Goal Planning and Diabetes Self-Efficacy
Determine Weight Regulating Behavior in Patients with Type 2 Diabetes

A version of this chapter was submitted for publication (Huisman, Maes, De Gucht, Chatrou, Haak)
Abstract

This study examined the relationships between motivational cognitions (goal ownership, goal support, goal pressure, goal planning), diabetes self-efficacy and weight regulating behavior in a sample of 96 overweight patients with type 2 diabetes.

A series of regression analyses was performed to examine the relationships between these cognitions, diabetes self-efficacy and weight regulating behavior. An empirically derived path model was then constructed on the basis of these regression analyses.

Results showed that goal planning predicted both diabetes self-efficacy and weight regulating behavior. The relationship between goal planning and weight regulating behavior appeared to be mediated by diabetes self-efficacy. No direct effects of goal ownership, goal support or goal pressure on either diabetes self-efficacy or weight regulating behavior were found.

Although these findings must be confirmed by future research, the results suggest that goal planning and self-efficacy enhancement could be important intervention components of diabetes programs aiming at weight regulating behavior.
Introduction

Since 90% of the patients with type 2 diabetes is overweight \(^1\) (BMI > 25), weight reduction is an essential step in the treatment of type 2 diabetes \(^2\). Weight loss improves the insulin absorption and can lower high blood glucose levels which are responsible for many complications in diabetes patients. A 5 to 10% weight loss can lead to a strong improvement in blood glucose levels and thereby reduce the risk of serious complications, such as cardiovascular diseases, retinopathy, or nephropathy \(^3\text{-}^4\). As a consequence, diet and exercise became an important target of treatment of patients with type 2 diabetes. Understanding why diabetes patients do or don’t perform self-management behaviors has been given a crucial role in diabetes care. Therefore psychological theories on human motivation and behavior change have been increasingly applied to the field of diabetes care throughout the years \(^5\).

Self-regulation in diabetes care

Self-regulation theory provides a theory-based framework from which practical guidelines for interventions and specific working mechanisms for behavior change can be derived \(^6\). Self-regulation theory argues that most human behaviour is goal-directed \(^7\text{-}^8\) and that goals can be defined as thoughts about desired states or outcomes \(^8\). The achievement of a goal is facilitated by self-regulatory processes or mechanisms such as goal setting, goal monitoring, planning, problem solving and emotion regulation \(^6\). These goal processes or mechanisms can be divided into three phases \(^9\text{-}^10\). In the motivational phase, cognitive determinants of intention (goal ownership and goal planning) are believed to play a key role. Persons who strive for goals which are personally relevant and important (autonomous goals) are more likely to attain their goal \(^11\text{-}^13\). A study by Williams, Grow, Freedman, Ryan and Deci \(^14\) showed that individuals who pursued autonomously set weight loss goals, attended a weight loss program more regularly and lost more weight during the weight loss program, and at follow-up.

Self-regulation theory also considers the support one perceives in the (planned) achievement of a goal. Many previous studies have demonstrated the importance of perceived social support in the achievement of behavioral changes \(^15\text{-}^16\). Within the context of diabetes self-management social support has been associated with diet and physical exercise \(^17\text{-}^18\). Negative consequences of social support on self-management, however, have also been found, when support is perceived as pressure or overprotection \(^19\).

The importance of goal planning for the engagement in specific behaviours was acknowledged for several health behaviours \(^20\text{-}^22\) including diabetes self-care behaviours, such as diet \(^23\text{-}^24\) and
physical exercise \textsuperscript{25}. In general, it can be concluded that the facilitation of these goal cognitions contribute to goal achievement.

\textit{Self-regulation cognitions and self-efficacy}

Although self-regulation theory postulates direct effects of self-regulatory cognitions on various health behaviors, it is also strongly suggested that self-efficacy plays an important role in the relationship between self-regulation cognitions and the achievement of a health goal. In his social cognitive model Bandura \textsuperscript{26} states that both self-efficacy and self-regulatory mechanisms facilitate the achievement of a (health) goal. The interplay of self-regulatory cognitions and self-efficacy as predictors of diabetes goal achievement was tested by Sénécal, Nouwen and White \textsuperscript{27}. It was hypothesized that the effect of autonomous regulation (goal ownership) on diabetes self-care behaviors and life satisfaction would be mediated by self-efficacy beliefs. Results from this study pointed to the complementary nature of autonomous regulation and self-efficacy both of which appeared to make independent contributions to the prediction of dietary self-care and life satisfaction. However, self-efficacy was a significantly better predictor of self-reported dietary self-care than was autonomous regulation. Sénécal, Nouwen and White \textsuperscript{27} proposed a motivational model of diabetes dietary self-care “which postulates direct links between autonomous regulation and self-efficacy on the one hand and dietary adherence on the other”.

In line with Sénécal, Nouwen and White \textsuperscript{27}, the present study explores the direct and indirect relationships between self-regulation cognitions, self-efficacy and diabetes related health behaviour. More specifically this study will investigate the relationships between autonomous regulation (goal ownership), goal support, goal pressure, goal planning, diabetes self-efficacy (SE) and weight regulating behavior in a sample of overweight patients with type 2 diabetes.

\textit{Research Questions}

The specific research questions that were formulated for this paper were:

1) Is there a relationship between self-regulation cognitions (goal ownership, goal planning, perceived goal support, perceived goal pressure) and weight regulating behavior (fat consumption and exercise behavior)?

2) If there is a relationship between self-regulation cognitions and weight regulating behavior, is this relationship mediated by diabetes self-efficacy?
Methods

Subjects
The sample consisted of 129 patients with type 2 diabetes from the diabetes clinic of a large general hospital in the Netherlands. Patients were included in the study on the basis of the following criteria: having diabetes type II according to the WHO classification 1999\textsuperscript{28}: fasting blood glucose levels > 126 mg/dl (7 mmol/l) or levels > 200 mg/dl (11.1 mmol/l) two hours after an oral glucose tolerance test, BMI 27-45, age between 21 and 70 years old, being Caucasian, being able to understand, read and write Dutch. Patients with any severe somatic co-morbidity (except for cardiovascular diseases) and patients who were currently under treatment for a mental disorder were excluded from the study. In total 101 patients returned the baseline questionnaire. Due to the incompleteness of the responses of five patients, a final number of 96 patients was included in the analyses.

Measurements
Patients’ self-regulation cognitions were measured by two subscales of the Self-Regulation Skills Battery (SRSB)\textsuperscript{29} and two subscales of the validated 71-item Goal and Processes Inventory (GAPI)\textsuperscript{30}. The subscales that were included in this study corresponded with the motivational phase of goal achievement in which patients have only recently formulated their (health) goal. Both the SRSB and the GAPI consist of statements for which the patients indicate on a 5-point Likert scale to what extent they agree with the statement (totally disagree – totally agree). The motivational subscales of the SRSB are ‘goal ownership’ (Cronbach’s $\alpha = .65$, 5 items, e.g. ‘This is really my own goal’), and ‘goal planning’ (Cronbach’s $\alpha = .73$, 4 items, e.g. ‘I have a detailed step-by-step plan to help me attain this goal’). The two GAPI-subscales that were added were ‘goal support’ (Cronbach’s $\alpha = .80$, 7 items, e.g. ‘My partner supports me in the pursuit of this goal’) and ‘goal pressure’ (Cronbach’s $\alpha = .70$, 7 items, e.g. ‘My partner puts pressure on me to attain this goal’).

Weight regulating behaviour was assessed by means of a short self-report questionnaire. This self-report questionnaire assessed fat consumption (2 items) and physical exercise (1 item) during the past 7 days. The items for fat consumption were ‘How many days in the past week did you control your fat consumption?’ and ‘How many days in the past week did you eat products that were high in fat (examples given)?’. The item for physical exercise was ‘How many days in the past week did you engage in physical exercise for at least 30 minutes per day?’.

Weight regulating behaviour was assessed by means of a short self-report questionnaire. This self-report questionnaire assessed fat consumption (2 items) and physical exercise (1 item) during the past 7 days. The items for fat consumption were ‘How many days in the past week did you control your fat consumption?’ and ‘How many days in the past week did you eat products that were high in fat (examples given)?’. The item for physical exercise was ‘How many days in the past week did you engage in physical exercise for at least 30 minutes per day?’.

Answers to these questions could be indicated on an 8-point scale (0 days – 7 days). The compound
variable ‘weight regulating behaviour’ was calculated by calculating an average score for these 3 items.
Diabetes related self-efficacy (SE) was measured by a Dutch version of the validated Diabetes Management Self-Efficacy Scale\(^{30}\). The DMSES consists of 20 items (e.g. ‘I am able to take more exercise when the doctor advises me to’) that assess self-efficacy with respect to diabetes self-management. A 10-point Likert scale (absolutely not able – I’m totally able) was used. The reliability of the DMSES was good (Cronbach \(\alpha = .86\)).

**Statistical Analyses**
Analyses were conducted using SPSS 13.0 (2005)\(^{32}\). Descriptive analyses (frequencies, averages and standard deviations) were conducted to describe baseline characteristics of study participants. Pearson correlation coefficients were used to examine the relationships between the various subscales and variables. Correlations were inspected for multicollinearity, but no multicollinear correlations were found.
In a series of hierarchical regression analyses the relationships between motivational self-regulation mechanisms, diabetes self-efficacy and weight regulating behaviour were explored. In all regression analyses, the effect of the independent variables was controlled for age and gender.

**Results**

**Baseline demographics**
The average age of participants was 58.14 years (SD = 8.86). Fifty-two percent of participants was female. Thirty-nine percent of participants was employed. Most participants were married or living together with a partner (83%) and had received lower primary or secondary vocational education (59%).

**Bivariate relationships between variables in the study**
Pearson correlation coefficients were used to test the bivariate relationships between the variables in this study. In table 1 the correlation coefficients and their levels of significance are presented. Goal ownership was positively related to goal support indicating that people who perceive weight loss as their own goal also perceive more support in (the pursuit of) this goal. Goal planning was positively related to weight regulating behavior and negatively related to goal pressure. The positive relationship between goal planning and weight regulating behavior indicates that people who use more planning strategies in the pursuit of their weight goal report
better weight regulating behavior. The negative relationship between goal planning and goal pressure indicates that people who are pressured in the pursuit of their weight goal use less planning strategies. As was expected, goal support was negatively related to goal pressure. Goal pressure was negatively related to gender indicating that women experience more goal pressure than men. Diabetes self-efficacy was positively related to goal planning, goal support and weight regulating behavior indicating that people who feel efficacious about the self-management of their diabetes perceive more support in (the pursuit of) their weight loss goal, use more planning strategies in the pursuit of this goal and report better weight regulating behavior. Furthermore, diabetes self-efficacy was positively related to age, indicating that older people feel more efficacious about their diabetes self-management than younger people. Gender was positively related to weight regulating behavior indicating that women report better weight regulating behaviors than men.

Table 1. Pearson correlation coefficients of study variables (N = 96)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Goal Ownership</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Goal Planning</td>
<td>.134</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Goal Support</td>
<td>.279*</td>
<td>.165</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Goal Pressure</td>
<td>-.205</td>
<td>-.226*</td>
<td>-.392**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Weight Regulation</td>
<td>.167</td>
<td>.317**</td>
<td>.213</td>
<td>-.217*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Diabetes SE</td>
<td>.200</td>
<td>.392**</td>
<td>.234*</td>
<td>-.142</td>
<td>.338**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Age</td>
<td>-.025</td>
<td>.118</td>
<td>-.028</td>
<td>-.010</td>
<td>.266**</td>
<td>.245*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8. Gender</td>
<td>-.081</td>
<td>.107</td>
<td>.107</td>
<td>-.344**</td>
<td>.208*</td>
<td>.113</td>
<td>-.014</td>
<td>-</td>
</tr>
</tbody>
</table>

** p < .01, * p < .05 (two-tailed)

To test whether self-regulation cognitions determined weight regulating behavior, a hierarchical regression analysis of weight regulating behavior on self-regulation cognitions was performed. This regression analysis, which controlled for age and gender, revealed that age and goal planning are significant determinants of weight regulating behavior indicating that older patients and patients who use more planning strategies report better weight regulating behaviors. The total model of weight regulating behavior on self-regulation cognitions (controlled for age and gender) was significant [\( F (6, 75) = 3.64, p = .003, R^2 = .225 \)] (see table 2).
To explore whether the relationship between goal planning and weight regulating behavior was mediated by diabetes self-efficacy (research question 2) additional hierarchical regression analyses were performed according to Baron and Kenny’s four step approach. To test whether goal planning alone (controlled for age and gender) determined weight regulating behavior (Path C) a hierarchical regression analysis of weight regulating behavior on goal planning (without the other self-regulation cognitions) was performed. This analysis also revealed a positive relationship ($\beta_{=.272}$, $t = 2.810$, $p = .007$) between goal planning and weight regulating behavior. The total model of weight regulating behavior on goal planning (controlled for age and gender) was significant $[F(3, 88) = 6.74, p = .000, R^2 = .186]$.

To test whether goal planning determined diabetes self-efficacy, a second hierarchical regression analysis of diabetes self-efficacy on goal planning (controlled for age and gender) was performed (path A). This regression analysis revealed a significant relationship between age and diabetes self-efficacy ($\beta_{=.204}$, $t = 2.063$, $p = .042$) and goal planning and diabetes self-efficacy ($\beta_{=.359}$, $t = 3.611$, $p = .001$) indicating that older patients and patients who use more goal planning strategies have more confidence in their diabetes self-care. The total model of goal planning as determinant of diabetes self-efficacy (controlled for age and gender) was significant $[F(3, 83) = 6.90, p = .000, R^2 = .200]$.

In the third step it was tested whether diabetes self-efficacy determined weight regulating behavior. A hierarchical regression analysis of weight regulating behavior on diabetes self-efficacy revealed a significant relationship between age and weight regulating behavior ($\beta_{=.202}$, $t = 2.008$, $p = .048$) and diabetes self-efficacy and weight regulating behavior ($\beta_{=.268}$, $t = 2.647$, $p = .010$) (controlled for age and gender), indicating that patients with more confidence in diabetes self-care report better weight regulating behavior. The total model of weight regulating behavior on diabetes self-efficacy was significant $[F(3, 82) = 5.74, p = .001, R^2 = .175]$. 

---

### Table 2. Total Regression Model of Weight Regulating Behavior on Self-Regulation Cognitions

<table>
<thead>
<tr>
<th>Model</th>
<th>$\beta$</th>
<th>$t$</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.212</td>
<td>2.004</td>
<td>.048</td>
</tr>
<tr>
<td>Age</td>
<td>.269</td>
<td>2.537</td>
<td>.013</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.173</td>
<td>1.575</td>
<td>.119</td>
</tr>
<tr>
<td>Age</td>
<td>.247</td>
<td>2.410</td>
<td>.018</td>
</tr>
<tr>
<td>Goal ownership</td>
<td>.118</td>
<td>1.086</td>
<td>.281</td>
</tr>
<tr>
<td>Goal planning</td>
<td>.226</td>
<td>2.136</td>
<td>.036</td>
</tr>
<tr>
<td>Goal Support</td>
<td>.118</td>
<td>1.036</td>
<td>.303</td>
</tr>
<tr>
<td>Goal Pressure</td>
<td>-.033</td>
<td>-.277</td>
<td>.782</td>
</tr>
</tbody>
</table>
behavior on diabetes self-efficacy, controlled for age and gender was significant [\( F (3, 86) = 6.38, p = .001, R^2 = .182 \)].

To check whether self-efficacy was a mediator between goal planning and weight regulating behavior (Path C’) or had the same independent determinants as weight regulating behavior, we performed a final multiple regression analysis with weight regulating behavior as outcome and goal planning and self-efficacy as predictor variables (controlled for age and gender). This analysis showed that the regression coefficient of goal planning for determining weight regulating behavior became non-significant (\( \beta = .182, p = .100 \)) when included together with diabetes self-efficacy in the regression analysis. Self-efficacy is thus a mediator between goal planning and weight regulating behavior. Figure 1 and 2 represent the two empirically derived path models that were constructed on the basis of these series of regression analyses.

Fig. 1. Empirically Derived Path Model of Relationship between Goal Planning and Weight Regulation (controlled for age and gender), **p<.01

Fig. 2. Empirically Derived Path Model of Relationships between Goal Planning, Diabetes Self-Efficacy and Weight Regulation (controlled for age and gender), **p<.01, ***p<.001
Conclusion and Discussion

This study explored the relationship between goal ownership, goal support, goal pressure, goal planning, diabetes self-efficacy and weight regulating behavior.

When interpreting the series of regression analyses that were conducted, it can be concluded that weight regulating behavior is determined by both goal planning and diabetes self-efficacy and that diabetes self-efficacy functions as a mediator in the relationship between goal planning and weight regulating behavior. No effects of goal ownership, goal support or goal pressure on diabetes self-efficacy or weight regulating behavior were found.

As was mentioned before, part of the results of this study is in line with the results of previous studies that indicated that goal planning and self-efficacy are important determinants of health behavior and diabetes weight related behaviors specifically. Furthermore, our results are in line with the findings of the study of Senécal, Nouwen and White as no direct effect of goal ownership on behavioral diabetes outcomes was found. The results of this study, however, differ from the study of Sénecal, Nouwen and White in this respect that in the study of Sénecal, Nouwen and White no mediating role of diabetes self-efficacy was found as self-efficacy appeared to be the predominant predictor of diabetes dietary behavior. In our study, goal planning predicts (diabetes) weight regulating behavior whereas autonomous regulation (goal ownership) does not. One of the reasons for this difference may be that autonomous regulation or ownership is more a personal characteristic, while planning is a skill that has already proven to bridge the gap between motivation and actions. However, diabetes self-efficacy or having confidence in one’s ability to perform general diabetes self-care behaviors (using insulin, engaging in physical exercise) completely mediates the relation between planning and weight regulating behavior. These results indicate that diabetes self-efficacy is the most proximal predictor of actual behavior change, that is in turn influenced by planning strategies.

Although our study points at the importance of goal planning and diabetes self-efficacy for future diabetes weight regulating interventions, it is important to keep in mind the study limitations when interpreting the results.

A first limitation concerns the use of self-report measures for nutrition and exercise in this study. Using pedometers to register exercise could e.g. increase the reliability and validity of exercise measures in future studies. Future, longitudinal research could also relate goal planning and diabetes self-efficacy to other diabetes outcomes, such as HbA1c, cholesterol or weight. The use of biomedical in stead of behavioral self-report outcomes would increase the objectivity of behavior change and decrease the chances of response bias that are known to influence self-report measures.
A second limitation concerns the congruence of the goal cognitions and the self-efficacy measures as the self-regulation cognitions (goal ownership, goal planning, perceived goal support, perceived goal pressure) are measured in relation to weight regulating behavior, while diabetes self-efficacy regards a larger scope of self-management behavior. In future studies it should be explored whether the (in)congruence of the goal and self-efficacy measures influences the relationship between these measures.

Another final limitation concerns the cross-sectional design of this study that prohibits any conclusions about causal relationships. For this reason, the directions and predictions that were found in this study need to be interpreted with care. Repeated measures are needed to make more reliable conclusions about the interrelations between self-regulation cognitions and self-efficacy and their relationship with diabetes self-care outcomes.

References


