation and long-term medication adherence in adult outpatients. Health Psychol 1998;17:269–76.

[17] Bollen KA. Structural equations with latent variables. New York: Wiley; 1989.

[18] Byrne BM. Structural equation modeling with amos: basic concepts, applications, and programming. Mahwah, NJ: Lawrence Erlbaum Associates; 2001.

[19] Glasgow RE, Nutting PA, King DK, Nelson CC, Cutter G, Gaglio B, Kulchak, Rahm A, Whitesides HA, Amthauer H. Results from a practical randomized trial of the diabetes priority program: improvements in care and patient outcomes using RE-AIM criteria, submitted for publication.

[20] Centers for Disease Control and Prevention (CDC). Behavioral risk factor surveillance system survey data. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2001.

[21] (NCQA) NCfQA. Diabetes physician recognition program (DPRP) frequently asked questions: measures for adult patients; 2002.

[22] Amthauer H, Gaglio B, Glasgow RE, Dortch W, King DK. Lessons learned: patient recruitment strategies for a type 2 diabetes intervention in a primary care setting. Diabet Educ 2003;29:673–81.

[23] Kroenke K, Spitzer RL, Williams JB. The phq-9: validity of a brief depression severity measure. J Gen Intern Med 2001;16:606–13.

[24] Joyner L, McNeeley S, Kahn R. Ada's (American Diabetes Association) provider recognition program. HMO Pract 1997;11:168–70.

[25] Dawson B, Trapp RG. Basic and clinical biostatistics. 3rd ed. New York: McGraw-Hill; 2001.

[26] Arbuckle JL. Amos. 5th ed. Chicago, IL: SmallWaters Corp.; 2003.

[27] Kline RB. Principles and practice of structural equation modeling. New York: The Guilford Press; 1998.

[28] Williams GC, Deci EL. Internalization of biopsychosocial values by medical students: a test of self-determination theory. J Pers Soc Psychol 1996;70:767–79.

[29] Williams GC, Deci EL. Activating patients for smoking cessation through physician autonomy support. Med Care 2001;39:813–23.

[30] Williams GC, Levesque C, Zeldman A, Wright S, Deci EL. Health care practitioners' motivation for tobacco-dependence counseling. Health Educ Res 2003;18:538–53.

[31] Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. JAMA 2002;288:1775–9.

[32] Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness: the chronic care model, part 2. JAMA 2002;288:1909–14.

[33] Wagner EH, Austin BT, Von Korff M. Improving outcomes in chronic illness. Manage Care Q 1996;4:12–25.

[34] Wagner EH, Glasgow RE, Davis C, Bonomi AE, Provost L, McCulloch D, Carver P, Sixta C. Quality improvement in chronic illness care: a collaborative approach. Jt Comm J Qual Improv 2001;27:63–80.

[35] Williams GC. Improving patients' health through supporting the autonomy of patients and providers. In: Deci EL, Ryan RM, editors. Handbook of self-determination research. Rochester, NY: University of Rochester Press; 2002. p. 233–54.

[36] Institute of Medicine. Crossing the quality chasm: a new health system for the 21st century. Washington, DC: National Academy Press; 2001.