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The Relation between Self-Management of People with Chronic Diseases and Personality based on the Personal Health Record MijnGezondheidsPlatform

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Abstract

Objective: A high prevalence of chronic diseases, severe symptoms, a high mortality-rate of people with chronic diseases and high costs for the health care providers give reasons to improve the health care of the affected people. As patients with chronic diseases need to actively take part within their health care, an increase in patient activation through enhancing self-management could improve the patients' situation. This study evaluated the effect of an eHealth self-management intervention (MijnGezondheidsPlatform) within one year follow-up. Moreover the effect of personality on self-management was assessed. Finally, the association between personality and the commitment to the intervention was examined as well as the development of the commitment within one year and its effect on the change of self-management within this year.

Method: The study included questionnaires about the self-management (PAM-13), personality (TIPI) and commitment to the intervention and was given to people with chronic diseases (asthma/COPD, diabetes mellitus type 2, and cardiovascular diseases) who were exposed to the intervention over one year as well as to a control group who got the care 'as usual'.

Results: No significant effect of the intervention and no association between personality and the change of self-management were found in this study. A positive association between the commitment to the intervention and the personality traits conscientiousness (p = .008) and extraversion (p = .043) was found, but between the commitment to the intervention and its effect, no association was found. The commitment did not change within the one year follow-up.

Conclusion: The study revealed that the intervention did not have the desired effect, but further research is needed to examine if there are other effects on the health status of the patients. Furthermore, changes should be implemented to improve MGP, as for example the use of more design principles for persuasive systems. Tailoring for personality could actually affect self-management through its effect on the commitment. Although this was not reflected in the results of this study, this connection should be evaluated within further research.

Introduction

People who have to live with chronic diseases can suffer from severe symptoms and consequences. Four of the most common chronic diseases in the Netherlands are the following: diabetes mellitus type 2, asthma, COPD and cardio-vascular diseases (Gommer & Poos, 2013). To illustrate the burdens of the chronic diseases, the example Diabetes mellitus type 2 was used here. Diabetes mellitus type 2 is one of the five leading causes of death in most of the developed countries (Gan, 2003). It is also one of the leading causes for blindness, renal failure and lower limb amputation (Gan, 2003). In general, chronic diseases negatively influence the physical as well as the mental health of affected people (Alonso et al., 2004). Diabetes and also the other mentioned chronic diseases lead next to the personal suffering of the patients also to high socio-economic costs due to several visits to the doctor and the treatment (Ray, Thamer, Gardner, Chan, & Kahn, 1998). About 5.3 million people of the Dutch population have to live with at least one chronic disease (Gijsen, Oostrom, Schellevis, & Hoeymans, 2013). The prevalence of chronic diseases within the population above an age of 75 years is about 79% (Gijsen, Oostrom, Schellevis, et al., 2013). Between 2004 and 2011 there was a rise of 12% in these numbers, reaching its highest point at 2011 (Gijsen, Oostrom, & Schellevis, 2013). Around 5% of the deaths in Europe can be attributed to diabetes mellitus type 2 (Roglic et al., 2005).

One approach to improve the health status of people with chronic diseases is the Chronic Care Model (CCM, figure 1), developed by Gee and colleagues (Gee, Greenwood, Paterniti, Ward, & Miller, 2015). This model aims to improve the attendance of patients to their care through six independent components: The community, the health system, self-management support, the design of the delivery system, decision support and clinical information systems (Gee et al., 2015). The CCM pursues a patient-directed approach for care and therefore points on the importance of the disease-specific

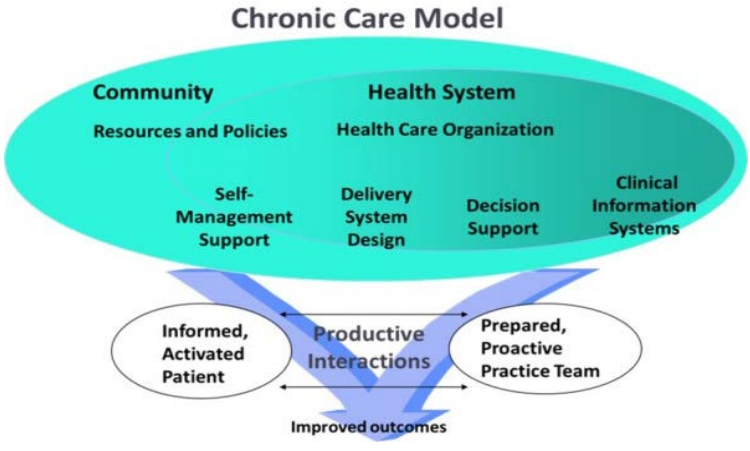

Figure 1. The Chronic Care Model, aiming at the improvement of the attendance of patients to their health care through six different components (Gee et al., 2015).

knowledge of the patients (Gee et al., 2015). This knowledge and the activation of the patient are important factors to reach the aim of a more effective and productive cooperation between the patient and the health care provider (Gee et al., 2015). To improve the knowledge and patient-activation, it is in particular necessary to work with the component 'Self-management support' of the CCM (Bodenheimer, Wagner, & Grumbach, 2002; Funnell & Anderson, 2000). Lorig and colleagues stated that self-management means, for example, to practise a healthful behaviour or to actively manage a disease and further that what is perceived as no self-management actually just represents a style of self-management (Lorig & Holman, 2003).

Self-Management

Six different skills are required to be able to execute self-management in a proper manner: solving problems, making decisions, utilizing resources, forming a patient-provider partnership, planning actions and self-tailoring (Lorig & Holman, 2003). 'Solving problems' includes several steps from defining the problem over finding possible solutions to the final implementation of a solution and the evaluation of the solution (Lorig & Holman, 2003). 'Making decisions' concerns the ability to make decisions and to have the relevant and appropriate knowledge (Lorig & Holman, 2003). The next skill is 'utilizing resources' and it means that patients do not only need to be given resources, but also need to know how to use them (Lorig & Holman, 2003). 'Forming a patient-provider partnership' means that the patient should work with the provider as a partner (Lorig & Holman, 2003). The patient should be able to report his health status to the partner, meaning that the patient knows what is important to report, including the ability to ask questions regarding the health status to the practitioner and to discuss decisions with the general health practitioner (Lorig & Holman, 2003). The skill to 'plan actions' involves making short and realistic action plans (Lorig & Holman, 2003). 'Self-tailoring', the skill that was mentioned last, involves being able to use the other mentioned skills as necessary to manage a specific personal situation (Lorig & Holman, 2003).

For a patient with diabetes mellitus type 2, for example, these skills would mean that he is able to recognize, handle and evaluate a situation where he gets low blood glucose. Therefore, the patient has to know about symptoms, treatment and the evaluation and thus also about the devices necessary for the evaluation. Moreover the patient should know how to improve his health status, as for example through exercising and should be able to find an appropriate kind of

sports as well as to discuss the decision with his doctor. Next to this he should be able to make a short-term action plan about his exercising, for example for the following week about how often, when exactly and how long he will do the exercise. Finally, the patient has to combine all mentioned factors to manage his disease.

An improvement in self-management would lead to better management of the care, medication and symptoms by the patients self (Hendriks, Plass, Heijmans, & Rademakers, 2013). This could improve the patient's treatment and therefore possibly also his general health status, what then could lead to fewer visits to the care provider and therefore to lower costs for the care provider. Interventions to improve self-management should be on the one hand general about self-management, but on the other hand also specific about the disease (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). For people with diabetes for example, this could mean that such an intervention would support the patient in not only gaining self-management skills, but also gaining specific knowledge to use the learned skills, as for example knowledge about the type and amount of exercise that is recommended for patients suffering from diabetes.

Self-management interventions should focus on three tasks of self-management for the patient (Lorig & Holman, 2003). The first one is the management of medication which means the adherence to the care but also doing enough exercise or following a special diet, what is important for patients with diabetes (Lorig & Holman, 2003). The second task is the management of the behaviour and the life role of the patient (Lorig & Holman, 2003). This includes to change behaviour in a way that it fits as well the life of the patient as the disabilities through the disease (Lorig & Holman, 2003). Patients with diabetes for example could bake a sugar free cake instead of a regular cake. The last task is the management of the emotions of the patient regarding the disease (Lorig & Holman, 2003). Chronic diseases can make the patients feel negative emotions regarding their future. For staying in control of the disease, it is important for the patients to know how to deal with those feelings.

The aim of self-management interventions is to support people in enhancing their health-related behaviour to improve their health status (Lorig & Holman, 2003). Lorig and Holman (2003) found that the positive effect on the health status of patients with chronic diseases is due to higher self-efficacy, which patients gain through self-management interventions (Lorig & Holman, 2003). Following Bandura, self-efficacy refers to the trust in oneself regarding the

ability to perform a behaviour which leads to a specific goal (in Bodenheimer, Lorig, Holman, & Grumbach, 2002). The patient in the example above would need to trust in his ability to do more exercise to be able to reach a better health status and the patient's trust in himself could be enhanced through better self-management skills.

Enhancing Self-Management with the Use of EHealth

EHealth can be described as information and communication technology which aims at the improvement of health and health care (Gemert-Pijnen, Peters, & Ossebaard, 2013). Examples for the technology can be web-based or mobile applications, as well as devices to measure for example blood pressure (Gemert-Pijnen et al., 2013). Several studies revealed that eHealth can be effective to improve health and health care. McKay and colleagues conducted a study on an internet-based, diabetes self-management and peer support intervention (Garth McKay, Glasgow, Feil, Boles, & Barrera Jr, 2002). It was concluded that the use of eHealth in self-management interventions results in a better health status for the patients and also in overcoming costs and limitations of conventional interventions (Garth McKay et al., 2002). Gee and colleagues studied the effect of eHealth on the CCM, using eHealth especially for improving the communication between the patient and the provider (Gee et al., 2015). Based on the positive results of this study, Gee implemented the eHealth Enhanced Chronic Care Model (eCCM) (Gee et al., 2015). One assumption to use eHealth effectively is that eHealth interventions should be based on a holistic approach, meaning among others the involvement of different stakeholders, the use of evaluation cycles and using advanced methods to assess the impact of the intervention (Gemert-Pijnen et al., 2011). For an eHealth intervention, it is important that directly within the development phase a high sensibility to the effect, usefulness and the implementation self is given, because after the implementation, these interventions often work on their own, while traditional interventions often ask for contact between the participants and the provider or supporters of the intervention.

Following Fogg, eHealth technology that is designed to change the attitude or behaviour of its users is called persuasive technology (Oinas-Kukkonen & Harjumaa, 2009). Oinas-Kukkonen and Harjumaa (2009) stated that persuasive systems should lead the user to set goals and to find systematic and effective ways to reach these goals (Oinas-Kukkonen & Harjumaa, 2009). For patients with chronic diseases, possible goals could be regularly taking the

medication, healthy nutrition or regular exercising. One example of a persuasive system that enhances the achievement of these goals are Personal Health Records.

The Markle Foundation defined Personal Health Records (PHR's) as "An electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment" (Tang, Ash, Bates, Overhage, & Sands, 2006, p. 122). In the context of chronic diseases, a PHR could for example include information about the medication intake, as well as data of health measures like blood sugar, and also entries about physical exercise. The structure PHR's provide for important actions regarding the health status can enhance the patient to set personal goals which, in turn, can improve the health status. Through this path, PHRs can finally enhance patient activation (Tenforde, Jain, & Hickner, 2011). Next to this, a PHR can also give a connection to the care provider and enhance not only the patient activation but also the communication between the patient and the care provider.

Several principles can be used to further improve the effect of persuasive systems (Oinas-Kukkonen & Harjumaa, 2009). One of the principles for Primary Task Support is tailoring, which means adapting the technology on the needs of the different user groups (Oinas-Kukkonen & Harjumaa, 2009). One example is to tailor the technology on different characteristics of the users to facilitate the use of the technology for the users. Different studies have shown that the personality of users can influence their usage of persuasive systems (Halko & Kientz, 2010; Hill & Roberts, 2011; John, Naumann, & Soto, 2008).

Personality

The Five Factor Model describes personality through the Big Five personality dimensions: Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness (John et al., 2008). John and colleagues (2008) define the dimensions as follows: Neuroticism refers to the emotional stability of a person. Agreeableness is characterized by a pro-social orientation of a person. Furthermore, conscientiousness includes the control of impulses that improve a socially determined, aim-directed behaviour, as for example the ability to plan, organize and prioritize. Extraversion means that the person approaches the world in an energetic way. Finally, openness describes the mental and experience-aimed life in different facets as breadth, depth, originality and complexity.

Research about the effects mobile devices can have on physical activity, has shown that a high manifestation of extraversion is associated with more interest in persuasive systems (Halko & Kientz, 2010). Therefore, an intervention based on a persuasive system may work better for extraverted people than for introverted people. Furthermore, the interest in the persuasive technologies could also indicate that there is an association between extraversion and the commitment to a persuasive system. Several studies have found an association between a high score on conscientiousness and working with high adherence on the own care (Hill & Roberts, 2011; John et al., 2008). A high manifestation of conscientiousness could therefore be related to a high self-management in general and to a higher commitment to interventions regarding the own care.

These studies suggested that the use of persuasive systems and tailoring for personality within self-management interventions for people with chronic diseases could enhance the effect of the intervention in different ways. First, a high manifestation of conscientiousness could enhance the self-management of the patients and second, it could be associated with higher commitment to the intervention. Finally, extraversion could influence the effects that the persuasive system has within the intervention. The aim of this study was to examine the effect personality can have as well on the impact of a self-management intervention for people with chronic diseases as also on the commitment to an intervention on self-management of people with chronic diseases. This study was based on the PHR MijnGezondheidsPlatform.

MijnGezondheidsPlatform

MijnGezondheidsPlatform (MGP) is a website made for patients who take part at a care program for at least one of the following chronic diseases: diabetes, cardio-vascular risk, asthma or COPD. The aim of MGP is to support the users in their self-management and to improve their lifestyle. Figure 2 shows the start page of the website. Users can fill in and manage their information about care, different measurements, and they can access different coaching programs. These information are placed within ‚My actions' because here the user can directly follow up his health care status. The menu on the top gives access to the different topics of MGP as well as access to information about the program, help, contact and logout. Within ‚My health file' the user can find his care dossier and measurements. By clicking on ‚My coaches' the three different coaching programs to the topics smoking, exercise and nutrition are placed . On the

right hand side of the display, a short description of MGP and of the currently opened page is given. The data of MGP filled in through the user are not only accessible for the user himself, but also for his medical practitioner and vice versa. MGP was designed by Medicinfo, a company which designs programs regarding the topic healthcare in cooperation with different, appropriate stakeholders (Medicinfo, 2014).

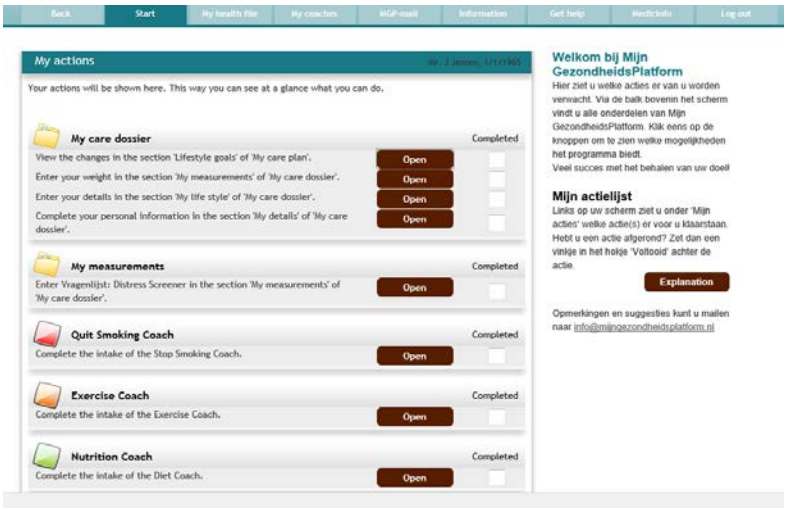

Figure 2. First page of MijnGezondheidsplatform, a Personal Health Record, which aims at the improvement of the self-management of patients with chronic diseases.

Research Questions

1) Is there a difference in the change of self-management of patients with chronic diseases (Asthma, Diabetes mellitus type 2, COPD, cardiovascular disorders) who were exposed to MijnGezondheidsPlatform over a period of one year and patients with the same chronic diseases who were not exposed to MGP over a period of one year?
2) Do the Big Five personality dimensions (extraversion, agreeableness, conscientiousness, emotional stability and openness) have an association with the self-management of patients with chronic diseases at the baseline measure?
3) Is there an increase in the commitment to MGP of patients with chronic diseases who were exposed to MGP after one year?
4) Are the Big Five personality dimensions extraversion and conscientiousness associated with the commitment to MGP of patients with chronic diseases who were exposed to MGP over one year?
5) Is the commitment to MGP of patients with chronic diseases who were exposed to MGP over the period of one year associated with the change of self-management of the same patients within the one year?

Methods

Design

To get the information to answer the research questions, different questionnaires were used at different time spots. Therefore a questionnaire survey and cohort design has been employed in this study. To examine the first research question, a control group was needed. Therefore, as well an intervention group as a control group were part of the study. In accordance to the first research question both groups were compared, resulting in a between groups design. The independent variable was here the group of participants and the dependent variable was the change in self-management over one year. For the second research question, no distinction between the groups was needed. The results of both groups were used to answer the question through a within-groups design. The independent variables of the second question were the Big Five personality traits and the dependent variable was the self-management at the baseline measure. The third research question only needed information of the intervention group and therefore a within-groups design was used. The first and the last measurement of commitment to MGP were the variables here. For the fourth research question only the intervention group was needed and a within groups design was employed. The mean commitment to MGP was the dependent variable and the personality traits extraversion and consciousness were the independent variables. For the fifth research question, only the intervention group could be used, because of the variable commitment to MGP. Therefore, a within-groups design was employed. The mean commitment to MGP was the independent variable and the change in self-management over one year the dependent variable. The data set used in this study is based on a former study about MGP.

Participants

Recruitment and Selection

All participants took part in a care program within PoZoB for chronic diseases (diabetes, cardio-vascular diseases, asthma or COPD). The study consisted of two groups of participants. The intervention group had access to MGP in their care whereas the participants of the control group had access to the care ‘as usual’. Participants were searched through a not randomized, pragmatic

cluster trial. This means that it was searched for general health practitioners where patients had access to MGP and for practitioners where patients had access to the care as usual. Patients of the first group of medical practices were randomly chosen to participate in the intervention group and patients of the second group of medical practices were randomly chosen to participate within the control group. The participants of the control group had to be registered at the chain information system of the practices (Care2U) and had to take part in a care program for at least one of the chronic diseases diabetes, cardio-vascular diseases, asthma or COPD.

Inclusion and Exclusion Criteria

All participants had to be at least 18 years old and they had to give informed consent about the participation in the study. Furthermore, all participants needed internet access via a tablet or PC in their living space. Reasons for exclusion of the study were life-threatening (co-) morbidity, a short life expectation, cognitive disabilities, inadequate knowledge of the Dutch language and taking part in another PoZoB study, which could conflict with this study.

Ethical Aspects

Informed consent was given by the participants in different ways. Participants of the intervention group accepted through the registration at MGP the Conditions of Use, including an acceptance for the use of the anonymized log-data and data from MGP. A Pop-up at MGP asked for the consent to approach the users regarding the participation in this study. The users had always the possibility to take back this consent via MGP. Users of MGP got a digital informed consent and non-users a written informed consent about the study itself and patient information regarding the independence of the study and the anonymity. PoZoB personnel, general practitioners and general medical practice personnel were kept informed over the study and their tasks.

Material

Ten-Item Personality Inventory (TIPI)

The Dutch version of the Ten-Item Personality Inventory (TIPI) was used to explore the personality of the participants (Hofmans, Kuppens, & Allik, 2008). The whole questionnaire can

be found in Appendix A. The TIPI includes ten items, measuring each of the Big Five personality dimensions (extraversion, conscientiousness, agreeableness, emotional stability and openness) through two different items. Per item, two characteristics are mentioned and the participant fills in how well the item describes his personality. Examples of the items are ‘extraverted and enthusiastic’ (‘extravert, enthousiast’) for extraversion and ‘calm and emotional stable’ (‘kalm, emotioneel stabiel’) for emotional stability. The response possibilities per item were given as a 7-point Likert scale beginning with ‘disagree strongly’ (‘beschrijft mij helemaal niet’; 1) and ending with ‘agree strongly’ (‘beschrijft mij zeer goed’; 7; Gosling, 2003).

Per dimension, one item had to be recoded with the result that a high score displays a high manifestation of the personality trait. In this context, items 2, 6, 8, 9, 10 were recoded. The mean test-retest reliability is acceptable with r = .72 for all dimensions ranging from r = .77 for extraversion to r = .62 for openness (George & Mallery, 2003; Gosling, Rentfrow, & Swann Jr, 2003) . The same study revealed questionable Cronbach’s alpha of .68 for extraversion, .40 for agreeableness, .76 for conscientiousness, .70 for emotional stability and .62 for openness (George & Mallery, 2003; Gosling et al., 2003). The Cronbach’s alpha within this study resulted in .45 for extraversion, .44 for agreeableness, .51 for conscientiousness, .55 for emotional stability, .27 for openness. Compared to Gosling’s research, the internal consistence for extraversion, neuroticism and openness is much lower in this study and the internal consistence of agreeableness and conscientiousness is around the same level. All internal consistencies are on a low level between poor and questionable, as well as unacceptable for openness (George & Mallery, 2003). For the statistical evaluation, the mean of both items per dimension was calculated. Only data of participants were used who filled in both items per personality dimension.

Patient Activation Measure (PAM-13)

The Dutch version of the Patient Activation Measure 13 (PAM-13) was used to examine the self-management within this study (Rademakers, Nijman, van der Hoek, Heijmans, & Rijken, 2012). The PAM-13 is a short form of the Patient Activation Measure and uses four different stages to describe the patient activation: ‘Believes Active role important’ (Items 1 and 2); ‘Confidence and knowledge to take action’ (Items 3 to 8); ‘Taking action’ (Items 9 to 11); ‘Staying the Course

under Stress' (Items 12 and 13) (Hibbard, Mahoney, Stockard, & Tusler, 2005). The questionnaire looks for the knowledge, skills and the trust in the own self-management of an individual. All thirteen items are listed in Appendix 2 and one example is 'Finally, I am responsible for my health by myself' ('Uiteindelijk ben ik zelf verantwoordelijk voor mijn gezondheid'). The response possibilities were presented as a 4-point Likert Scale with 'completely wrong' ('helemaal niet mee eens', 1) on the one side, 'completely right' ('helemaal mee eens', 4) on the other side and additionally the possibility 'does not fit' (niet van toepassing, 5).

The raw score of 13-52 was converted into 0-100 (from low to high) (Solomon, Wagner, & Goes, 2012). Hibbard et al revealed a good internal consistence (Cronbach's alpha) of .91 for the sum-scale, matching with the Cronbach's alpha in this study of .89 (George & Mallery, 2003; Hibbard, Stockard, Mahoney, & Tusler, 2004). The Dutch version of the PAM-13 has moderate to strong inter-item correlations and a moderate test-retest reliability (Rademakers et al., 2012). It was only data of participants' used, who did not miss more than two items of the questionnaire and not more than 50% of the items per activation stage. For the missing values, the mean score of the other items per activation stage was taken.

Commitment

In the first study about MGP, an own questionnaire was built up with the purpose to investigate the intervention group's commitment to MGP. This survey included ten items as written in Appendix C. Every item begins with 'MGP is for me' ('MGP is voor mij') and then two opposite dimensions are given. One example of these opposite dimensions is 'important' and 'not important' ('belangrijk' en 'niet belangrijk'). Participants had to respond on a 7-Point scale, starting with one of the opposite dimensions (1) and ending with the other one(7).

The items 1, 3, 4, 6, 7 and 9 were formulated opposite to the other items. Therefore, these items were recoded for the data analysis, resulting in a high score meaning high commitment. Per measurement a mean score was calculated and then converted into the scale of 0-100. In this study, the internal consistence (Cronbach's alpha) of the commitment questionnaire was excellent with .96 (George & Mallery, 2003). The questionnaire has an acceptable mean inter-item correlation of r = .74, ranging from r = .59 to r = .85 (George & Mallery, 2003). Only the

responses of participants were used, who filled in more than 50% of the measurements. For missing measurements, the mean of the other measurements was used. A measurement was seen as filled in, if more than 50% of the answers were given. The mean of the other answers per measurement were used to fill in the missing values.

Procedure

The participants got an informed consent form either via e-Mail (control group) or via a pop-up in MGP (intervention group) and signed these. The study included 5 measures in a period of one year: a baseline measure (t0), one after 3 months (t3), after 6 months (t6), after 9 months (t9) and after one year (t = one year). The first measure (t0) included questionnaires about demographic variables as gender and age, the TIPI, the PAM-13 and the commitment-questionnaire. In all other measurements, the participants received only the PAM-13 and the commitment questionnaire. For the completion of the questionnaires, Qualtrics was used. The control group got the links to the questionnaires via e-Mail and the intervention group got the links via MGP. The date at which the next questionnaire was handed to the participants, depended on the completion of the last one. There were always three months between the completion of the last questionnaire and the sending of the new one.

Data Analysis

Through the investigation of the different variables in the boxplot-diagram, statistical outliers were found and excluded from the analysis as far as possible. Based on the investigation of histograms with a normal distribution line and the Shapiro-Wilk test, a normal distribution of the following variables could be adopted: the first and the last measure of the PAM-13 in the control group (baseline: $p = .117$; after one year: $p = .171$) and the measure of commitment ($p = .836$). All other measures deviated from the normal distribution in at least one of the two tests.

To answer the first research question, an analysis of covariance (ANCOVA) was done. The independent variable was the group of participants (nominal variable), the dependent variable was the measurement of self-management after one year (t = one year; continuous variable) and the covariant was the baseline measure of self-management (t = 0; continuous variable).

For answering the second research question, the correlation between the different variables was examined. Due to the distribution of the data, the Spearman's Rho was used. Per personality trait (five continuous variables), the correlation with the change in self-management within one year of using MGP (continuous variable) was investigated.

Regarding the third question, first, the descriptive statistics were compared graphically. Then, a Wilcoxon signed-rank test was done, with the commitment at t=0 as first measurement and the commitment at t = one year as last measurement.

Due to the distribution of the variables, the fourth research question was answered as well with the use of Spearman's Rho. Therefore, two correlations were examined: on the one hand, the correlation between the commitment to MGP (continuous variable) and the personality trait extraversion (continuous variable) and on the other hand the correlation between the commitment to MGP (continuous variable) and the personality trait conscientiousness (continuous variable).

Also for the association of investigation in the last research question and due to the data's distribution, Spearman's Rho was used. In this case, the correlation between the mean commitment to MGP over one year (continuous variable) and the change of self-management within the same year (continuous variable) was examined.

Results

The study included N = 216 participants in complete, with 29 % women and 71 % men (table 1). The mean age of the total group was M = 62.3 (SD = 9.37) years. In the intervention group there were N = 64 participants. 23 % of these participants were women, 77 % were men and the mean age was M = 62.0 (SD = 8.78) years. The control group included N = 152 participants with 31 % women and 69 % men and a mean age of M = 62.4 (SD = 9.64) years. There was no significant difference between the groups regarding the measured demographic variables, including gender, age, marital status, level of education, housing situation, work situation and smoking behaviour. Moreover, no significant difference was found between the groups for the five personality traits extraversion, agreeableness, conscientiousness, emotional stability and openness.

Table 1

Descriptive Statistics about Demographic Variables and Personality.

	Total Sample (*N* = 216)	Intervention group (*N* = 64)	Control group (*N* = 152)	*p*-value
Demographic variables				
Age in years, *M (SD)*	62.3 (9.37)	62.0 (8.78)	62.4 (9.64)	.371
Female, *N (%)*	62 (28)	15 (23)	47 (31)	.081
Marital status, *N (%)*				.123
Married	173 (80)	49 (77)	124 (82)	
Divorced	24 (11)	11 (17)	13 (9)	
Unmarried	6 (3)	2 (3)	4 (3)	
Level of education, *N (%)*				.071
Low	64 (23)	12 (19)	52 (34)	
Medium	57 (26)	16 (25)	41 (27)	
High	92 (43)	36 (56)	56 (37)	
Housing situation, *N (%)*				.207
Living alone	29 (13)	11 (17)	18 (12)	
Living with family/ friends	186 (87)	53 (83)	133 (88)	
Work situation, *N (%)*				.398
(self-)employed	84 (39)	25 (39)	59 (39)	
unemployed	7 (3)	2 (3)	5 (3)	
homemaker	12 (6)	1 (2)	11 (7)	
unable to work	17 (8)	5 (8)	12 (8)	
retirement	89 (41)	29 (45)	60 (39)	
Smoking behaviour, *N (%)*				.258
Not smoking	60 (28)	19 (30)	41 (27)	
Not smoking, but smoked before	138 (64)	42 (66)	96 (63)	
Smoking	17 (8)	3 (4)	14 (10)	
Personality Questionnaire, Md (IQR)				
Extraversion	4.50 (2.00)	4.50 (1.25)	4.50 (2.00)	.385
Agreeableness	5.50 (1.00)	5.50 (1.50)	5.50 (1.00)	.111
Conscientiousness	5.50 (1.00)	5.50 (1.50)	6.00 (1.00)	.052
Emotional Stability	5.50 (1.50)	5.50 (1.50)	5.50 (2.00)	.129
Openness	4.50 (1.50)	4.50 (1.50)	4.50 (1.50)	.488

Note. Statistical outliers were excluded from the data. Not all participants filled in each questionnaire; therefore, the percentages do not sum up to 100 % for all variables. The level of education was summarized in three categories: Low (LBO, VMBO, MAVO, (M)ULO), Medium (HAVO, MMS, HBS, VWO, MBO, MTS, MEAO, MHNO, INAS) and High (HBO, WO). The Ten-Item Personality Inventory (TIPI) was used to examine the personality of the participants. The p-values were examined through the Pearson's chi-squared test for categorical variables, the t-test for independent samples for normally distributed continuous variables and the Mann-Whitney U test for not normally distributed continuous variables.

In the baseline measure of self-management (t = 0), there was a significant difference between the two groups (p = .003), meaning that the intervention group scored higher than the control group (table 2). The measurement of self-management at the follow-up after one year (t = one year) did not show this difference (p = .219). There was a dropout-rate regarding the self-management questionnaire within the intervention group from the baseline measure (t = 0) to the last measure (t = one year) of 61 % and within the control group, it was 46 %.

Table 2

Descriptive Statistics about Self-Management.

	Baseline value t_0	t = one year	Change within one year
Self-management, Md (IQR)			
Intervention group	79.49 (12.82)*	79.49 (21.79)	-5.13 (13.46)
Control group	73.85 (12.55) [a]	73.94 (13.47)[a]	0.00 (10.26)
Participants, N (%)			
Intervention group	57	22 (39)	-35 (-61)
Control group	148	80 (54)	-68 (-46)

Note. Statistical outliers were excluded from the data. The Patient Activation Measure (PAM-13) was used to examine the self-management of participants. Within the baseline values of self-management, only the data of participants who filled in both questionnaires were used.
[a]: *M (SD)*
* p = .003 for intervention vs. control group at the baseline (Mann-Whitney U test)

The Difference in the Change of Self-Management from Baseline to One Year Follow-Up between the Intervention Group and the Control Group

The analysis of covariance revealed that the covariate, self-management at t = 0 significantly predicted the dependent variable self-management at t = one year ($p < .001$). There was no significant effect of the variable group (intervention group and control group) on the self-management at t = one year after controlling for the effect of self-management at t = 0, F (1, 102) = 1.224, p = .271.

The Relation between the Big Five Personality Dimensions and Self-Management

No significant correlation between the first measurement of self-management (t = 0) and of the four personality traits: extraversion (r = .039, p = .289), agreeableness (r = -.079, p = .137), conscientiousness (r = .110, p = .061) and emotional stability (r = .108, p = .064) was found. However, there was a positive association between openness and the first measurement of self-management (t = 0), meaning that participants with high scores on openness, also scored high on self-management (r = .120, p = .045).

The Commitment to MGP from Baseline to One Year Follow-Up

No significant change in the commitment to MGP was found after one year follow-up (Z = -.818, p = .207). Also with taking in account the five measurements within the one year, no change in the commitment was found (figure 3, table 3).

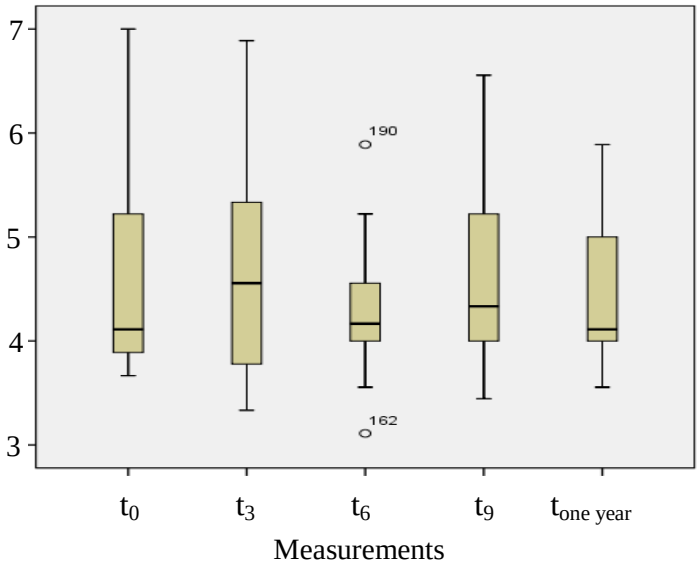

Figure 3. The Development of the Commitment to MGP within One Year Follow-Up.

Table 3

The Commitment to MGP within One Year Follow-Up.

	Baseline value t_0	t = 3 months	t = 6 months	t = 9 months	t = one year	Mean over one year
Commitment	4.17 (1.43)	4.56 (1.67)	4.22 (1.14)	4.44 (1.42)	4.11 (1.25)	4.47 (1.44)
N (%)[a]	38 (59)	35 (55)	27 (42)	32 (50)	22 (34)	36 (56)

Note. Due to the distribution, Median and interquartile range were used. Statistical outliers were excluded from the data. Commitment to MGP was measured through a self-developed questionnaire and only within the intervention group. No significant differences were found.
[a] Percentage of the total intervention group (N = 64)

The Relation between the Commitment to MGP and the Personality Dimensions Extraversion and Conscientiousness

There was a positive association both, between extraversion and commitment to MGP (r = .411, p = .008) and between conscientiousness and the commitment to MGP (r = .300, p = .043). The correlation coefficient as well as the p-value were higher for extraversion than for conscientiousness, meaning that the association between extraversion and commitment to MGP was higher than the association between conscientiousness and commitment to MGP.

The Relation between the Commitment to MGP and the Change of Self-Management within One Year

No association was found between the commitment to MGP and the difference between the self-management scores at t = 0 and at t = one year (r = .235, p = .160).

Discussion

There was no difference in the change of self-management of patients with chronic diseases who could use MGP over one year compared to patients with chronic diseases who got the care ‘as usual’ over one year. Therefore, MGP did not affect the self-management of patients with chronic diseases. Only one of the Big Five personality traits – openness – was positively associated with the self-management of patients with chronic diseases. All other personality traits were not associated with the self-management of patients with chronic diseases at all. The commitment to MGP did not change between the beginning and the follow-up after one year. Both, the personality traits extraversion and conscientiousness were positively associated with the commitment to MGP over one year, meaning that both, participants with high manifestations of extraversion and of conscientiousness, were stronger committed to MGP than participants with low manifestations of these personality traits. Finally, the commitment to MGP of patients with chronic diseases was not associated with the effect of MGP on self-management over one year.

Several studies led to the expectation that MGP would increase the self-management of people with chronic diseases. For example, eHealth is expected to improve health and health care in general (Garth McKay et al., 2002; Gee et al., 2015). Next to this, the structure and enhanced communication between the patient and the general health practitioner to which Personal Health Records should lead, supported the expectation of MGP as a tool to improve self-management (Tenforde et al., 2011). One reason, why no effect was found here, could be that the sample of patients who were exposed to MGP and who filled in both questionnaires about self-management was very small, also due to a high dropout rate of more than half of the participants. Moreover, the participants in the intervention group were not all exposed to MGP at the first time as they filled in the first questionnaire. It is not known how many users were exposed to MGP before study and how long they were. Therefore, it is possible that MGP did already affect the self-management of these participants, before the study started. This was also supported through the significant higher self-management in the intervention group than in the control group at the first measurement. An improvement in self-management from a lower level is much easier than beginning already at a high level. So, if these users already improved their self-management former to this study, it was more difficult for them to improve it within the study, compared to the control group. Finally, it was not known what was meant by ‘usage’. It is possible that participants in the intervention group used MGP only a few times within this year or did not use MGP at all, what consequently could affect the impact of the intervention. Next to this, it is also not known if they only stopped filling in the questionnaire or in general with using MGP. For future research about the effect of MGP, it would be important to work with more participants, especially in the intervention group. Moreover, a sample would be needed, where all participants of the intervention group begin with the study, as they are registering at MGP. Furthermore, information about the usage of MGP should be included in the dataset.

Next to the positive effect of MGP on self-management, an impact of personality, especially of the personality trait conscientiousness on the self-management of people with chronic diseases was expected. A high manifestation of conscientiousness was associated to a high self-management in different studies (Hill & Roberts, 2011; John et al., 2008). This study revealed no association, but only a positive trend for conscientiousness and self-management. As well unexpected was the relation between openness and self-management. These deviations of

the expectations could be explained through the low psychometric sound of the Ten-Item Personality Inventory. Due to the low internal consistence of the items for each personality trait, this questionnaire should only be used for a survey on groups level (Gosling et al., 2003). The aim of the basic study was to get a general survey about personality and therefore the application of the Ten-Item Personality Inventory was sufficiently. Finally, the participant group was not as large as desired. This led to an even lower internal consistence within this study, for example on an unacceptable level for openness and a poor level for conscientiousness. To examine these correlations more specifically, a more reliable measure of personality and a larger sample would be needed.

In contrast to the expectation, there was not found any association between the commitment to MGP and the effect of this intervention. It was possible that the commitment affected only the usage of MGP. Thus, higher commitment could have led to more usage of MGP, what actually did not affect the self-management. The fact that MGP seemed not to affect self-management, supported this idea. Actually, patients could have seen MGP as a tool which rather takes the self-management off of them, than which enhances their self-management. This would not mean in general that MGP was not effective, but it could mean that there was another effect than expected. Therefore, research about other health related factors – as for example the quality of life or physical health status - could give more information about the effect of MGP.

Between the two personality traits conscientiousness and extraversion and the commitment to MGP, the results met the expectations of this study. Participants with a high manifestation of extraversion were expected to be more interested in persuasive systems and participants with a high manifestation of conscientiousness were expected to work with more adherence to MGP (Halko & Kientz, 2010; John et al., 2008). Due to the positive association between personality and the commitment to MGP, the idea about tailoring for personality shouldn’t be abandoned. Future research should investigate again, if personality affects the self-management of patients with chronic diseases – or other health related factors – through its impact on the commitment to an intervention. Based on the literature, especially the traits extraversion and conscientiousness could be associated with a change in self-management (Halko & Kientz, 2010; John et al., 2008). Consequently, only measurements of these two traits and health related factors as self-management, the quality of life or the physical health status,

would be needed in that study. If any effect was found, this result could be used in different ways. Users could for example fill in a short questionnaire about the relevant personality traits at the registration on MGP. The information could then be used to regulate the amount and sort of design principles and generally the way of presentation of the intervention. This could then improve the commitment to MGP and therefore perhaps also the use of MGP and its effect.

Further research should be directed on other factors for tailoring, too, as for example the diseases of the patients. Implementing tailoring on the different diseases could mean to present functions and information to the user in accordance with the needs which the different diseases bring about. The user would have to report his disease(s) at the registration to have access to the relevant functions and information. Furthermore, there should be the ability for the user to change this information if appropriate. For MijnGezondheidsPlatform, this could mean that the current intervention becomes the basis and that more specific information and functions related to the diseases are added and shown only to user for whom this is relevant. This idea is also supported through the Chronic Care Model where the disease-specific knowledge of the patients takes an important part within the improvement of the health care for patients with chronic diseases (Gee et al., 2015). Research could investigate the effect of tailoring for the disease in the same way as the recent study was conducted but with recognizing the described limitations.

Finally, the intervention could be evaluated regarding the six self-management skills and three self-management tasks following Lorig and Holman (2003). The self-management skills are abilities the patients should have or where there should be supported, while the self-management tasks are more like domains of self-management, where interventions could aim at (Lorig & Holman, 2003). Therefore, it is important to take care of both the skills and the tasks within an eHealth intervention to improve its effect. A study, investigating this effect, could be built up like this study and should include questionnaires for both variables. A control group would not be necessary in this case. If the results show that the intervention is not effective for some skills, it could be tried to look for improvements directly aimed at these skills. If there was found that there was no effect for one of the three tasks, this could indicate that some general changes could improve the overall effect of the study, in accordance to the different tasks.

This study did not found any effect of MijnGezondheidsPlatform on the self-management of patients with the chronic diseases diabetes mellitus type 2, asthma, COPD and cardiovascular

diseases. Actually, MGP could have affected other health related factors than self-management as for example the quality of life or the general health status of its users. As already mentioned, this should be the aim of investigation in a next step. Based on the results of the recent study, changes within MGP are needed. These changes should be implemented in accordance with a holistic approach (Gemert-Pijnen et al., 2011). A holistic approach for developing interventions contains six working principles: The first one implicates that the development takes place as a participatory process: all stakeholders, as here the healthcare providers, health practitioner as well as the patients support the development process from their point of view (Gemert-Pijnen et al., 2011). The second principle of using continuous feedback loops makes sure that the stakeholders can give feedback within development phases (Gemert-Pijnen et al., 2011). Moreover, the implementation should already begin during the development to make sure that limitations for the implementation are not overlooked (Gemert-Pijnen et al., 2011). Another principle states that the intervention should give a new organisation of health care, meaning for example new processes which could replace costly and longer processes of the traditional health care (Gemert-Pijnen et al., 2011). Furthermore persuasive design techniques should be used within the intervention to match with the needs of the users and therefore to enhance their commitment to the intervention (Gemert-Pijnen et al., 2011). The last principle contains appropriate methods to assess the effect of the intervention, what among others means that not only the effect itself, but also why there was this effect should be evaluated (Gemert-Pijnen et al., 2011). An implementation of changes within MGP could be more successful, if it is based on these principles. Moreover, this could lead to an improvement of the intervention itself. Participants would approximately not only give feedback about the change itself, but more on the whole product they work with. Therefore, the provider could implement more improvements of MGP which possibly are clarified throughout the different feedback circles.

The actual changes could be related to different features of the intervention. One idea would be to try to improve the commitment to MGP. This could happen through the use of more design principles (Oinas-Kukkonen & Harjumaa, 2009). One example could be the usage of the principle ‘rewards’: If patients would get different titles on their profile for using MGP 5 or 10 weeks successively, or complete a coaching program, this could enhance their motivation, their usage and therefore their commitment to MGP. In this case, however, it would be important to

decide how much use of MGP would be desirable. This could be investigated through a study similar to this one, which searches for differences in the change of self-management between patients who use MGP in different extents. Another idea was to improve the communication between the patient and the practitioner within the intervention. This could mean to make the care dossiers of the patient applicable to the practitioner and vice versa. This change could improve the effect of an Personal Health Record as MGP (Tang et al., 2006).

Another line of argument could be to abort MijnGezondheidsPlatform. With the recent information, this would implicate that the costs for development would not be benefited by savings due to the effect of the intervention. Moreover, the health status of the patients should clearly be the main issue within a decision about MGP. However, bringing changes to MGP opens possibilities to get at least the costs and savings balanced for the care providers and to find a new solution to support the patients with chronic diseases in improving their health status.

The results of this study can have implications for other Personal Health Records, or eHealth interventions in general, too. The study revealed that personality can influence parts of eHealth interventions, as in this case, the commitment of the user. Therefore, tailoring on personality could influence the effect of an intervention. Actually, further research is needed to look for the impact of this connection for the intervention and implementing tailoring for personality would be associated with high costs and efforts which should be balanced against the expected effect for the intervention. Moreover, due to the limitations of this study, the result should not be seen as implicating in general no effect of eHealth interventions, or in particular of Personal Health Records for self-management, especially because of the positive effects found in many other studies (Garth McKay et al., 2002; Gee et al., 2015; Tenforde et al., 2011).

In conclusion, changes within MijnGezondheidsPlatform should follow this study to enhance the effect of the Personal Health Record to improve the self-management of patients with chronic diseases. Moreover more research should examine the effect of MGP on other health related factors than self-management, as for example the quality of life, and should look for possible improvements of the intervention. Finally, for eHealth in general, tailoring on personality could improve the effect of a persuasive technology, for example via the commitment of the users and could therefore be a point of investigation also for interventions aimed at different topics.

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Appendix

Appendix A: The Ten-Item Personality Inventory

3. Persoonlijkheid (Big 5)

Hieronder staan een aantal eigenschappen die wel of niet op u van toepassing zijn. We verzoeken u om voor elk paar eigenschappen aan te geven in hoeverre het paar eigenschappen u beschrijft. Het is de bedoeling dat u aangeeft hoe goed elk paar eigenschappen op u van toepassing is, ook als de ene eigenschap misschien meer van toepassing is dan de andere.

	beschrijft mij helemaal niet					beschrijft mij zeer goed	
	1	2	3	4	5	6	7
extravert, enthousiast							
kritisch, ruziezoekend							
grondig, gedisciplineerd							
angstig, makkelijk van streek te brengen							
open voor nieuwe ervaringen, levendige fantasie							
gereserveerd, stil							
sympathiek, vriendelijk							
lui, gemakzuchtig							
kalm, emotioneel stabiel							
weinig artistieke interesse, weinig creatief							

Appendix B: The Patient Activation Measure PAM-13

10. Zelfmanagement (PAM 13)

Hieronder staan enkele uitspraken die mensen soms doen over hun gezondheid. Geef voor elke uitspraak aan, in hoeverre u het ermee eens of oneens bent. Doe dit door het antwoord te omcirkelen dat het meest op uw persoonlijke situatie van toepassing is. *We willen dus weten wat u zelf vindt en niet wat u denkt dat de dokter of onderzoeker wil horen.*

	helemaal niet mee eens	niet mee eens	mee eens	helemaal mee eens	nvt
Uiteindelijk ben ik zelf verantwoordelijk voor mijn gezondheid.	O	O	O	O	O
Een actieve rol op me nemen in de zorg voor mijn gezondheid, heeft de meeste invloed op mijn gezondheid.	O	O	O	O	O
Ik heb er vertrouwen in dat ik kan bijdragen aan het voorkomen of verminderen van problemen met mijn gezondheid.	O	O	O	O	O
Ik weet wat elk van mijn voorgeschreven medicijnen doet.	0	0	0	0	0
Ik heb er vertrouwen in dat ik kan beoordelen of ik naar de dokter moet gaan of dat ik een gezondheidsprobleem zelf kan aanpakken.	O	O	O	O	O
Ik heb er vertrouwen in dat ik een dokter mijn zorgen durf te vertellen, zelfs als hij of zij daar niet naar vraagt.	O	O	O	O	O
Ik heb er vertrouwen in dat het mij lukt om medische behandelingen die ik thuis moet doen uit te voeren.	O	O	O	O	O
Ik begrijp mijn gezondheidsproblemen en wat de oorzaken ervan zijn.	O	O	O	O	O
Ik weet welke behandelingen er zijn voor mijn gezondheidsproblemen.	O	O	O	O	O
Ik heb veranderingen in mijn leefstijl (zoals gezond eten of bewegen) kunnen volhouden.	O	O	O	O	O
Ik weet hoe ik gezondheidsproblemen kan voorkomen.	0	0	0	0	0
Ik heb er vertrouwen in dat ik zelf oplossingen kan bedenken voor nieuwe problemen met mijn gezondheid.	O	O	O	O	O
Ik heb er vertrouwen in dat ik veranderingen in mijn leefstijl (zoals gezond eten en bewegen) kan volhouden, zelfs in tijden van stress.	O	O	O	O	O

Appendix C: The commitment questionnaire

5. Betrokkenheid

Het MGP is voor mij:

belangrijk	O	O	O	O	O	O	O	niet belangrijk
saai	O	O	O	O	O	O	O	interessant
relevant	O	O	O	O	O	O	O	niet relevant
enthousiasmerend	O	O	O	O	O	O	O	niet enthousiasmerend
betekenisloos	O	O	O	O	O	O	O	betekenisvol
aansprekend	O	O	O	O	O	O	O	niet aansprekend
fascinerend	O	O	O	O	O	O	O	alledaags
waardeloos	O	O	O	O	O	O	O	waardevol
betrokken	O	O	O	O	O	O	O	niet betrokken
niet nodig	O	O	O	O	O	O	O	nodig