Success in weight management among patients with type 2 diabetes: Do perceived autonomy support, autonomous motivation and self-care competence play a role?

Anne M. Koponen, Nina Simonsen, and Sakari Suominen

Anne M. Koponen, Ph.D., Adjunct Professor, Folkhälsan Research Center, and Department of Public Health, University of Helsinki, Finland, e-mail: anne.m.koponen@helsinki.fi, Cell phone +358 50 3234025.

Nina Simonsen, Ph.D, Folkhälsan Research Center, and Department of Public Health, University of Helsinki, Finland, e-mail: nina.simonsen-rehn@helsinki.fi, Cell phone +358 400948123

Sakari Suominen, Ph.D., M.D., Professor, University of Skövde, Sweden; Folkhälsan Research Center, Helsinki, and Department of Public Health, University of Turku, Finland, e-mail: sakari.suominen@utu.fi, Cell phone +358 400736961

Correspondence: Anne M. Koponen

Address: P.O. Box 211 (Topeliuksenkatu 20), 00250 Helsinki, Finland

Cell phone +358 50 3234025

e-mail: anne.m.koponen@helsinki.fi

Abstract

Based on self-determination theory (SDT), this study investigated whether the three central SDT variables: perceived autonomy support (from a physician), autonomous motivation and self-care competence, were associated with success in weight management (SWM) among primary care patients with type 2 diabetes when the effect of other important life-context factors was controlled for. Patients participated in a mail survey in 2011. Those who had tried to change their health behavior during the last two years in order to lose weight, either with or without success (n=1433, mean age 63 years, 50% men), were included in this study. The successors were more autonomously motivated and energetic than the non-successors. Moreover, male gender, younger age, taking oral medication only and receiving less social support in diabetes care predicted better success. Autonomous motivation predicted SWM, and self-care competence also played a role by partly mediating the effect of autonomous motivation on SWM. These results support the idea of SDT that internalizing the value of weight management and its health benefits is necessary for long-term maintenance of health behavior change. Perceived autonomy support was not directly associated with SWM. However, physicians can promote patients' weight management by supporting their autonomous motivation and self-care competence.

Key words: diabetes, autonomy support, motivation, self-care competence, weight management

Introduction

Diabetes is an increasing international health burden.[1, 2] In Finland, approximately 500000 people have type 2 diabetes,[3] which is about 10% of the total population. Type 2 diabetes is largely rooted in obesity and an unhealthy lifestyle, and change in health behavior is the main target in diabetes care in order to reach glycemic control and avoid diabetes complications. Ideal self-care includes healthy diet, regular physical exercise, weight loss, and pharmacologic therapy when needed.[4, 5] Motivating patients for good self-management of diabetes is one of the greatest challenges of health care.[6]

Evaluations of the effectiveness of lifestyle interventions show that many are successful in introducing short-term changes leading to e.g. weight loss and improved glycemic control whereas the long-term outcome remains a challenge.[7] Understanding the maintenance of health behavior change might be improved by using behavioral theory more explicitly in studies on the self-management of chronic illnesses.[8] Self-determination theory (SDT) is such a theory, focusing on patients' motivation for health behavior change and its maintenance. According to SDT, lasting behavior change requires that patients internalize values and skills for change and are self-determined: they experience a true sense of volition and choice and act because of the personal importance of the behavior.[9,10] Health-care providers can facilitate this internalizing process if they are autonomy supportive, that is, if they satisfy patients' innate psychological needs for autonomy (self-determination), competence (effectance) and relatedness (belonging).[6,11] Sense of autonomy is supported by giving choice and meaningful rationale for behavior change, by minimizing pressure and acknowledging patients' feelings and perspectives. Competence is fostered by constructive feedback, and by encouraging problem solving and skills building. Sense of relatedness is growing in an empathic and warm interpersonal environment.[6,9,12]

Satisfaction of the three basic needs fosters patients' autonomous motivation (self-determined motivation) and self-care competence (confidence in an ability to manage a chronic illness). According to SDT,[9,12] behavior change will occur and persist if it is autonomously motivated and patients experience the confidence and competence to change. Autonomously motivated individuals engage in healthful activities for internal reasons: a) activities are seen to be interesting, enjoyable, and satisfactory (intrinsic regulation), b) individuals personally value these behaviors and endorse their importance (identified regulation), or c) have internalized their value even more strongly so that commitment to a healthy life style is a central value in their life (integrated regulation). In contrast, individuals with controlled motivation engage in healthful activities for external reasons such as a) to get a reward, avoid punishment or comply with social pressures (external regulation), or b) to avoid guilt or shame or because of a need to prove something (introjected regulation). Thus, healthful activities are carried out with a sense of pressure, demand, or coercion. Autonomous motivation predicts maintenance of a healthy lifestyle better than controlled motivation.[9,12]

Obesity is strongly associated with development of type 2 diabetes, and weight loss is one of the major targets in diabetes care.[13-15] SDT suggests that maintained weight reduction requires that the person has internalized its value for his/her health and is not only complying with other people's advice or demands for health behavior change.[16] Health-care settings can promote the internalization process by supporting patients' autonomous motivation and self-care competence. In an intervention study, Williams et al.[16] showed that participants whose motivation for weight loss was more autonomous attended the dieting program more regularly, lost more weight during the program, and more often maintained their weight loss at the 23-month follow-up. Also, participants' autonomous motivation for weight loss could be predicted both by their autonomy orientation and by the perceived autonomy supportiveness of the health-care staff. The study by Silva et al.[17] showed similar results. The SDT-model has

4

got support also in several other studies analyzing various variables as outcome of care,[18] e.g. motivation and ability to regulate glucose levels.[10,19]

Patients with type 2 diabetes are forced to cope with challenging self-management behaviors over a long time period. Besides autonomy support, autonomous motivation and perceived self-care competence, there are many other factors in their life that may support or hinder their success in this task. A strong sense of coherence and supportive significant others may enhance,[10,20] and poor physical health, stress and depression, which is common among patients with diabetes,[21,22] may hinder the ability to cope with illness.[23-27] Thus, it is possible that these other important life-context factors hamper success in weight management (SWM) despite autonomy support, autonomous motivation and self-care competence. In that case, the SDT-variables would not be very powerful predictors of SWM.

This study investigates whether the three central SDT variables: perceived autonomy support (from a physician), autonomous motivation and self-care competence, are associated with SWM among patients with type 2 diabetes when the effect of other important life-context factors (physical health, medication, duration of diabetes, mental health, stress and social support) has been controlled for. Also, we investigate whether autonomous motivation and self-care competence mediate the effect of perceived autonomy support on SWM.

We hypothesize that 1) perceived autonomy support (from a physician), autonomous motivation and self-care competence are positively associated with SWM even after the effect of the other important life-context factors has been controlled for, and 2) the effect of perceived autonomy support from a physician on SWM is mediated by autonomous motivation and self-care competence.

Methods

Study design

The study was carried out as a mail survey in 2011. Patients with type 2 diabetes were identified 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 keeps the register of persons entitled to a special reimbursement for medicines for chronic diseases such as diabetes. The sample of the present study was collected among persons who fulfilled the following inclusion criteria:

a) had entitlement to a special reimbursement for medicines used in the treatment of type 2 diabetes (ICD-10 code, E11) in 2000-2010, and the right was valid in September 2011 and onward,

b) born in 1936-1991 (20-75 years), alive and had no safety prohibition at the time of the data collection,

c) Finnish as native language,

d) one of the five study municipalities as place of residence.

A total of 7 575 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 2 962 (57%) men and 2205 women (43%) in the sample, corresponding to gender rates in the total population of patients with type 2 diabetes in the study municipalities.

The authors of this study tested the questionnaire by a pilot study (n=50) in May 2011 and revised the questionnaire after which it was mailed to respondents by the SII in September 2011. A reminder to non-respondents was sent out in October, and another reminder with a new copy of the questionnaire was sent out in November.

Ethical issues

6

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 a contact person (a statistician) 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.

Measures

In this study, success in weight management has been defined as success in health behavior change during the last two years in order to lose weight. All measures used in the study are presented in Table 2. Cronbach's alphas of the measures chosen for the final analyses varied from 0.75 to 0.95, and can be regarded acceptable (over 0.70) or excellent (over 0.80). [28]

Averaged sum scales for perceived autonomy support from a physician, autonomous motivation, self-care 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/he had answered at least to 70% of the scale items. (Table 2.)

Body mass index (BMI) was calculated by dividing weight in kilograms by the square of height in meters. Participants were classified as underweight if their BMI was under 18.5, normal weight if BMI ranged from 18.5 through 24.9, and overweight if their BMI ranged from 25 through 29.9. We divided obesity (BMI ≥30) into 3 levels: BMI of 30 through 34.9, class 1, moderately obese; BMI of 35 through 39.9, class 2, severely obese; and BMI of 40 or higher, class 3, very severely obese.[14] (Tables 1-2.)

Statistical procedures

Descriptive statistics were estimated and the baseline associations between independent variables, covariates and dependent variables were tested with Pearson chi²-tests, t-tests or one-way analysis of variance depending on the measurement scale of the variable of interest. In the final analyses, multivariate logistic regression analysis was used. Correlations between the study variables were explored before the analyses by Pearson or Spearman correlations (when one or both variables were dichotomous, ordinal scale). The level of statistical significance was set at p<.05.The variables to the regression models were chosen on theoretical and statistical basis. Of the independent variables that measured the same phenomena, such as mental health (energy, emotional well-being, diagnosed depression, sense of coherence), only the one that correlated most strongly with SWM was chosen to the final logistic regression analyses in order to avoid multicollinearity problems.

In the mediation analysis between perceived autonomy support, autonomous motivation, self-care competence and SWM, the instructions reported by Baron & Kenny[29] 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. Statistical significance of the mediation was calculated by the Sobel test.[30] Statistical analyses were performed using SPSS version 23.

Results

Sample characteristics

8

The final response rate was 56% (range 54-59% across municipalities, n=2866). 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.

Of the respondents 84% (n=2307) had been for longer than two years in diabetes care in their current and principal primary care health center. A third of them (n=732) had tried and succeeded to change their health behavior during the two last years in order to lose weight, and almost a third (32%, n=701) had tried but had not yet succeeded. Twenty-six percent (n=569) reported having no need for change, 5% (n=117) had not yet carried out any change but intended to do so in the near future, and 5% (n=106) had no intention for change. Eighty-two cases were missing. (Table 1.)

Only the respondents who had been in care for longer than two years in their current and principal primary care health center, and who had tried to lose weight either with success (successors) or without success (non-successors) during the last two years (n=1433), were included in the present analysis. The mean age of the respondents was 63 years (standard deviation (SD) 8 years, range 31-75 years), 50% of them were men, and 95% were overweight or obese. Over half (52%) of the respondents were retired because of old age, 58% were married, and 59% had less than higher professional education. The majority (83%) of the respondents had a municipal primary care health center as their primary care setting in diabetes care, and 73% used tablets only for diabetes therapy. These rates are quite comparable with all respondents who had been in care in their principal primary care health center for longer than two years and with the whole sample, except for gender, age and BMI. Those who had tried to lose weight were more often female, younger and obese. (Table 1, [31])

Preliminary analysis

9

A majority of the respondents reported that they had been advised to follow a special diet. Both the successors and the non-successors had been equally advised (64%/68%, p>.05) but the successors had followed the diet more often during the last week before the survey (mean 3.4 days, SD 2.7) than the non-successors (mean 2.6 days, SD 2.5, p<.001). Both groups had also been equally advised to exercise regularly (92%/93%), but the successors had exercised more often (3.8 days, SD 2.2/ 3.3 days, SD 2.2, p<.001). A total of 52% of the successors and 71% of the non-successors were obese.

The four variables measuring mental health or positive personality orientation (energy, emotional well-being, diagnosed depression, sense of coherence) correlated moderately or strongly with each other (-0.38 - 0.78).[31,32] Only the correlation between sense of coherence and depression was quite weak (-0.34). Correlations between the four variables and SWM were weak (≤ 0.21).[32] Of these four variables, energy correlated most strongly with SWM (0.21, p<.001). Spearman correlations between sense of coherence, emotional well-being and diagnosed depression, and SWM were 0.16 (p<.001), 0.14 (p<.001) and -0.06 (p<.05), respectively. Therefore, energy was included as an independent variable to the multivariate logistic regression analyses.

The three variables measuring physical health (perceived health, the number of chronic diseases and diabetes complications) correlated with each other but quite weakly.[31] Of these three variables, perceived health correlated most strongly with SWM (-0.15, p<.001). Spearman correlations between the number of chronic diseases and diabetes complications and SWM were -0.09 (p<.05) and -0.07 (p<.05), respectively. Therefore, perceived health was included as an independent variable to the multivariate logistic regression analyses.

Table 3 shows that perceived autonomy support did not correlate with SWM but there were positive correlations between autonomous motivation and SWM, and between self-care competence and SWM. In addition, energy and perceived health correlated positively with SWM. Perceived autonomy support was positively associated with autonomous motivation and self-care competence.

Primary analyses

Table 4 shows that perceived autonomy support was not directly associated with SWM but autonomous motivation was, as well as self-care competence in the first three models. In addition, energy was positively and female gender, higher age, insulin medication and social support negatively associated with SWM.

Table 5 shows that perceived autonomy support was associated both with autonomous motivation and self-care competence, and the association between perceived autonomy support and self-care competence diminished lightly after the effect of autonomous motivation was controlled for. This result indicates that the effect of perceived autonomy support on self-care competence was partially mediated by autonomous motivation. Also, autonomous motivation was associated with SWM, and this association was partially mediated by self-care competence.

Discussion

This study investigated whether the three central SDT variables (perceived autonomy support, autonomous motivation and self-care competence) were associated with SWM after controlling for the effect of other important life-context factors. The results showed that the successors were more autonomously motivated and energetic than the non-successors. Moreover, male gender, younger age, having oral medication only, and receiving less social support in diabetes care predicted better success. Perceived autonomy support (from one's physician) was not directly associated with SWM. However, perceived autonomy support was positively associated with autonomous motivation which predicted SWM. Self-care competence also played a role by mediating, to some extent, the effect of autonomous motivation on SWM. Thus, health care professionals are able to promote patients' weight management by supporting their autonomous motivation and self-care competence. However, the detected correlations were not very strong indicating that besides an autonomy supportive health care climate many other factors, such as personality differences in autonomy and life aspirations[9], determine the strength of patients' autonomous motivation for effective self-management of diabetes.

The results of this study are in line with SDT[10] and the previous studies[6,16,17] indicating that the lasting behavior change necessary for maintenance of weight loss depends on accepting the regulation for change as one's own. Patients must personally value weight loss and its health benefits. They must also have competence to perform complex behaviors that are needed for effective weight management.

Weight management is one of the major targets in diabetes care. However, previous studies have shown that long-term maintenance of weight loss and complete adherence to diet and physical exercise recommendations is rare.[33,34] In this study, those who had succeeded in

12

weight management had followed diet and exercise recommendations more often than the non-successors. The successors were more autonomously motivated. The association between autonomous motivation and SWM persisted even after controlling for the effect of many important life-context factors such as physical health, medication, duration of diabetes, mental health, stress and social support. Thus, internalizing the value of efficient self-management of diabetes seems to be the key factor in a sustained health behavior change. Patients with diabetes should adhere to various self-management behaviors that are not intrinsically interesting. This may not be possible without self-determined motivation to follow diet and exercise recommendations, that is, to act because of the personal importance of the behavior. Interventions based on SDT are worth testing in diabetes care in order to promote long-term health behavior change.

The negative association between social support and SWM in this study is somewhat surprising but may be explained by the fact that those who need more support in diabetes care have poorer health and thus may have compromised ability to control their weight. Previous studies have shown the negative association between depression and diabetes treatment nonadherence.[25] However, in this study energy was more strongly associated with SWM than diagnosed depression. Our previous study similarly showed that energy was a better predictor of physical activity than diagnosed depression.[35]

One limitation of the study was that in a mail survey it is not possible to confirm data with objective measurements. However, we found the basic information (age at diagnosis, duration of diabetes, medication, HbA1c-values, BMI) reported by the patients in this study, highly reliable when we compared means, medians and percentages with register data from the whole

13

country[36] and with the electronic medical records from the municipal primary care health centers in the study municipalities.[37,38] Another limitation was that the response rate in the youngest age group was low. All respondents were Finnish speaking and almost all native Finns. Thus, the results of this study may not be generalizable to cultures with different perceptions of autonomy.

A strength of our study was that in the analyses we were able to control the effect of many important confounding factors. Also, despite the fact that this was a cross-sectional study, we were able to catch the time dimension by analyzing only those who had been for longer than two years in care in their current and primary care health center and who had during the last two years either succeed or failed in weight management. Strengths and limitations of the study are discussed in more detail in Koponen et al.[31]

Conclusions

Findings gave support to the predictions of SDT by showing the importance of autonomous motivation and self-care competence for success in weight management among patients with type 2 diabetes. Physicians and other health care professionals have an important role in trying to help patients to internalize the value of health benefits of weight loss. Patients' autonomous motivation and self-care competence could be enhanced by SDT-based interventions and by an autonomy supportive care environment.

References:

1. Guariguata L, Whiting DR, Hambleton I, Beagley J, Linnenkamp U, Shaw JE. Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes Res Clin Pract*. 2014;103(2):137-149.

2. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: Global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract*. 2011;94(3):311-321.

3. THL. National Institute for Health and Welfare. Available at: https://www.thl.fi/web/kansantaudit/diabetes/diabeteksen-yleisyys. Accessed January 22, 2016.

4. American Diabetes Association. Standards of medical care in diabetes--2011. *Diabetes Care*. 2011;34:S1,4-61.

5. American Diabetes Association. Standards of medical care in diabetes--2014. *Diabetes Care*. 2014;37:S1,14-80.

6. Teixeira PJ, Silva MN, Mata J, Palmeira AL, Markland D. Motivation, self-determination, and long-term weight control. *International Journal of Behavioral Nutrition and Physical Activity*. 2012;9(1):1.

7. Madden SG, Loeb SJ, Smith CA. An integrative literature review of lifestyle interventions for the prevention of type II diabetes mellitus. *J Clin Nurs*. 2008;17(17):2243-2256.

8. Norris SL, Engelgau MM, Narayan KV. Effectiveness of self-management training in type 2 diabetes: A systematic review of randomized controlled trials. *Diabetes Care*. 2001;24(3):561-587.

9. Ryan RM, Patrick H, Deci EL, Williams GC. Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. *European Health Psychologist*. 2008;10(1):2-5.

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

11. Deci EL., Ryan, RM. Intrinsic motivation and self-determination in human behavior. *New York and London: Plenum*; 1985.

12. Patrick H, Williams GC. Self-determination theory: Its application to health behavior and complementarity with motivational interviewing. *International Journal of Behavioral Nutrition and Physical Activity*. 2012;9(1):1.

13. Anderson JW, Kendall CW, Jenkins DJ. Importance of weight management in type 2 diabetes: Review with meta-analysis of clinical studies. *J Am Coll Nutr*. 2003;22(5):331-339.

14. Mokdad AH, Ford ES, Bowman BA, et al. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *JAMA*. 2003;289(1):76-79.

15. Norris SL, Zhang X, Avenell A, et al. Long-term effectiveness of weight-loss interventions in adults with pre-diabetes: A review. *Am J Prev Med*. 2005;28(1):126-139.

16. Williams GC, Grow VM, Freedman ZR, Ryan RM, Deci EL. Motivational predictors of weight loss and weight-loss maintenance. *J Pers Soc Psychol*. 1996;70(1):115.

17. Silva MN, Vieira PN, Coutinho SR, et al. Using self-determination theory to promote physical activity and weight control: A randomized controlled trial in women. *J Behav Med*. 2010;33(2):110-122.

18. Ng JY, Ntoumanis N, Thøgersen-Ntoumani C, et al. Self-determination theory applied to health contexts: a meta-analysis. *Perspectives on Psychological Science*. 2012;7(4):325-340.

19. Williams GC, McGregor HA, Zeldman A, Freedman ZR, Deci EL. Testing a self-determination theory process model for promoting glycemic control through diabetes self-management. *Health Psychology*. 2004;23(1):58-66.

20. Antonovsky A. *Unraveling the mystery of health: How people manage stress and stay well.* San Francisco: Jossey-Bass; 1987.

21. Ali S, Stone MA, Peters JL, Davies MJ, Khunti K. The prevalence of co-morbid depression in adults with type 2 diabetes: A systematic review and meta-analysis. *Diabetic Med*. 2006;23(11):1165-1173.

22. Pirkola SP, Isometsä E, Suvisaari J, et al. DSM-IV mood-, anxiety-and alcohol use disorders and their comorbidity in the Finnish general population. *Soc Psychiatry Psychiatr Epidemiol*. 2005;40(1):1-10.

23. Dirmaier J, Watzke B, Koch U, et al. Diabetes in primary care: Prospective associations between depression, nonadherence and glycemic control. *Psychother Psychosom*. 2010;79(3):172-178.

24. Egede LE, Ellis C. Diabetes and depression: Global perspectives. *Diabetes Res Clin Pract*. 2010;87(3):302-312.

25. Gonzalez JS, Peyrot M, McCarl LA, et al. Depression and diabetes treatment nonadherence: A meta-analysis. *Diabetes Care*. 2008;31(12):2398-2403.

26. Gonzalez JS, Safren SA, Cagliero E, et al. Depression, self-care, and medication adherence in type 2 diabetes relationships across the full range of symptom severity. *Diabetes Care*. 2007;30(9):2222-2227.

27. Gonzalez JS, Safren SA, Delahanty LM, et al. Symptoms of depression prospectively predict poorer self-care in patients with type 2 diabetes. *Diabetic Med*. 2008;25(9):1102-1107.

28. Andresen EM. Criteria for assessing the tools of disability outcomes research. *Arch Phys Med Rehabil*. 2000;81:S20.

29. Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J Pers Soc Psychol*. 1986;51(6):1173.

30. Preacher KJ, Leonardelli GJ. Calculation for the sobel test. Available at: http://quantpsy.org/sobel/sobel.htm. Accessed November 15, 2015.

31. Koponen AM, Simonsen N, Laamanen R, Suominen S. Health-care climate, perceived self-care competence, and glycemic control among patients with type 2 diabetes in primary care. *Health Psychology Open*. 2015;2(1):2055102915579778.

32. Taylor R. Interpretation of the correlation coefficient: A basic review. *Journal of Diagnostic Medical Sonography*. 1990;6(1):35-39.

33. Broadbent E, Donkin L, Stroh JC. Illness and treatment perceptions are associated with adherence to medications, diet, and exercise in diabetic patients. *Diabetes Care*. 2011;34(2):338-340.

34. Lin EH, Katon W, Von Korff M, et al. Relationship of depression and diabetes self-care, medication adherence, and preventive care. *Diabetes Care*. 2004;27(9):2154-2160.

35. Koponen AM, Simonsen N, Suominen S. Determinants of physical activity among patients with type 2 diabetes: The role of perceived autonomy support, autonomous motivation and self-care competence. *Psychol Health Med*. 2016:1-13.

36. Valle T and the working group. *Diabeetikkojen hoitotasapaino Suomessa vuosina 2009-2010* [Glycemic control among patients with diabetes in Finland 2009-2010]. DEHKO-report, 5. Finnish Diabetes Association; 2010.

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

38. Koponen A, Vahtera J, Pitkäniemi J, et al. Job strain and supervisor support in primary care health centres and glycaemic control among patients with type 2 diabetes: A cross-sectional study. *BMJ open*. 2013;3(5):e002297.

39 Health care climate questionnaire (HCCQ). Available at: http://www.selfdeterminationtheory.org. Accessed October 10, 2010.

40 Autonomous regulation scale. *Treatment self-regulation questionnaire (TSRQ).* Available at: http://www.selfdeterminationtheory.org. Accessed October 10, 2010.

41 Perceived competence scale (PCS). Available at: http://www.selfdeterminationtheory.org. Accessed October 10, 2010.

42. Hays RD, Sherbourne CD, Mazel RM. The rand 36-item health survey 1.0. *Health Econ*. 1993;2(3):217-227.

43. Donald M, Dower J, Ware R, Mukandi B, Parekh S, Bain C. Living with diabetes: Rationale, study design and baseline characteristics for an Australian prospective cohort study. *BMC Public Health*. 2012;12(1):1.

44 Toljamo M. *Self-care among adults with insulin-treated diabetes mellitus*. PhD Thesis. University of Oulu, Finland; 1999. Available at: http://herku-les.oulu.fi/isbn9514251180/isbn9514251180.pdf Accessed May 20, 2011.

45. Brandt PA, Weinert C. The PRQ-a social support measure. *Nurs Res*. 1981;30(5):277-280.

46. Goodenow C, Reisine ST, Grady KE. Quality of social support and associated social and psychological functioning in women with rheumatoid arthritis. *Health Psychology*. 1990;9(3):266.

47. Norbeck JS, Lindsey AM, Carrieri VL. The development of an instrument to measure social support. *Nurs Res*. 1981;30(5):264-269.

48. Norbeck JS, Lindsey AM, Carrieri VL. Further development of the Norbeck social support questionnaire: Normative data and validity testing. *Nurs Res*. 1983;32(1):4-9.

49. Stewart MJ, Tilden VP. The contributions of nursing science to social support. *Int J Nurs Stud*. 1995;32(6):535-544.

50. Weinert C. A social support measure: PRQ85. *Nurs Res*. 1987;36(5):273-277.

51 Finnish Diabetes Association. Available at: http://www.diabetes.fi/. Accessed October 2, 2010.

52 Success in weight management. GOAL (Good Ageing in Lahti region; Ikihyvä). Finnish research project on ageing and well-being. Available at: http://www.palmenia.helsinki.fi/iki-hyva/Ikihyva_perusraportti_2008_70.pdf Accessed October 2, 2010.

53. Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities mea sure: Results from 7 studies and a revised scale. *Diabetes Care*. 2000;23(7):943-950.

Table 1. Sociodemographic background factors of respondents

	N In care over 2 years	%	Has tried to lose weight N	%
Sex				
Man	1274	55.4	721	50.4
Woman	1027	44.6	709	49.6
Total	2301	100	1430	100
Age				
27-54 years	268	11.8	207	14.7
55-64 years	845	37.3	560	39.8
65-75 years	1152	50.9	639	45.4
Total	2265	100	1406	100
Marital status				
Single	220	9.6	152	10.7
Married	1383	60.5	823	57.9
Cohabiting	156	6.8	106	7.5
Divorced	323	14.1	218	15.3
Widowed	204	8.9	122	8.6
Total	2286	100	1421	100
Professional education				
Upper secondary education (vocational school) or less	1350	59.8	835	59.3
Higher education (college, polytechnic, university)	906	40.2	574	40.7
Total	2256	100	1409	100
Principal activity				
Working	552	24.3	384	27.3
Retired because of old age	1283	56.5	728	51.7
Retired because of chronic illness	298	13.1	208	14.8
Other	138	6.1	89	6.3
Total	2271	100	1409	100
Diabetes medication				
Tablets	1660	73.9	1011	72.6
Insulin	119	5.3	64	4.6
Tablets + insulin	424	18.9	285	20.5
Other	44	2.0	32	2.3
Total	2247	100	1392	100
Service provider				
Municipal	1856	83.6	1148	82.9
Private	364	16.4	237	17.1
Total	2220	100	1385	100
Body Mass Index				
Underweight <18.5	6	0.3	0	0.0
Normal weight 18.5-24.9	311	13.9	72	5.1
Overweight 25.0-29.9	818	36.5	468	33.4
Class I obesity 30.0-34.9 (moderately obese)	642	28.6	492	35.1
Class II obesity 35.0-39.9 (severely obese)	300	13.4	234	16.7
Class III obesity ≥40.0 (very severely obese)	165	7.4	134	9.6
Total	2242	100	1400	100
Success in weight management				
No need for change	569	25.6		
Has changed behavior	732	32.9	732	51.1
Has tried to change but has not succeeded	701	31.5	701	48.9
Not yet but intends to change in the near future	117	5.3		
Has not and has no intention to change in the near future	106	4.8		
Total	2225	100	1433	100

Table 2. Measures used in the study

SDT-variables	
Perceived autonomy support (from a physician)	The short 6-item form of health care climate questionnaire (HCCQ[39]), (range 1=fully disagree, 5=fully agree, Cronbach's alpha reliability α=0.95). Example item: I feel that my physician has provided me choices and options.
Autonomous motivation	Autonomous regulation (motivation) scale B. Five items from the treatment self-regulation questionnaire (TSRQ[40]), (range 1=not at all true, 7=very true, α=0.83). Example item: The reason I follow my diet and exercise regularly is that I personally believe that these are important in remaining healthy.
Self-care competence	The 4-item perceived competence for diabetes scale (PCS[41]), (range 1=fully disagree, 5=fully agree, α=0.93). Example item: I feel confident in my ability to manage my diabetes.
Mental health	
Energy	The 4-item scale measuring energy during the last four weeks from the RAND-36-Item Survey, 1.0 (range 0-100%, α=0.85). Example item: How much of the time during the **past 4 weeks** did you have a lot of energy?[42]
Emotional well-being	The 5-item RAND-36 scale measuring emotional well-being during the last four weeks (range 0-100%, α=0.84). Example item: How much of the time during the **past 4 weeks** have you felt so down in the dumps that nothing could cheer you up?[42]
Sense of coherence	The short 13-item scale (range 1=weak, 7=strong, α=.80, five items reversed). Example item: Do you have feeling that you don't really care about what goes on around you? (1=very often, 7=very seldom or never)[20]
Depression	Diagnosed depression (1=no, 2=yes).
Experienced stress and social support	
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.[43]
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, α=.75). Example item: When I feel bored, depressed or desparate, my friends and family are ready to listen to me.[44] The scale is based on social support scales by Brandt & Weinert[45], Goodenow, Reisine, & Grady[46], Norbeck, Lindsay, & Carrieri[47,48], Stewart &Tilden[49] and Weinert[50].
Physical health	
Perceived health	A single-item scale, range 1=excellent, 2=very good, 3=good, 4=quite poor, 5=poor. The scale was dichotomized: 1=good (1-3), 2=poor (4-5).
Complications	At least one of the twelve diabetes related complications (e.g. kidney disease or neuropathy) 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[43] and Finnish Diabetes Association[51]
Chronic diseases	Number of diagnosed chronic diseases
BMI and health behavior	
Body mass index (BMI)	Counted based on answers to two questions: About how tall are you?, About how much do you weigh with light clothes?" BMI=((P2/(P1*P1))*10000.
Success in weight management	Have you changed your health behavior during the last two years (24 months) in order to lose weight? 1=I have tried but failed, 2=I have changed my health behavior.[52]
Diet during the last week	How many of the last seven days have you followed a healthful eating plan?[53]
Physical activity during the last week	On how many of the last seven days did you participate in at least 30 minutes of physical activity?[53]

Table 3. Pearson/Spearman correlations[1] between the study variables (n=1433)

	1	2	3	4	5	6	7	8	9	10	11	12
1.Perceived autonomy support												
2.Autonomous motivation	.23***											
3.Self-care competence	.32***	.40***										
4.Sex (1=man, 2=woman)	-.05	.11***	-.00									
5.Age	.05	.10***	.10***	.02								
6.Education (1=low 2=high)	-.01	-.02	-.05*	-.01	-.11 ***							
7.Duration of diabetes	-.01	-.02	.01	-.06*	.20 ***	-.04						
8. Diabetes medication (1=tablets only, 2=other)	-.01	-.00	-.02	-.04	-.10 ***	-.02	.26***					
9. Perceived health (1=good, 2=poor)	-.23***	-.17***	-.27 ***	.00	.08 **	-.08**	.12***	.10***				
10.Energy	.28***	.24***	.36 ***	-.08**	.11 ***	-.01	-.06*	-.10 ***	-.45***			
11.Stress	-.20***	-.09**	-.24 ***	.19 ***	-.35 ***	.10**	-.01	.07*	.21***	-.48***		
12.Social support	.43***	.33***	.30 ***	.05*	.08**	-.07**	-.08**	-.00	-.21***	.39***	-.29***	
13. Success in weight management (1=not suc-ceeded, 2=succeeded)	.04	.19***	.17 ***	-.12 ***	-.05	.01	-.02	-.11 ***	-.15***	.21***	-.11***	.06*

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

[1] Spearman correlation was used when one or both variables were dichotomous (ordinal scale).

Table 4. Multivariate logistic regression models on the associations of perceived autonomy support (from a physician), autonomous motivation, self-care competence and important confounding factors with success in weight management

	Model 1 (95% CI)	Model 2 (95% CI)	Model 3 (95% CI)	Model 4 (95% CI)
Perceived autonomy support	.96 ns. (.86 – 1.06)	.94 ns. (.84-1.04)	.92 ns. (.83-1.03)	.93 ns. (.82-1.06)
Autonomous motivation	1.27*** (1.15-1.41)	.1.35*** (1.21-1.50)	1.32*** (1.18-1.48)	1.35*** (1.19-1.53)
Self-care competence	1.27 ** (1.10-1.47)	.1.25 ** (1.08-1.46)	1.20* (1.02-1.42)	1.09 ns. (.92-1.30)
Sex (1=man, 2=woman)		.58 *** (.46-.73)	.58*** (.46-.73)	.62*** (.48-81)
Age		.98* (.97-1.00)	.98* (.96-1.00)	.97** (.95-.99)
Professional education (1=low 2=high)		1.13 ns. (0.90-1.42)	1.04 ns. (.82-1.33)	1.04 ns. (.81-1.34)
Duration of diabetes			1.01 ns. (0.99-1.03)	1.01 ns. (.99-1.04)
Medication (1=tablets only, 2=other)			.54*** (.41-.71)	.59*** (.44-.79)
Perceived status of health (1=good, 2=poor)			.66** (.51-.84)	.84 ns. (.63-1.11)
Energy				1.02*** (1.01-1.02)
Stress				.83 ns. (.61-1.14)
Social support				.76* (.59-.97)
Nagelkerke R Square	.05	.08	.11	.13
n	1348	1300	1217	1100

ns. p>.05
** p<.01
*** p<.001

Table 5. Mediation analysis between perceived autonomy support (from a physician), autonomous motivation, self-care competence and success in weight management (SWM), linear/logistic regression models.

	Beta	OR (95% CI)	n
1. Perceived autonomy support x autonomous motivation	.23***		1363
2. Perceived autonomy support x self-care competence	.32***		1367
3. Perceived autonomy support x self-care competence	**.25***		1348
Autonomous motivation x self-care competence	.35***		
Sobel test: z=7.31, SE=0.01, p=0.00			
1. Autonomous motivation x self-care competence	.40***		1387
2. Autonomous motivation x SWM		1.34 *** (1.23-1.47)	1404
3. Autonomous motivation x SWM		**1.26 *** (1.15-1.39)	1387
Self-care competence x SWM		1.25** (1.09-1.44)	
Sobel test: z=3.09, SE=0.02, p=0.002			

The bold value indicates mediation which 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.

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<.01
*** p<.001