Health Psychology
2000, Vol. 19, No. 5, 452–457

0278-6133/00/$5.00 DOI: 10.1037//0278-6133.19.5.452

Motivation and Dietary Self-Care in Adults With Diabetes: Are Self-Efficacy and Autonomous Self-Regulation Complementary or Competing Constructs?

Caroline Senécal and Arie Nouwen
Université Laval

David White
Staffordshire University

This study examined constructs drawn from social–cognitive theory (A. Bandura, 1986) and self-determination theory (E. L. Deci & R. M. Ryan, 1985, 1991) in relation to dietary self-care and life satisfaction among 638 individuals with diabetes. A motivational model of diabetes dietary self-care was proposed, which postulates direct links between self-efficacy/autonomous self-regulation, and adherence/life satisfaction. Structural equation modeling showed that both self-efficacy and autonomous self-regulation were associated with adherence (βs = .54 and .21, respectively) and with life satisfaction (βs = .15 and .34, respectively). Constraint analyses confirmed that self-efficacy was significantly more associated with adherence, whereas autonomous self-regulation was significantly more associated with life satisfaction. According to the model, interventions for dietary self-care and life satisfaction should focus on increasing self-efficacy and autonomous self-regulation.

Key words: autonomous self-regulation, self-efficacy, motivation, diabetes, dietary self-care, life satisfaction

It is generally agreed that dietary self-care is the most central element of diabetes management, although many individuals with diabetes fail to follow the recommended dietary self-care activities on a regular basis (e.g., Ary, Toobert, Wilson, & Glasgow, 1986). An area of psychology that has particular relevance to the issue of adherence to self-care activities is the study of motivation (e.g., Williams, Freedman, & Deci, 1998; Williams, Grow, Freedman, Ryan, & Deci, 1996; Williams, Rodin, Ryan, Grolnick, & Deci, 1998). *Motivation* encompasses self-regulatory processes involving the selection, activation, and sustained direction of behavior toward certain goals (e.g., Bandura, 1997). Numerous theoretical perspectives have been proposed to better understand human motivation. Among them, two theories, namely social–cognitive theory (Bandura, 1986) and self-determination theory (Deci & Ryan, 1985, 1991), have received a great deal of attention from researchers over the past two decades. The purpose of the present study was to test the range of applicability of the central constructs arising from these two theories in relation to dietary self-care and life satisfaction among individuals with diabetes.

A key element of social–cognitive theory is the concept of *self-efficacy*, which involves a judgement of one's abilities to produce given attainments (Bandura, 1997). According to Bandura (1986, 1997), self-efficacy contributes to motivation in several ways, namely by (a) shaping aspirations and goals (Campion & Lord, 1982); (b) determining the amount of effort and perseverance one will expend in a given endeavor; and (c) shaping the outcomes expected from one's efforts. People who perceive themselves as highly efficacious will expect favorable outcomes, whereas those with less confidence in their performance capabilities will envision negative outcomes. In addition, progressive mastery of a given activity leads to satisfaction, which in turn serves as an ongoing motivator (Bandura & Schunk, 1981).

Support for the importance of self-efficacy to diabetes self-care adherence comes from several studies showing that higher self-efficacy is associated with higher self-rated adherence, (e.g., McCaul, Glasgow, & Schafer, 1987; Padgett, 1991), even after controlling for past levels of adherence, metabolic control, and a number of demographic variables (Kavanagh, Gooley, & Wilson, 1993). High self-efficacy is also associated with both treatment satisfaction and glycemic control (Howorka et al., 2000). More importantly, interventions that increase dietary self-efficacy also result in increased dietary self-care (Anderson et al., 1995; Glasgow, Toobert, & Hampson, 1996).

Self-determination theory claims that perceived competence, a closely related but more general variable of individual aptitude and capacity than self-efficacy (Deci, 1992; Williams, Freedman, & Deci, 1998), is essential for optimal functioning. However, these authors attribute greater importance to the autonomy (self-determination) construct (Deci & Ryan, 1985, 1991; Vallerand, 1997). They proposed that intentional behaviors differ in the extent to which they are determined by autonomy versus external control. The behaviors of people who function autonomously are self-

Caroline Senécal and Arie Nouwen, École de Psychologie, Université Laval, Québec, Canada; David White, Division of Psychology, School of Sciences, Staffordshire University, Stoke-on-Trent, England.

This study was supported by a grant from the Canadian Diabetes Association.

Correspondence concerning this article should be addressed to Arie Nouwen, who is now at the Division of Psychology, School of Sciences, Staffordshire University, College Road, Stoke-on-Trent, Staffordshire ST4 2DE England. Electronic mail may be sent to a.nouwen@staffs.ac.uk.

initiated; their behavior is important to them and ties into their values and goals system. On the other hand, controlled behaviors are initiated and regulated by environmental pressures such as reward structures, which may be internalized as imperatives of how one "should" or "must" behave (Ryan, 1992). It follows then that, although the amount of motivation does not necessarily differ when people's actions are autonomously regulated rather than environmentally controlled, the type of motivation does, and accordingly the "quality of functioning" (Ryan, Sheldon, Kasser, & Deci, 1996, p. 9). Specifically, self-determination theory predicts that autonomously regulated individuals should experience greater life satisfaction and, in the long term, show greater persistence and adherence.

Support for self-determination theory comes from numerous studies showing that people who are autonomously self-regulated tend to display higher satisfaction, confidence, enjoyment, and trust (Deci, Connell, & Ryan, 1989); greater initiative and persistence (Deci & Ryan, 1985, 1987); better physical and psychological health (Langer & Rodin, 1976); and better adherence to medication prescription (Williams, Rodin, et al., 1998) than people who feel controlled by external agents or internal pressure. To date, only one study used self-determination constructs in the context of diabetes, and that study did not assess dietary adherence. In a longitudinal study, Williams, Freedman, and Deci (1998) showed that perceived autonomy support from a health care provider resulted in increases in patients' autonomous self-regulation and subsequently in their perceived competence, which in turn led to improvement in metabolic control over 12 months. This study only considered the indirect link between autonomous self-regulation and metabolic control mediated by perceived competence. Therefore, whether autonomous self-regulation has any explanatory power over and above that of perceived competence remains to be determined. Both self-efficacy and self-determination have been shown to be associated with adherence to medical regimens, but to date there have been no studies that explore self-efficacy and autonomous self-regulation together in the context of adherence. Similarly, self-efficacy and autonomous self-regulation have not been considered together when exploring life satisfaction, although both are posited to be associated with satisfaction (e.g., Deci et al., 1989; Howorka et al., 2000).

The present study considers autonomous self-regulation and self-efficacy together in relation to dietary adherence and life satisfaction in individuals with diabetes. In doing so, it considers whether the self-efficacy and autonomous self-regulation constructs are complementary (i.e., accounting for different aspects of motivation) or competing (i.e., providing alternative explanations for the same phenomena). The knowledge gained should have direct implication for the development of intervention strategies aimed at augmenting motivation to dietary self-care. The reason for including life satisfaction are threefold: (a) Deci and Ryan (1985, 1991) emphasize its importance in their theorizing; (b) it is an important health outcome in its own right (Jacobson, de Groot, & Samson, 1994; Muldoon, Barger, Flory, & Manuck, 1998); and (c) it may be associated with perceived difficulties in adherence to a regimen and thus affect adherence (Hanestad & Albrektsen, 1991). The particular model of relationships between the constructs tested in this study was a simple one that postulates direct links between self-efficacy/autonomy and adherence/life satisfaction outcomes (see Figure 1).

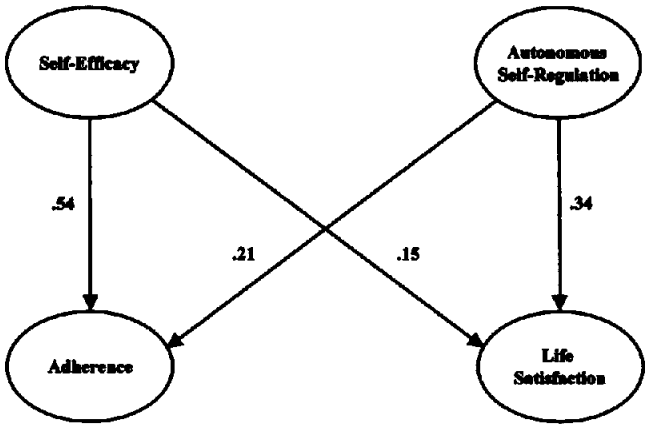

Figure 1. Results of the test of the motivational model of adherence and life satisfaction among individuals with diabetes. All parameters are significant at $z > 1.96$.

Method

Participants

Participants were 638 individuals with diabetes recruited through a mailing to members of the Quebec Diabetes Association (313 women, 324 men, and 1 participant who did not specify gender). Eligibility criteria included (a) being diagnosed with either type 1 or type 2 diabetes for at least 3 years; (b) being between 20 and 70 years of age; (c) having had no major modification in the treatment of diabetes during the 6 months preceding the study (e.g., no transfer to insulin, or addition of a second injection); and (d) being able to understand written French.

Procedure

Questionnaires were sent with a mailing of the quarterly publication *Plein Soleil* to 2,500 members of the Quebec Diabetes Association. The 15,000 members of the Quebec Diabetes Association are estimated to represent 5% of all individuals with diabetes in that province. This recruitment procedure was preferred to recruitment through a hospital setting to avoid a sample in which individuals in need of specialized care were overrepresented. A cover letter spelled out the selection criteria and explained to participants that the purpose of the study was "to learn more about the feelings and behaviors of people with diabetes." A total of 704 completed questionnaires were received. This low response rate (26%) may be explained in part by the fact that, among subscribers to the quarterly, there are many older adults or parents of children with type 1 diabetes. Because the association does not keep records of the demographics of its membership, it was impossible to do a first screening before mailing the questionnaires.

Measures

Dietary self-efficacy. Self-efficacy in dietary care was assessed with a 34-item scale. Participants rated the confidence they have in their ability to follow recommended dietary self-care activities on a regular basis, given 34 common barriers to dietary self-care. The barriers, which were based on Glasgow, McCaul, and Schafer (1986) and Schlundt, Rea, Kline, and Pitchert (1994), encompassed three kinds of situations, namely: temptations (e.g., "when I see other people eat foods that are high in calories"), negative mood (e.g., "when I feel depressed or bored"), and uncontrollable situations (e.g., "when I am sick"). Confidence was rated on a 100-point scale ranging from 0 (*I am not confident at all that I can follow the dietary*

plan) to 100 (*I am completely confident that I can follow the dietary plan*). Cronbach's alpha was .94.

Autonomous self-regulation of dietary self-care activities. This measure assesses autonomous self-regulation of dietary care. It was adapted from Pelletier, Tuson, and Haddad's (1997) Therapy Motivation Scale and is composed of four items. Participants had to answer the following question: "Why are you following your dietary plan?" Each item represents a possible autonomous self-regulated reason for following a dietary plan (e.g., "Because I think that this is important to maintain good health"). Items are scored on a 7-point Likert scale ranging from 1 (*do not agree at all*) to 7 (*very strongly agree*). Cronbach's alpha was .89.

Dietary self-care activities. Dietary self-care was measured with three items of the French-Canadian version of the Summary of Diabetes Self-Care Activities questionnaire (SDSCA; Toobert & Glasgow, 1994). The three-item subscale assessed, over the previous 7 days, overall adherence to recommended dietary self-care activities, percentage of time the individual successfully limited caloric intake, and percentage of meals that included high amounts of fiber. The SDSCA has been shown to correlate with self-monitoring, interview responses, and objective indices of dietary self-care. Construct validity of the French-Canadian version has been demonstrated (Talbot, Nouwen, Gingras, Gosselin, & Audet, 1997). The first item was scored on a 5-level descriptor scale, ranging from 1 (*never*) to 5 (*always*); the other items were rated on a 5-point Likert scale ranging from 1 (*0%*) to 5 (*100%*). Cronbach's alpha was .71. This somewhat lower internal consistency rating may be explained by the fact that diabetes dietary self-care is a multidimensional construct (Johnson, Tomer, Cunningham, & Henretta, 1990; Toobert & Glasgow, 1994).

Life satisfaction. Life satisfaction was measured with a French-Canadian version of the Life Satisfaction Scale (Diener, Emmons, Larsen, & Griffin, 1985), which assesses the extent to which participants feel generally satisfied with their life. Both the original and the French-Canadian scale have adequate validity and reliability (Blais, Vallerand, Pelletier, & Briere, 1989). The scale was composed of five statements (e.g., "In most ways my life is close to my ideal"). Items were scored on a 7-point Likert scale ranging from 1 (*do not agree at all*) to 7 (*very strongly agree*). Cronbach's alpha was .91.

Statistical Analyses

The statistical model to be estimated. The adequacy of the model was assessed by structural equation modeling with the EQS program (Version 5.1; Bentler, 1993). As can be seen in Figure 1, the proposed model contained two exogenous variables: self-efficacy in following dietary plan and autonomous self-regulation, and two endogenous variables: dietary self-care and life satisfaction. Demographic and illness-related descriptors (including gender, educational background, income, body mass index, and diabetic complications) were not included in the model because preliminary analysis showed no systematic relationships between them and any of the variables in the motivational model of dietary self-care. Exogenous and endogenous variables were measured by three scales each, with the exception of autonomous self-regulation, which was measured by four scales, and life satisfaction, which was measured by five scales. Furthermore, covariance was estimated between the two exogenous variables. The overall model contained 35 free parameters to be estimated. Bentler (1993) suggested that the ratio of sample size to the number of free parameters to be estimated may be able to go as low as 5:1 under normal elliptical theory, whereas a ratio of at least 10:1 may be more appropriate for arbitrary distributions. In this study, the measurement strategy used offered a ratio of 18:1 for a normal multivariate distribution. Consequently, we are confident that trustworthy z scores were obtained on the significance of parameters.

Matrix to be analyzed and method of estimation. A covariance matrix with the 15 observed variables was used as a database for measurement and for the structural models. Moreover, skewness and kurtosis values for all variables were considered satisfactory (see Table 1). The specified model was tested with standardized coefficients obtained from the maximum likelihood method of estimation. A growing body of research indicates that this method performs reasonably well when the data are multivariate and normally distributed and the sample size is large enough (e.g., Chou & Bentler, 1995). These conditions were met in the present study.

Fit indices. The EQS program provides different indices to ascertain model fit. Herein, we used the chi-square (Bollen, 1989), the Comparative Fit Index (CFI; Bentler, 1990), and the Bentler–Bonnet Non-Normed Fit Index (NNFI; Tucker & Lewis, 1973). The chi-square indicates a lack of fit resulting from overidentifying the restrictions placed on the model (Bollen, 1989). Consequently, a nonsignificant chi-square indicates that the model

Table 1
Factor Loadings, Error Residuals, Means, Skewness, and Kurtosis for Each Measurement Variable

Measure and variable	Loadings	Errors	*M*	Skewness	Kurtosis
Self-efficacy					
Temptations	.86	.51	62.200	−0.587	−0.058
Uncontrollable situations	.87	.63	71.694	−0.982	0.973
Negative emotions	.77	.64	60.953	−0.440	−0.430
Autonomous self-regulation					
Identified Motivation 1	.79	.61	6.146	−1.702	3.439
Identified Motivation 2	.78	.63	6.064	−1.582	2.981
Identified Motivation 3	.84	.54	6.157	−1.685	3.752
Identified Motivation 4	.85	.52	6.027	−1.612	3.309
Adherence					
Adherence 1	.62	.78	3.878	−1.667	4.696
Adherence 2	.79	.62	3.586	−1.032	1.439
Adherence 3	.48	.88	3.901	−0.573	−0.170
Life satisfaction					
Life Satisfaction 1	.85	.53	4.867	−0.741	0.126
Life Satisfaction 2	.85	.52	5.119	−0.835	0.449
Life Satisfaction 3	.91	.41	5.110	−0.818	0.260
Life Satisfaction 4	.81	.59	5.165	−0.878	0.260
Life Satisfaction 5	.67	.75	4.625	−0.501	−0.834

is an adequate representation of the sampled data. On the other hand, the CFI assesses the relative reduction in lack of fit as estimated by the noncentral chi-square of a target model versus a baseline model in which all the observed variables are uncorrelated (Bentler, 1990). The NNFI compares the lack of fit of a target model to the lack of fit of the baseline model. Thus, the NNFI estimates the relative improvement per degree of freedom of the target model over the baseline model (Bentler & Bonett, 1980). The CFI varies between 0 and 1, whereas the NNFI can exceed this range (i.e., > 1).

Results

A Test of the Motivational Model of Dietary Self-Care in Adults With Diabetes

Results showed that the chi-square was significant, $\chi^2(85, N = 638) = 157.48$, $p < .001$. However, the CFI (.99) and the NNFI (.98) were acceptable. Figure 1 presents the standardized solutions for the structural model, and Table 1 presents factor loadings and error residuals for the measurement model. All hypothesized path coefficients, factor loadings, covariances, error residuals, and factor residuals were found to be significant ($zs > 1.96$). More specifically, self-efficacy was associated with self-reported adherence to self-care activities ($\beta = .54$) and with life satisfaction ($\beta = .15$). Further, autonomous self-regulation was associated with self-reported adherence to dietary self-care activities ($\beta = .21$) and with life satisfaction ($\beta = .34$).

Thus, results of the model showed that autonomous self-regulation has a higher path coefficient (.34) on life satisfaction when compared with self-efficacy (.15), and that self-efficacy has a higher path coefficient (.54) on diabetes self-care activities when compared with autonomous self-regulation (.21). To establish whether there was a significant difference between self-efficacy and autonomous self-regulation in their impact on life satisfaction and self-reported adherence, a second structural equation modeling analysis was conducted in which two equality constraints were imposed: (a) The path connecting self-efficacy to life satisfaction was set equal to the path leading from autonomous self-regulation to life satisfaction, and (b) the path connecting self-efficacy to diabetes self-care activities was set equal to the path leading from autonomous self-regulation to diabetes self-care activities. With these constraints, the model was also significant, $\chi^2(87, N = 638) = 209.06$, CFI = .98, NNFI = .97. However, when the two models were compared, the difference in chi-square was significant. Results showed that the model with the constraints offered a significantly worse fit to the data than the original model, χ^2 diff(2) = 51.58, $p < .05$. Results of these analyses thus showed that, compared with autonomous self-regulation, self-efficacy is significantly more associated with adherence. On the other hand, autonomous self-regulation is significantly more associated with life satisfaction than is self-efficacy.

Discussion

Results from structural equation modeling point to the complementary nature of self-efficacy and autonomous self-regulation, both of which appear to make independent contributions to the prediction of both dietary self-care and life satisfaction. However, self-efficacy was a significantly better predictor of self-reported adherence to dietary self-care activities than was autonomous self-regulation, whereas the latter was the best predictor of life satisfaction. Thus, although adherence to dietary self-care activities seems determined primarily by self-efficacy, whether one feels happy in life is related to whether those self-care activities have personal significance.

One explanation of the pattern of results relates to the way autonomous self-regulation is operationalized. Most researchers (Deci & Ryan, 1985, 1987; Pelletier et al., 1997; Williams, Freedman, & Deci, 1998) operationalize it in global terms (e.g., "I follow my dietary plan because my health matters to me;" Williams, Freedman, & Deci, 1998), and, as such, the concept may be less well-suited to predict specific performance outcome measures such as dietary adherence than is the specific measure of self-efficacy. Although global reasons for following specific self-care activities may sustain effort directly, as indicated by the significant independent link between autonomous self-regulation and adherence, individuals with diabetes who are self-efficacious are better equipped to carry out the various self-care activities when faced with specific and often difficult barriers. Our results suggest that when such barriers to maintaining dietary adherence occur, it is self-efficacy rather than autonomous self-regulation that matters most. Nevertheless, the present results confirm the earlier finding of Williams, Rodin, et al. (1998) that autonomous self-regulation is independently related to adherence.

The stronger link between autonomous self-regulation and life satisfaction is consistent with Deci (1992), who argued that when goal-directed behaviors are tied into one's value system, they give rise to self-satisfaction even when the behaviors themselves are not pleasurable. In contrast, people who feel controlled in following their dietary plan, even if they perceive themselves as self-efficacious, would still feel pressured and would be unlikely to live harmoniously with their diabetes. Our data showed, however, that self-efficacy contributes to life satisfaction independently of autonomous self-regulation. Thus, being confident about one's ability to carry out recommended dietary self-care activities may generate feelings of satisfaction even when such activities are not embedded into one's value system (e.g., being satisfied with having successfully followed the dietary recommendations even when it is done to please the doctor). Alternatively, sustained adherence because of higher self-efficacy could lead to better control of diabetes and consequently to fewer diabetes-related symptoms. This in turn may lead to lower levels of perceived interference of diabetes with daily life and greater life satisfaction. This seems consistent with Grey, Boland, Yu, Sullivan-Bolyai, and Tamborlane (1998), who showed that adolescents who had higher diabetes self-efficacy were more satisfied with their quality of life, coped more successfully with their diabetes, and had lower levels of depression.

It is important to consider how the joint influence of self-efficacy and autonomous self-regulation on dietary self-care and life satisfaction could enhance the power of interventions aimed at these important health outcome variables. Strategies for enhancing self-efficacy are clearly specified and generally include identifying and setting realistic goals, problem-solving to reduce barriers to goal achievement, coping with unchangeable circumstances, and identifying and eliciting appropriate social support (e.g., Anderson et al., 1995; Strecher et al., 1995). Existing intervention strategies developed to promote autonomy include motivational interviewing (Harland et al., 1999), patient empowerment, and the provision of

autonomy support (Ryan et al., 1996; Williams, Freedman, & Deci, 1998; Williams, Rodin, et al., 1998). Autonomy support occurs when significant others (e.g., health care providers, family members) devote time, attention, and resources to the target person. Such support entails taking that person's perspective, providing choice, encouraging self-initiation, and minimizing controls (Ryan et al., 1996). Intervention strategies for enhancing both autonomy and self-efficacy could provide individuals with diabetes with an environment that allows informed choices about dietary plan and diabetes, enhances the ability to identify and set realistic goals, and enhances problem-solving capabilities and coping potential. Autonomy support and motivational interviewing, together with strategies for enhancing self-efficacy, are important elements to include in interventions aimed at improving adherence to medical regimens and enhancing life satisfaction and quality of life. Such interventions are much needed (Foreyt & Poston, 1999).

The strength of the present study relative to previous studies is the integration of key constructs drawn from two different theoretical perspectives into the explanation of behavioral (adherence) and affective (life satisfaction) consequences of motivation. However, there are a number of limitations to be addressed in future research. The study sample, which was selected to cover the range of complications experienced by people with diabetes, was recruited from the rank and file of the Quebec Diabetes Association, whose membership includes only 1 out of 20 individuals with diabetes in the province. Therefore, it is possible that the individuals who participated in this study had higher levels of motivation than the average person with diabetes. Although preliminary analyses suggested that demographics, level of complication, and other disease factors were not significantly related to self-efficacy, autonomous self-regulation, dietary adherence, or life satisfaction, some caution is needed at this stage in generalizing the results. In addition, the nature of the study was correlational, which precludes reaching conclusions about causality, even though we used structural equation modeling. Future longitudinal studies are needed to establish causal links between the four variables. Of particular interest would be studies investigating the role of self-efficacy and autonomous self-regulation during the internalization process in persons who are newly diagnosed with diabetes.

The pattern of results found in the present study may relate to the fact that people rated these motivational aspects on the basis of existing dietary care skills rather than newly learned skills. This distinction appears important given Locke and Latham's (1990) contention that self-determination of goals may be particularly influential during the developmental phase of skills, especially for those with low self-efficacy. It is therefore important to test the model in relation to newly emerging skills.

Incorporating self-efficacy and autonomous self-regulation into a model of motivation for individuals with diabetes would seem to be important in dealing with well-rehearsed self-care behaviors and life satisfaction. Further, it would seem important to test the application of this model to other health behaviors and circumstances, including the development of new health-related skills. The model has clear implications for the development of interventions to promote adherence to medical regimens. It also invites questions about the interrelationships between the four model variables that future longitudinal research should address. Examples of these questions are: How do self-determination and self-efficacy interact and affect outcomes; how does life satisfaction relate to self-care activities; how does specific goal attainment satisfaction affect life satisfaction; and what are the temporal relations between these four variables?

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