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Health-care climate, perceived self-care competence, and glycemic control among patients with type 2 diabetes in primary care

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Abstract

This study showed, in line with self-determination theory, that glycemic control among patients with type 2 diabetes ($n = 2866$) was strongly associated with perceived self-care competence, which in turn was associated with autonomous motivation and autonomy-supportive health-care climate. These associations remained after adjusting for the effect of important life-context factors. Autonomous motivation partially mediated the effect of health-care climate on perceived competence, which fully mediated the effect of autonomous motivation on glycemic control. The results of the study emphasize health-care personnel's important role in supporting patients' autonomous motivation and perceived self-care competence.

Keywords

competence, diabetes, glycemic control, health-care climate, motivation

Introduction

Type 2 diabetes is affecting an increasing proportion of population worldwide. Environments that foster physical inactivity and access to diet rich in energy are the most important determinants of this epidemic (Unwin et al., 2010.) In Finland, about 9 percent of the population already has type 2 diabetes. The amount of diagnosed patients with type 2 diabetes has been doubled in intervals of 12 years, and there is no sign of change in this trend (Koski, 2011).

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia (Alberti and Zimmet, 1998). Achieving and maintaining recommended levels of glycemic control is the main target in the management of diabetes. Good glycemic control is essential in order to reduce micro- and macrovascular complications associated with diabetes. Glycemic control is best achieved by pharmacologic therapy combined with lifestyle changes including weight loss, increased physical activity, and healthy diet (American Diabetes Association, 2011, 2014).

Autonomy-supportive health-care climate is one factor that is supposed to promote healthy lifestyle and good glycemic control among patients with type 2 diabetes (Williams et al., 1998). According to the self-determination theory (SDT), people are most effective in long-term glycemic control when they are autonomously motivated and feel competent with respect to critical self-management behaviors (Deci and Ryan, 1985). SDT assumes that people are oriented toward physical and psychological health. They also have psychological needs for autonomy, competence, and relatedness. Autonomous motivation and feeling of competence for effective self-management of diabetes is best achieved in environments that support these basic psychological needs. Health-care personnel's autonomy- and

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relatedness-supportive behaviors, such as acknowledging patients' perspectives and giving relevant information, respect, and understanding, are supposed to enhance patients' sense of autonomy, competence, and relatedness, which in turn is assumed to be positively associated with favorable health behavior change and ultimately better physical and mental health (Ryan and Deci, 2000; Williams et al., 2009.) Need satisfaction and sense of being the initiator of the behavior and being competent to control important outcomes such as maintaining glucose levels in a healthy range are assumed to give long-term psychological energy for adapting and maintaining healthy lifestyle (Ng et al., 2012; Williams et al., 2004). The meta-analysis by Ng et al. (2012) showed that the SDT-model has got support in several studies analyzing various variables as outcome of care, for example, high-density lipoprotein (HDL)-cholesterol, HbA1c and glucose levels (Williams et al., 1998, 2004, 2005, 2009), depression and patient satisfaction (Williams et al., 2005), and medical adherence (Williams et al., 1998).

Health-care climate is an important but not the only factor that possibly affects patients' perceived competence in diabetes self-management and ultimately glycemic control. The effect of the larger life context, such as the severity of the illness, other stressful experiences, personality factors, and social support, should also be evaluated. Patients with diabetes are forced to cope with self-management demands and threat of complications and their possible effect on daily functioning and important roles (Gonzales et al., 2011). Other stressful life experiences may additionally increase the general stress level and decrease emotional well-being. For example, the prevalence of major depression and minor depressive symptoms has been shown to be significantly higher in patients with type 2 diabetes than in the general population (Ali et al., 2006; Anderson et al., 2001; Nouwen et al., 2010). Several studies have found an association between depressive symptoms and poor self-management of diabetes, unsatisfactory glycemic control, and complications of diabetes (Ali et al., 2006; De Groot et al., 2001; Dirmaier et al., 2010; Egede and Ellis, 2010; Gonzales et al., 2007).

Significant others in the person's social context may also have an effect on perceived competence and glycemic control to the extent that these persons are autonomy supportive (Williams et al., 1998). In addition, personality orientations, such as a strong sense of coherence, may enhance perceived self-care competence directly or indirectly by increasing the ability to cope with stress (Antonovsky, 1987). Socioeconomic status may be associated with glycemic control through health behavior, since many unhealthy behaviors, such as smoking, poor dietary habits, and physical inactivity, are known to be more prevalent in lower socioeconomic groups (Laaksonen et al., 2008).

This study extends previous research by examining whether the perceived health-care climate is associated with outcomes of care, in terms of perceived competence in diabetes care and glycemic control, when the effect of a wide variety of other important life-context factors is controlled for.

We hypothesize that an autonomy-supporting health-care climate and autonomous motivation are positively associated with perceived self-care competence even after the effect of other important life-context factors is controlled for. Also, we hypothesize that an autonomy-supporting health-care climate, autonomous motivation, and perceived self-care competence are positively associated with good glycemic control even after the effect of other important life-context factors is controlled for.

Methods

Data collection

The sample of the study was collected in 2011 from the register of the Social Insurance Institution of Finland (SII). SII is a Finnish government agency (funded directly from taxation) in charge of settling benefits under national social security programs. SII handles retirement pay, child benefits, unemployment benefits, sickness benefits, health insurance, and student benefits. All permanent residents of Finland are covered under the Finnish National Health Insurance (NHI) scheme and are eligible for reimbursement of medical expenses under the Health Insurance Act. SII keeps the register of those persons who have entitlement to a special reimbursement for medicines because of chronic diseases such as diabetes. The sample for this study was collected among persons who fulfilled the following inclusion criteria:

1. Had entitlement to a special reimbursement for medicines used in the treatment of type 2 diabetes (International Classification of Disease–10 (ICD-10) code, E11) in 2000–2010, and the right was valid in September 2011 and onward;
2. Born in 1936–1991 (20–75 years), alive, and had no safety prohibition at the time of the data collection;
3. Finnish as native language; and
4. One of the five study municipalities as place of residence.

A total of 7575 persons fulfilled the inclusion criteria. Based on power-analysis, a sample of 5167 persons was collected: 2000 persons from the two large municipalities and all persons from the three small municipalities. There were 2962 (57%) men and 2205 women (43%) in the sample, corresponding the rate of sex in the total population of patients with type 2 diabetes in the study municipalities.

The questionnaire was tested by a pilot study ($n=50$) in May 2011, and after some revisions, the questionnaire was mailed to respondents in September 2011. A reminder to nonrespondents was sent out in October, and another reminder with a new copy of the questionnaire was sent out in November. The final response rate was 56 percent ($n=2866$). The response rates in the two large municipalities were 54 and 56 percent, and in the three small municipalities 54, 56, and 59 percent. Women responded slightly more often (57%) than men (54%). The response rate was highest (63%) in the oldest age group (65–75 years), lower (55%) in the age group of 55–64 years, and lowest (36%) in the age group of 20–54 years.

Ethical issues

The research plan was accepted by the Ethical Committee of the Hjelt Institute, University of Helsinki, and the permission to conduct the study was received from the SII. The sample was collected by the contact person who worked at the SII, and the questionnaires were posted from there. Respondents returned filled questionnaires, provided only by an identification number, directly to the researchers by mail. An identification number was needed in order to check for nonresponse. Identity of respondents was not revealed to the researchers at any stage of the sample or data collection, nor was the content of the questionnaires revealed to anybody else except the researchers.

Respondents

The mean age of respondents was 63 years (standard deviation (SD): 8 years, range: 27–75 years), and 56 percent of them were men. Over half (56%) of the respondents were retired because of old age, 60 percent were married, and 59 percent had less than higher professional education. The majority (83%) of the respondents had a municipal primary care health center as their primary care place in diabetes care, and 74 percent used tablets only for diabetes therapy (Table 1).

Table 1. Sociodemographic background factors of respondents (corrected by rescaled sampling weight).

	N (estimate)	%
Sex		
Man	1590	55.7
Woman	1266	44.3
Total	2856	100
Age		
27–54 years	353	12.6
55–64 years	1057	37.7
65–75 years	1396	49.7
Total	2806	100
Marital status		
Single	278	9.8
Married	1688	59.5
Cohabiting	190	6.7
Divorced	428	15.1
Widowed	253	8.9
Total	2837	100
Professional education		
Upper secondary education (vocational school) or less	1636	58.8
Higher education (college, polytechnic, university)	1148	41.2
Total	2784	100
Principal activity		
Working	674	24,0
Retired because of chronic illness	383	13,6
Retired because of old age	1567	55,9
Other	181	6.5
Total	2805	100
Diabetes medication		
Tablets	2052	74.3
Insulin	142	5.1
Tablets + insulin	500	18.1
Other	67	2.4
Total	2761	100
Service provider		
Municipal	2236	82.8
Private	464	17.2
Total	2700	100

Measures

Measures used in the study are presented in Table 2. Averaged sum scales for health-care climate, autonomous motivation, perceived competence, energy, emotional well-being, sense of coherence, life stress, and social support in diabetes were calculated. The respondent was included in the analysis if she or he had answered at least to 70 percent of the scale items.

Statistical procedures

Descriptive statistics were estimated, and the baseline associations between independent variables, covariates, and dependent variables were tested with Pearson chi-square-tests, *t*-tests, or one-way analysis of variance depending on the measurement scale of the variable of interest. In the final analyses, multivariate linear and logistic regression analyses were used. The correlations between study variables were explored before the analyses by Pearson or Spearman correlations. The variables for the regression models were chosen on theoretical and statistical basis. Independent variables that correlated strongly with each other, such as variables measuring mental well-being, were omitted from the regression analyses. Only the variable that correlated most strongly with the dependent variable was chosen for the models.

Table 2. Measures used in the study.

Health Care Climate Questionnaire (HCCQ) (n.d.)	The short 6-item form of HCCQ (range: 1 = *fully disagree*, 5 = *fully agree*, Cronbach's alpha reliability $r = 0.95$) (http://www.selfdeterminationtheory.org/).
Autonomous Regulation Scale (n.d.)	Eight items from the treatment self-regulation questionnaire (TSRQ) (range: 1 = *not at all true*, 7 = *very true,* $r = 0.86$) (http://www.selfdeterminationtheory.org/).
Perceived Competence Scale (PCS) (n.d.)	The 4-item scale (range: 1 = *fully disagree*, 5 = *fully agree,* $r = 0.93$) (http://www.selfdeterminationtheory.org/).
Energy	The 4-item scale measuring energy during the last 4 weeks from the RAND-36-Item Health Survey, 1.0 (range: 0%–100%, $r = 0.85$) (Hays et al., 1993).
Emotional well-being	The 5-item scale measuring emotional well-being during the last 4 weeks from the RAND-36-Item Health Survey, 1.0 (range: 0%–100%, $r = 0.84$) (Hays et al., 1993).
Sense of coherence	The short 13-item scale (range: 1 = *weak*, 7 = *strong,* $r = 0.80$, five items reversed) (Antonovsky, 1987).
Depression	Diagnosed depression (1 = *no*, 2 = *yes*).
Life stress	Experienced stress during the last year (12 months) in the 10 life areas e.g. own health and economic situation (range: 1 = *not at all*, 4 = *very much*). Based on the Living with Diabetes Study. School of Population Health. University of Queensland (Donald et al., 2012).
Social support in diabetes	A 12-item scale measuring support and help received from friends, relatives, and health-care personnel (range: 1 = *fully disagree*, 5 = *fully agree,* $r = 0.75$) (Toljamo, 1999). The scale is based on social support scales by Brandt and Weinert (1981), Goodenow et al. (1990), Norbeck et al. (1981, 1983), Stewart and Tilden (1995) and Weinert (1987).
Perceived status of health	A single-item scale, range: 1 = *very good*, 5 = *poor*.
Complications	At least one of the 12 diabetes-related complications mentioned, 1 = *yes*, 2 = *no*. The list of the complications was based on the Living with Diabetes Study, School of Population Health, University of Queensland (Donald et al., 2012) and Finnish Diabetes Association (n.d.) (http://www.diabetes.fi).
Glycemic control	The value of the glycated hemoglobin (HbA1c) in the last measurement. HbA1c reflects the average level of glycemic control over several months and has a strong predictive value for diabetes complications (American Diabetes Association, 2014).

The distributions of health-care climate, autonomous motivation, perceived competence, energy, emotional well-being, and sense of coherence scales were skewed to the right, and the distribution of the life stress scale was skewed to the left but without influence on the analysis. Statistical requirements for normal distribution, linearity, and homoscedasticity of regression residuals were fulfilled. List-wise deletion of missing data was used.

In the mediation analyses between health-care climate, autonomous motivation, perceived competence, and glycemic control, the instructions reported by Baron and Kenny (1986) were followed. First, the mediator was regressed on the independent variable. Second, the dependent variable was regressed on the independent variable. Third, the dependent variable was regressed on both the independent variable and on the mediator. A mediation exists if the predicted associations hold on each step of the analysis and if the effect of the independent variable on the dependent variable is less in the third step than in the second step. The mediation is perfect if the independent variable has no effect when the mediator is controlled (Baron and Kenny, 1986). Statistical significance of the mediation was calculated by the Sobel test (Preacher and Leonardelli, 2003).

Statistical analyses were performed using complex samples-procedure, which allows the use of weight coefficients in order to correct bias caused by the different sample collection methods in the small (all patients with type 2 diabetes) and big municipalities (a sample). SPSS version 20 was used.

Results

Health-care climate, reflecting the patient's assessment of his or her doctor's autonomy-supportive behavior in the health center, was quite good (mean: 3.6, SD: 1.2, range: 1–5). The same was true with patients' autonomous motivation (mean: 5.6, SD: 1.2, range: 1–7) and perceived self-care competence (mean: 4.2, SD: 0.9, range: 1–5). A majority (67%) of the patients reported good glycemic control (HbA1c < 7% (53 mmol/mol)) in the last measurement.

Almost all respondents (97%) reported having another diagnosed chronic illness apart from diabetes. Hypertension was the most common (72%) illness. A total of 42 percent of the respondents had at least one diabetes-related additional complication of which retinopathy was the most common (18%). A total of 22 percent of patients had a diagnosed depression.

The four variables measuring mental health or positive personality orientation correlated strongly, that is, energy correlated with emotional well-being (0.78***), sense of coherence (0.58***), and depression (−0.38***). Of these four variables, energy correlated most strongly with perceived self-care competence (0.36***) and glycemic control (0.12***). Pearson correlations between emotional well-being, sense of coherence, diagnosed depression, and perceived self-care competence were 0.34***, 0.31***, and −0.18***, respectively. Spearman correlations between emotional well-being, sense of coherence, diagnosed depression, and glycemic control were 0.09***, 0.08***, and −0.05*, respectively. Therefore, energy was included as an independent variable to the multivariate linear and logistic regression analyses [***p <.001, *p <.05].

Table 3 shows correlations between the variables chosen for the final analyses. Health-care climate correlated positively with autonomous motivation and perceived competence. These three SDT variables correlated positively with perceived energy, perceived social support, and good self-rated health, and negatively with stress. In addition, autonomous motivation and perceived competence correlated positively with good glycemic control and negatively with high body mass index (BMI), but these correlations were quite modest.

Table 4 shows that perceived competence was strongly associated with autonomous motivation and autonomy-supportive health-care climate. In addition, perceived competence was positively associated with good status of health, energy, social support, and higher age and negatively with stressful life experiences.

Table 5 shows that good glycemic control was strongly associated with perceived competence but not with health-care climate or autonomous motivation directly. The association between perceived competence and glycemic control remained statistically significant after the effect of disease related and other important life-context factors was controlled for. Of these factors, using tablets only as diabetes medication, higher age, higher professional education, and female gender were positively, and long duration of diabetes, high BMI, and social support in diabetes care were negatively associated with glycemic control.

Table 6, describing the mediation analysis, shows that health-care climate was positively associated with autonomous motivation and perceived competence and that the effect of health-care climate on perceived competence was reduced when the effect of autonomous motivation was controlled for. This indicates that autonomous motivation mediates the effect of health-care climate on perceived competence. Also, autonomous motivation was positively associated with perceived competence and glycemic control, and the effect of autonomous motivation on glycemic control disappeared after the effect of perceived competence was controlled for, which indicates perfect mediation (see Baron and Kenny, 1986).

Discussion

This study examined whether the health-care climate in primary care health centers is associated with outcomes of care in terms of perceived competence in diabetes care and glycemic control among patients with type 2 diabetes. The results of the study supported the predictions derived from the SDT (Williams et al., 2005) and emphasized the important role of health care in supporting autonomous motivation and perceived competence in order to reach good glycemic control.

As hypothesized, an autonomy-supporting health-care climate and autonomous motivation were strongly associated with high perceived competence in diabetes care even after the effect of other important life-context factors were controlled for. Autonomous motivation partially mediated the effect of health-care climate on perceived competence.

Our second hypothesis was partly supported. Glycemic control was strongly associated with perceived competence in diabetes care but not with health-care climate and autonomous motivation directly. The mediation analysis indicated that the effect of autonomous motivation on glycemic control was mediated by perceived competence.

Besides health-care-climate-related factors, disease severity and other life-context factors played a role in the outcomes of care. Perceived competence in diabetes care was positively associated with good perceived health, energy, social support, and higher age, and negatively associated with stress. Glycemic control was positively associated with using tablets only as diabetes medication, higher age, high professional education, and female gender, and negatively associated with long duration of diabetes, high BMI, and high social support in diabetes care. These results indicate that it is important to promote general health and well-being of patients with type 2 diabetes. As stated by Gonzales et al. (2007), the assessment of the psychological and social situation of patients should be included as an ongoing part of the medical management of diabetes.

Social support in diabetes care was positively associated with perceived competence but negatively associated with glycemic control. This may be due to the fact that those with poor glycemic control were more often insulin users and thus seemed to have a more serious illness and more need of support in diabetes care.

A total of 22 percent of the patients in this study reported diagnosed depression, while the prevalence of depression in the whole population of Finland is about 5 percent (Pirkola et al., 2005). This result is in line with the studies in other countries that show higher prevalence of depression among patients with type 2 diabetes compared with the general population (Ali et al., 2006; Anderson et al., 2001; Nouwen et al., 2010). However, of the four variables that we used to measure mental well-being, energy correlated most strongly and diagnosed depression most weakly with perceived competence in diabetes care and glycemic control. Also, the

Table 3. Correlations matrix between study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Climate													
2. Autonomous motivation	.25***												
3. Competence	.31***	.43***											
4. Sex (1 = *man*, 2 = *woman*)	−.08***	.10***	−.02										
5. Age	.03	.15***	.12***	.03									
6. Education (1 = *low*, 2 = *high*)	.00	−.03	−.03	−.02	−.09***								
7. Diabetes medication (1 = *tablets only*, 2 = *other*)	−.03	−.02	−.03	−.06***	−.12***	−.01							
8. Duration of diabetes	−.02	−.02	−.01	−.02	.19***	−.02	.17***						
9. Perceived health (1 = *good*, 2 = *poor*)	−.22***	−.19***	−.25***	.03	.06***	−.11***	.11***	.09***					
10. BMI	−.02	−.18***	−.16***	.09***	−.18***	−.04*	.14***	−.02	.19***				
11. Energy	.26***	.28***	.36***	−.09***	.12***	.01	−.12***	−.04	−.47***	−.16***			
12. Stress	−.17***	−.10***	−.26***	.23***	−.35***	.06**	.09***	−.02	.23***	.17***	−.49***		
13. Support	.41***	.36***	.33***	.02	.08***	−.05*	−.04*	−.06**	−.22***	−.06***	.37***	−.28***	
14. Glycemic control (1 = *poor*, 2 = *good*)	.02	.08***	.12***	.03	.12***	.07***	−.33***	−.11***	−.14***	−.15***	.12***	−.13***	.03

BMI: body mass index.
**$p < .01$; ***$p < .001$.

Table 4. Multivariate linear regression models on the association of health-care climate, autonomous motivation, and other important life-context factors with perceived competence in diabetes care. (Corrected by rescaled sampling weight.)

	Model 1	Model 2	Model 3	Model 4
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)
Climate	0.17*** (0.14 to 0.19)	0.16*** (0.14 to 0.19)	0.14*** (0.11 to 0.17)	0.11*** (0.08 to 0.14)
Autonomous motivation	0.29*** (0.26 to 0.31)	0.27*** (0.25 to 0.30)	0.26*** (0.23 to 0.28)	0.23*** (0.20 to 0.26)
Sex		0.08*** (0.03 to 0.13)	0.06* (0.01 to 0.11)	0.02 ns. (−0.04 to 0.07)
Age		0.01*** (0.00 to 0.01)	0.01*** (0.00 to 0.01)	0.01* (0.00 to 0.01)
Professional education		0.03 ns. (−0.02 to 0.08)	0.06* (0.01 to 0.11)	0.05 ns. (−0.00 to 0.10)
Duration of diabetes			−0.00 ns. (−0.01 to 0.00)	0.00 ns. (−0.00 to 0.01)
Perceived status of health			0.27*** (0.22 to 0.32)	0.14*** (0.08 to 0.20)
Energy				0.01*** (0.00 to 0.01)
Stress				−0.17*** (−0.24 to −0.10)
Social support				0.08** (0.03 to 0.14)
R square	.24	.24	.26	.30
n	2611	2508	2379	2117

CI: confidence interval.
ns. $p > .05$; *$p < .05$; **$p < .01$; ***$p < .001$.

Table 5. Multivariate logistic regression models on the association of health-care climate, autonomous motivation, perceived competence in diabetes care, and other important life-context factors with good glycemic control (HbA1c < 7% (53 mmol/mol)). (Corrected by rescaled sampling weight.).

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Climate	0.94 ns. (0.87 to 1.01)	0.97 ns. (0.90 to 1.05)	0.95 ns. (0.86 to 1.04)	1.00 ns. (0.90 to 1.11)
Autonomous motivation	1.09* (1.01 to 1.17)	1.05 ns. (0.97 to 1.14)	1.04 ns. (0.95 to 1.13)	1.09 ns. (0.98 to 1.20)
Competence	1.35*** (1.22 to 1.50)	1.35*** (1.21 to 1.51)	1.34*** (1.18 to 1.52)	1.28*** (1.11 to 1.47)
Man		1	1	1
Woman		1.17 ns. (0.99 to 1.38)	1.11 ns. (0.92 to 1.34)	1.24* (1.00 to 1.54)
Age		1.04*** (1.02 to 1.05)	1.03*** (1.02 to 1.05)	1.03*** (1.02 to 1.05)
Upper secondary education (vocational school) or less		1	1	1
Higher education (college, polytechnic, university)		1.45*** (1.23 to 1.71)	1.28** (1.07 to 1.55)	1.24* (1.02 to 1.52)
Tablets only			1	1
Insulin only			0.16*** (0.11 to 0.24)	0.15*** (0.10 to 0.25)
Tablets + insulin			0.22*** (0.18 to 0.28)	0.22*** (0.17 to 0.28)
Other (e.g. GLP-1 analog)			0.66 ns. (0.38 to 1.17)	0.57 ns. (0.31 to 1.03)
Duration of diabetes			0.98** (0.96 to 0.99)	0.97** (0.96 to 0.99)
Good health			1	1
Poor health			0.74** (0.61 to 0.90)	0.81 ns. (0.64 to 1.01)
BMI			0.98** (0.96 to 0.99)	0.97** (0.96 to 0.99)
Energy				1.00 ns. (1.00 to 1.01)
Stress				0.85 ns. (0.66 to 1.09)
Social support				0.73** (0.60 to 0.89)
Nagelkerke *R* square	.03	.06	.22	.22
n	2187	2097	1941	1733

OR: odds ratio; CI: confidence interval; BMI: body mass index.
ns. $p > .05$; *$p < .05$; **$p < .01$; ***$p < .001$.

results of Fisher et al. (2010) showed that diabetes distress, which is a minor affective variable, was associated with glycemic control but major depressive disorder was not. These results indicate that minor affective variables, such as energy and diabetes distress, may be better predictors of glycemic control than diagnosed major depressive disorder.

Table 6. Mediation analysis between health-care climate, autonomous motivation, perceived competence in diabetes care, and glycemic control, linear and logistic regressions. (Corrected by rescaled sampling weight.)

	Estimate	(95% CI)	*n*
1. Climate × autonomous motivation	0.26***	(0.22 to 0.29)	2643
2. Climate × competence	0.23***	(0.21 to 0.26)	2652
3. Climate × competence	**0.17*** **	(0.14 to 0.19)	2611
Autonomous motivation × competence	0.29***	(0.26 to 0.31)	
Sobel test: $z = 11.37$, SE = 0.01, $p = .00$			
		OR (95% CI)	
1. Autonomous motivation × competence	0.32***	(0.29 to 0.34)	2708
2. Autonomous motivation × glycemic control		1.16*** (1.09 to 1.24)	2289
3. Autonomous motivation × glycemic control		**1.06 ns.** (0.98 to 1.14)	2261
Competence × glycemic control		1.34*** (1.22 to 1.48)	
Sobel test: $z = 4.75$, SE = 0.02, $p = .00$			

The bold values indicate mediation: the effect of the independent variable on the dependent variable is less in the third step than in the second step of analysis. CI: confidence interval; SE: standard error; OR: odds ratio.
1 = the mediator regressed on the independent variable.
2 = the dependent variable regressed on the independent variable.
3 = the dependent variable regressed on both the independent variable and on the mediator.
ns. $p > .05$; ***$p < .001$.

The independent variables reported in this study were chosen on theoretical and statistical basis. In addition to these variables, we analyzed the effect of many health behavior variables describing eating habits and physical exercise on glycemic control. However, we found that BMI, which reflects the result of health behavior, was a better predictor of glycemic control than health behavior variables separately. Therefore, we included BMI to the final analyses. Also, perceived status of health was a better predictor of glycemic control than reported complications, and therefore perceived status of health was chosen for the final analyses.

The strength of this study was that in the analyses, we were able to control the effect of many important diabetes and life-context related factors. Even after this, the predictions of the SDT held. The data, based on self-reports, were highly reliable when compared with register data. We compared basic information (diagnosis age, duration of diabetes, medication, HbA1c-values, BMI) with register data from the whole country (Valle et al., 2010) and information on glycemic control also with the electronic medical records from the municipal health centers in the study municipalities (Koponen et al., 2013a, 2013b).

One limitation of the study was that, due to questionnaire technical reasons, we used 5-point Likert-scales instead of 7-point scales in the health-care climate questionnaire (HCCQ) and perceived competence scale (PCS) measures. However, we found no indication that this would have reduced the validity of these measures. In fact, for elderly people, as a majority of respondents were, it may be easier to fill a 5-point scale. Another limitation of the study was that a cross-sectional study is not methodologically capable to state anything about directionality of the hypothesized relations. However, 95 percent of the respondents had been at least 1 year, and 84 percent over 2 years in care in their current and principal primary care health center. Also, 75 percent of the respondents had a family doctor or a "regular" doctor. Therefore, it is reasonable to believe that care provided by the doctor and other health-care personnel in the health center has influenced the patient's motivation and perceived competence in diabetes care. In future, longitudinal intervention studies are needed.

In summary, the results of this study were in line with previous studies based on SDT (Ng et al., 2012) and gave further support to this model. An autonomy-supportive health-care climate may increase patients' sense of autonomy and competence that gives energy for long-term change in self-management behavior and thus can lead to better health. SDT can be used as a conceptual framework to plan interventions for improved diabetes care.

Conclusion

Health-care personnel's main task is to support patients' autonomy and perceived self-care competence in order to

reach long-term glycemic control among patients with type 2 diabetes. The general well-being of patients should also be promoted.

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Declaration of conflicting interests

The authors have no conflicting interests to declare.

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References

Alberti KGMM and Zimmet PZ (1998) Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: Diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation. *Diabetic Medicine* 15(7): 539–553.

Ali S, Stone MA, Peters JL, et al. (2006) The prevalence of comorbid depression in adults with type 2 diabetes: A systematic review and meta-analysis. *Diabetic Medicine* 23: 1165–1173.

American Diabetes Association (2011) Standards of medical care in diabetes—2011. *Diabetes Care* 34(Suppl. 1): S4–S61.

American Diabetes Association (2014) Standards of medical care in diabetes—2014. *Diabetes Care* 37(Suppl. 1): S14–S80.

Anderson RJ, Freedland KE, Clouse RE, et al. (2001) The prevalence of comorbid depression in adults with diabetes: A meta-analysis. *Diabetes Care* 24(6): 1069–1078.

Antonovsky A (1987) *Unraveling the Mystery of Health: How People Manage Stress and Stay Well*. San Francisco, CA: Jossey-Bass Publishers.

Autonomous Regulation Scale (n.d.) Treatment self-regulation questionnaire (TSRQ). Available at: http://www.selfdeterminationtheory.org

Baron RM and Kenny DA (1986) The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 51(6): 1173–1182.

Brandt PA and Weinert C (1981) The PRQ—A social support measure. *Nursing Research* 30: 277–280.

Deci EL and Ryan RM (1985) *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum.

De Groot M, Anderson R, Freedland KE, et al. (2001) Association of depression and diabetes complications: A meta-analysis. *Psychosomatic Medicine* 63: 619–630.

Dirmaier J, Watzke B, Koch U, et al. (2010) Diabetes in primary care: Prospective associations between depression, nonadherence and glycemic control. *Psychotherapy and Psychosomatics* 79: 172–178.

Donald M, Dower J, Ware R, et al. (2012) Living with diabetes: Rationale, study design and baseline characteristics for an Australian prospective cohort study. *BMC Public Health* 12: 8.

Egede LE and Ellis C (2010) Diabetes and depression: Global perspectives. *Diabetes Research and Clinical Practice* 87: 302–312.

Finnish Diabetes Association (n.d.) Available at: http://www.diabetes.fi/

Fisher L, Mullan JT, Arean P, et al. (2010) Diabetes distress but not clinical depression or depressive symptoms is associated with glycemic control in both cross-sectional and longitudinal analyses. *Diabetes Care* 33(1): 23–28.

Gonzales JS, Fisher L and Polonsky WH (2011) Depression in diabetes: Have we been missing something important? *Diabetes Care* 34(1): 236–239.

Gonzales JS, Safren SA, Cagliero E, et al. (2007) Depression, self-care, and medication adherence in type 2 diabetes. *Diabetes Care* 30(9): 2222–2227.

Goodenow C, Reisine ST and Grady KE (1990) Quality of social support and associated social and psychological functioning in women with rheumatoid arthritis. *Health Psychology* 9: 266–284.

Hays RD, Sherbourne CD and Mazel RM (1993) The RAND-36-Item Health Survey 1.0. *Health Economics* 2: 217–227.

Health Care Climate Questionnaire (HCCQ) (n.d.) Available at: http://www.selfdeterminationtheory.org

Koponen AM, Simonsen-Rehn N, Laamanen R, et al. (2013a) Diabeteksen hyvä hoito–tutkimusprojektin loppuraportti [Good care in diabetes–project: The Final Report]. Available at: http://www.kela.fi/tutkimusraportit

Koponen AM, Vahtera J, Virtanen M, et al. (2013b) Job strain and supervisor support in primary care health centre and glycemic control among patients with type 2 diabetes – a cross-sectional study. *BMJ Open* **3**:e002297. doi:10.1136/bmjopen-2012-002297.

Koski S (2011) *Diabetesbarometri 2010*. Suomen Diabetesliitto ry Kehitys Oy. Available at: http://www.diabetes.fi/files/1377/Diabetesbarometri_2010.pdf

Laaksonen M, Talala K, Martelin T, et al. (2008) Health behaviours as explanations for educational level differences in cardiovascular and all-cause mortality: A follow-up of 60000 men and women over 23 years. *European Journal of Public Health* 18(1): 38–43.

Ng JYY, Ntoumanis N, Thøgersen-Ntoumani C, et al. (2012) Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science* 7: 325–340.

Norbeck JS, Lindsay A and Carrieri V (1981) The development of an instrument to measure social support. *Nursing Research* 30: 264–269.

Norbeck JS, Lindsay A and Carrieri V (1983) Further development of an Norbeck Social Support Questionnaire: Normative data and validity testing. *Nursing Research* 32: 4–9.

Nouwen A, Winkley K, Twisk J, et al. (2010) Type 2 diabetes mellitus as a risk factor for the onset of depression: A systematic review and meta-analysis. *Diabetologia* 53: 2480–2486.

Perceived Competence Scale (PCS) (n.d.) Available at: http://www.selfdeterminationtheory.org

Pirkola SP, Isometsä E, Suvisaari J, et al. (2005) DSM-IV mood-, anxiety- and alcohol use disorders and their comorbidity in the Finnish general population: Results from the Health 2000 study. *Social Psychiatry and Psychiatric Epidemiology* 40: 1–10.

Preacher KJ and Leonardelli GJ (2003) Calculation for the Sobel test: An interactive calculation tool for mediation tests. Available at: http://quantpsy.org/sobel/sobel.htm

Ryan RM and Deci EL (2000) Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist* 55(1): 68–78.

Stewart MJ and Tilden VP (1995) The contributions of nursing science to social support. *International Journal of Nursing Studies* 32: 535–544.

Toljamo M (1999) *Self-care among adults with insulin-treated diabetes mellitus*. PhD Thesis, University of Oulu, Oulu. Available at: http://herkules.oulu.fi/isbn9514251180/isbn9514251180.pdf

Unwin N, Whiting D and Roglic G (2010) Social determinants of diabetes and challenges of prevention. *The Lancet* 375: 2204–2205.

Valle and the Working Group (2010) *Diabeetikkojen hoitotasapaino Suomessa vuosina 2009–2010*. DEHKO-raportti, 5. Diabetesliitto. Available at: http://www.diabetes.fi/files/1488/DEHKO-raportti_2010_5_Diabeetikkojen_hoitotasapaino_Suomessa_vuosina_2009-2010.pdf

Weinert C (1987) A social support measure: PRQ85. *Nursing Research* 36: 273–277.

Williams GC, Freedman ZR and Deci EL (1998) Supporting autonomy to motivate patients with diabetes for glucose control. *Diabetes Care* 21(10): 1644–1651.

Williams GC, McGregor HA, King D, et al. (2005) Variation in perceived competence, glycemic control, and patient satisfaction: Relationship to autonomy support from physicians. *Patient Education and Counseling* 57: 39–45.

Williams GC, McGregor HA, Zeldman A, et al. (2004) Testing a self-determination theory process model for promoting glycemic control through diabetes self-management. *Health Psychology* 23(1): 58–66.

Williams GC, Patrick H, Niemiec CP, et al. (2009) Reducing the health risks of diabetes. *The Diabetes Educator* 35(3): 484–492.