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
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).

**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.

| Table 1. Sociodemographic background factors of respondents (corrected by rescaled sampling weight). |
|--------------------------------------------------|--------|--------|
| Sex                                              | N (estimate) | %      |
| 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    |

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.

**Statistical procedures**

Descriptive statistics were estimated, and the baseline associations between independent variables, covariates, and
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 autonomy-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      |
|------------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Climate    |        | .25***  |         |         |         |         |         |         |         |         |         |         |         |
| Autonomous motivation | .31*** | .43***  |         |         |         |         |         |         |         |         |         |         |         |
| Competence |        |         | −.08*** | .10***  | .02     |         |         |         |         |         |         |         |         |
| Sex (1 = man, 2 = woman) |        |         |         | .15***  | .12***  | .03     |         |         |         |         |         |         |         |
| Age        |        |         |         |         | .03     |         |         |         | .15***  | .12***  | .03     |         |         |
| Education (1 = low, 2 = high) |        |         |         |         | .00     | −.03    | −.03    | −.02    | −.02    | −.03    | −.09*** | .19***  | .17***  |
| Diabetes medication (1 = tablets only, 2 = other) |        |         |         |         | −.03    | −.02    | −.03    | −.06*** | −.12*** | −.01    |         |         |         |
| Duration of diabetes |        |         |         |         | −.02    | −.02    | −.01    | −.02    | .19***  | −.02    | .17***  | .17***  |         |
| Perceived health (1 = good, 2 = poor) |        |         |         |         | −.22*** | −.19*** | −.25*** | .03     | .06***  | −.11*** | .11***  | .09***  |         |
| BMI        |        | .02     | −.18*** | −.16*** | .09***  | −.18*** | −.04*   | .14***  | −.02    | .19***  |         |         |         |
| Energy     |        | .26***  | .28***  | .36***  | .09***  | .12***  | .01     | −.12*** | −.04    | −.47*** | −.16*** |         |         |
| Stress     |        | −.17*** | −.10*** | −.26*** | .23***  | −.35*** | .06**   | .09***  | −.02    | .23***  | .17***  | −.49*** |         |
| Support    |        | .41***  | .36***  | .33***  | .02     | .08***  | −.05*   | −.04*   | −.06**  | −.22*** | −.06*** | .37***  | −.28*** |
| Glycemic control (1 = poor, 2 = good) |        | .02     | .08***  | .12***  | .03     | .12***  | .07***  | −.33*** | −.11*** | −.14*** | −.15*** | .12***  | −.13*** |

BMI: body mass index.

**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.
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

| 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) |
| 1. Climate × autonomous motivation | 0.26*** | (0.22 to 0.29) |
| 2. Climate × competence         | 0.23*** | (0.21 to 0.26) |
| 3. Climate × competence         | 0.17*** | (0.14 to 0.19) |
| 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) |
| 2. Autonomous motivation × glycemic control | 1.16*** | (1.09 to 1.24) |
| 3. Autonomous motivation × glycemic control | 1.06 ns. | (0.98 to 1.14) |
| 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. $p > .05$; ***$p < .001$. 
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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