

MASTER

Understanding patient portal use and patient satisfaction Implications for improving patient portals

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Understanding patient portal use and patient satisfaction: Implications for improving patient portals

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Abstract

Patient portals are e-health technologies that enable patients to connect with health care professionals in a safe and convenient way to receive remote care. Additionally, patient portals allow patients to be advocates for their own healthcare, since portals could facilitate online disease management.

Nevertheless, it remains a challenge to get patients actively engaged with these portals and generate the desired impact. In this report, the potential benefits and downsides of patient portals are discussed as well as the determinants of portal use. Also, the effect of multiple factors such as perceived effort and performance of the portals as well as the relationship between different patient characteristics and the use of and satisfaction with patient portals are investigated in an adaptation of the Unified Theory of Use and Acceptance of Technology (UTAUT). An online survey consisting of quantitative data supplemented by qualitative information was conducted amongst users of the patient portal Engage by Philips VitalHealth in the primary care setting. Despite some limitations, results showed social influence, perceived effort and portal use are the main predictors of satisfaction. A majority of patients using Engage was satisfied with the portal and valued the features of Engage as beneficial. Implications and suggestions for portal optimization are discussed.

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Chapter 1. Introduction

In the midst of the COVID-19 pandemic, health and safety are top priority. Especially for those already suffering from one or more chronic illnesses. Visiting the general practitioner or hospital costs time and effort and additionally in this time increases the risk of getting infected. Through patient portals, patients are able to connect with their health care providers in a safe and convenient way to receive remote care that is no longer restricted to consultations. According to the Dutch government, the definition of a patient portal is: *'An online gateway that facilitates patients via multiple websites and/or functionalities in gathering and sharing information about their health'* (Heldoorn, Herk, & Veereschild, 2011). Patient portals also allow patients to be advocates for their own healthcare, since portals could facilitate online disease management (Osborn et al., 2013; Urowitz et al., 2012). Reliable health information and online tools to improve patients' health are just a few clicks away. Nevertheless, it remains a challenge to get patients actively engaged with these portals and generate the desired impact. In this report, the potential benefits and downsides of patient portals are discussed as well as the determinants of portal use. Also, the effect of multiple factors such as perceived effort and performance of the portals as well as the relationship between different patient characteristics and the use of and satisfaction with patient portals are investigated.

Healthcare costs in the Netherlands are increasing every year and since 2018 the 'magical number' of more than €100 billion has been reached (*CBS StatLine - Zorguitgaven; Kerncijfers*, 2020). In 2018, 33% of the Dutch population has been in contact with their general practitioner (GP) to consult on at least one chronic illness (*Chronische Ziekte: Aantal Personen in Zorg Bij de Huisarts*, 2019). These staggering numbers stress the importance of innovation in healthcare as for example applications that facilitate self-management. Worldwide there is a growing interest in moving healthcare partially to the digital world to promote self-management for the chronically ill patients. Patients' self-management at home is crucial to manage chronic diseases and improve the lives of the chronically ill. Interventions through e-health solutions have the potential to improve self-management which could result in positive outcomes such as better monitoring of chronic illnesses, enhanced physical and psychosocial functioning, fewer symptoms and decreasing healthcare costs by reducing the need for healthcare resources (Clark, 2003). Innovation in health technologies have enabled us to get proper health information at home, which might result in fewer GP visits by patients. Especially in times of the global pandemic caused by COVID-19, patients are hesitant in visiting their GP and care professionals are hesitant to see patients. Increased workload experienced by GPs is causing them to introduce policies

that hamper the possibilities for visits even more (Johansen Fagerlund et al., 2019). Patient portals have the potential to be the e-health solution to achieve the benefits mentioned above (Clark 2003) without having to visit the GP (Ball & Lillis, 2001), since patient portals enable frequent and flexible personalized interaction between patient and healthcare providers, while at the same time providing relevant content and education to the patient. An example of a patient portal is Engage by Philips VitalHealth. Engage is a self-management platform for the chronically ill, mainly used in primary care groups in the Netherlands. The main goal of the platform is the facilitation of online health care and easy collaboration in the entire care network of a patient. Through the Engage patient portal, patients can enter home measurements, share them with care professionals, look into care plans and find relevant information about their disease. Engage also facilitates direct communication with the nurse practitioner.

Despite the potential benefits and increased availability of patient portals, their use rates are often low (Grossman et al., 2019). Tulu and colleagues (2016) found that a mere 20% of people who were offered the use of a patient portal, used at least one of the services. A systematic review by Grossman and colleagues (2019) found that the availability of patient portals increased from 43% in 2013 to 92% in 2015, but the self-reported use only rose from 17% in 2014 to 28% in 2017. Abd-Alrazaq and colleagues (2019) performed a cross-sectional study aimed to examine factors associated with patients' use of the portal *Patient Online* in England. They found that patients are more likely to use the program if they perceived it to be useful, advantageous, secure and they feel that they have the resources and knowledge to use it. However, their model accounted for 48% of the variance in the use behavior indicating that there are other factors impacting patients' use of patient portals yet to be identified.

The use of patient portals comes with many potential benefits, nevertheless for some patients the use of patient portals may also have downsides. An underexposed factor that might play a role in the lack of uptake of patient's portals is the assumption that more informed patients are better equipped to make informed decisions, resulting in more empowered patients. However studies are showing that this is not always the case, leaving some patients confused and anxious when confronted with unexpected results (Van Kuppenveld et al., 2020). Another study shows that the use of patient portals could also result in patients becoming more anxious when reading medical information without having somebody to discuss the results with or even misunderstand the information and take actions that might compromise their health and safety (Huvila et al., 2013). When studying the uptake of patient portals, the downsides of the portals should be taken in consideration and the negative consequences should be limited as much as possible.

Though there have been studies focusing on user acceptance of e-health solutions, the previous studies have been done on other technologies such as telemonitoring (Buysse et al., 2010), electronic personal health records (Abd-alrazaq et al., 2019; Tavares & Oliveira, 2016) and smartphone health technology (Dou et al., 2017; Luna-Perejon et al., 2019). In the past, to the best of my knowledge, very few studies to understanding the factors impacting patients' use of portals have been grounded in a theory-driven framework. The intention of performing the current study is narrowing the gap in previous research about patient portals regarding the user perception and use, by developing and testing a theoretical model to predict and explain patients' use of patient portals. Since previous models explained only part of the variance, there is room for improvement by combining models and identifying other important factors. The theory is tested in the context of the *Engage* patient portal by *Philips VitalHealth*. In addition, this study adds to the existing literature by not using the intention to use the system, but the self-reported actual portal use.

Next, previous research in terms of e-health and general technology acceptance is discussed, as well as the main determinants of patient portal use specifically. Based on these findings, a theoretical model is developed and tested with the current users of Engage. Lastly, recommendations are made to VitalHealth based on the findings aimed at increasing patient portal use in order to achieve all the potential health benefits.

Chapter 2. Theoretical background: e-health and patient portals

In this chapter, we elaborate on the benefits and downsides of e-health technologies in general, after which patient portals in specific are highlighted.

2.1 Defining e-health: benefits and downsides

Through the shift from offline healthcare to online healthcare, patients have the opportunity to transform into critical, assertive and informed consumers of healthcare with e-health as a crucial connector. The term e-health is widely used among many individuals like researchers, healthcare professionals, consumers, insurance companies and healthcare products producers. E-health is an accepted new concept, despite the lack of a precise definition. Literature reviews show that there is a wide range of themes, but no clear consensus about the exact meaning of the term e-health (Oh et al., 2005; Pagliari et al., 2005). However, two universal themes, health and technology, arise from the literature reviews. A scoping exercise to map the field of e-health by Pagliari and colleagues (2005) resulted in the conclusion that the global definition by Eysenbach (2001) in the early development of the field represented the concept of e-health well:

E-health is the field of medical informatics, referring to the organization and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology. (p. 3)

The introduction of e-health in the year 2000 represented the promise of new information and communication technologies (ICT) to improve health and the health care system. In the last twenty years, the use of ICT in the health care system through e-health tools has grown exponentially. E-health tools can be any internet-based programs or software used to help patients monitor and manage their health, including electronic medical records, mobile apps, patient portals, personal health records, and digital health libraries.

The potential of e-health to improve effectiveness and efficiency has been recognized by governments worldwide (Institute of Medicine, 2001). Countries developing health information infrastructures across North America, Europe, Australia and elsewhere are united by the vision to improve the safety, quality and efficiency of patient care by enabling access to electronic health records and by supporting clinical practice, service management, research and policy through availability of appropriate evidence and data (Pagliari et al., 2005). On top of that, strategies to ensure interoperability

and data security, as well as commitment to facilitate consumer empowerment and patient self-care through telemedicine, are more important than ever. The focus of health care information technology has been changing, from the emphasis on hardware and databases, to innovative applications of technology in order to facilitate communication and decision making, coupled with the growing recognition of the importance of patient engagement with their own health. The Dutch government even subsidizes projects to stimulate digital information exchange between health professionals and to create incentive to make remote care possible through e-health (*VIPP 5 - Medisch Specialistische Zorg / Subsidie, 2020*).

Nearly two-thirds of the internet users are estimated to access health information on the internet (Caligtan & Dykes, 2011). With such high demand for accessible, comprehensible health information, e-health has become a popular way to provide patients with health information, recommendations to self-manage their health, and access their health records and data

A literature review by Lancaster and colleagues (2018) on the use and effects of electronic health tools for patients showed that e-health tools focusing on symptoms and self-reporting can prompt positive changes in lifestyle and medication use. In addition, the majority of e-health tools studied were able to improve patient symptoms, self-management and self-efficacy. Research by Ball and Lillis (2001) showed that e-health can improve clinical decision-making, increases efficiency and strengthens communication between physicians and patients if sufficient support is offered.

However, e-health tools as electronic medical records (EMR) face some disadvantages too. Care providers expect a lack of understanding the EMR-data, resulting in fear and stress among patients. Second, physicians express the worry that too much of the valuable consultation time would be spent on explaining the interpretation of the health data to patients, resulting in an increase of workload (Van Der Vaart et al., 2013). Finally, EMR could have the negative effect on the physician-patient relationship, due to the care professionals' personal notes concerning the patient, especially in the case of psychiatric patients (Brakoulis, 2013).

2.2 Patient portals

One of the rather promising e-health tools are the patient portals. At the moment, patient data are gathered by different health care professionals. Since July 2020, according to the Dutch agreement regarding medical treatment, lawbook 7, section 5, articles 454, 455 and 456 (*Wetten.Overheid.NL - Regeling - Burgerlijk Wetboek Boek 7, 2020*), every patient in the Netherlands has the right to view, modify or destroy the data in their medical file. Dutch patients can view, manage and share their health

information in the personal health environment (persoonlijke gezondheidsomgeving (PGO)), however in this PGO no interpretation of the data is given, so the patient is left with an incomplete picture, leaving the patients possibly with more questions and no tools or skills to enhance their self-management. With the use of a patient portal, patients could be empowered by giving them the right actions based on the information. Features included in patient portals could be: keeping a diary for the health professional, chatting and video calling with health professional, entering home measurements and looking up previously made measurements, finding appropriate information and education about the condition, capturing agreements made with the health professional in the individual care plan, filling in surveys to prepare for a medical consultation, amongst other things. These features enabled by patient portals ensure that patients have the opportunity to look into their medical data at any desired time. In order to get patients more involved in their own health, patient portals help patients to transfer health information into the appropriate actions. Systematic literature research by Kruse and colleagues (2015) found that chronically ill patients using a patient portal improve in the management of their own health and their decision-making, which results in a heightened sense of responsibility and a greater feeling of empowerment in the management of their conditions. For example, in the self-management of some chronic conditions, the patient checks their own blood sugar or blood pressure and administers their own medicine. Furthermore, patients often have to change their lifestyle by altering their eating habits, getting more physically active and giving up on smoking. The use of a portal supports the patient in many ways in addition to the support of health care providers.

In addition, patient portals have some clear benefits for health care providers such as increased quality of care, more efficiency, and smarter and therewith cheaper processes. It has been shown that patients show more therapy compliance, client loyalty and a lower no-show rate for consultations when using a patient portal (Heldoorn et al., 2011). Especially in countries where health care is managed on a competitive market, client loyalty is an important effect caused by patient portals.

Despite the potential benefits of patient portals, their acceptance rates are often low (Tulu et al., 2016). In England, the National Health Service launched in 2015 a country-wide program, named *Patient Online*. In this program, general practices are able to provide their patients with internet-based services, such as seeing an overview of GP records, booking appointments and requesting medication refills (*National Health Service England » About GP Online Services*, 2016). In April 2017, the percentage of patients to use at least one of the online services was only 19.30%. In January 2020, this use rate only reached a mere 29.96%, hence acceptance rates remain low (*Patient Online Manag. Inf. April 2017 -*

Januari 2020, 2020). Abd-alrazaq and colleagues (2019) found that the use of patient portal is depending on a number of factors as usefulness, security and skills of patients, however that study indicated that there are other influential factors involved. To investigate the factors concerning use behavior, the development of a holistic model is necessary.

Chapter 3. Model development

In this chapter, the theory regarding general technology acceptance models that exist in literature are discussed in order to be able to explain general usage of technologies. These models, combined with specific determinants of patient portal use, result in the development of a holistic theoretical model of the use of patient portals in the context of Philips VitalHealth Engage.

3.1 Technology acceptance research

In the field of information technology, several technology acceptance models have been proposed focusing on factors influencing acceptance. In this paper, we will focus on the concept of acceptance, defined as the attitude towards accepting a technology (Renaud & Van Biljon, 2008), since this is a prerequisite of usage (Venkatesh et al., 2003). Some articles use the terms acceptance and adoption of a technology interchangeably, though there is a distinction between the two (Kaldi et al., 2008). Technology adoption is the expansive process of selecting, purchasing and committing to a technology by a user, followed by persistent use and the user embracing the technology in their lives. Acceptance, as opposed to adoption, is the attitude towards the technology. However, without the user accepting the technology, it is unlikely that adoption will occur.

In the past, studies to understanding web-based health information seeking behavior grounded in multiple theory-driven frameworks have been done. A review by Marton and Choo (2012) identified four studies that used theoretical frameworks to explain internet health information seeking. The frameworks in these studies were the Theory of Planned Behavior, the Technology Acceptance Model (TAM) and the Unified Theory of the Acceptance and Use of Technology (UTAUT). In general, all four studies identified by Marton and Choo (2012) were able to produce at least one significant relationship. The studies could explain a minimum of 23% and a maximum of 49% of the variance by the study variables. All studies identified race, income and employment as key demographic variables in health information seeking behavior.

Only recently, studies that use a theoretical framework have been done in the context of patient portals. However, these frameworks themselves are not recent at all. In terms of users' acceptance, the Technology Acceptance Model (TAM) by Davis (1989) is the most widely applied model. This model has strong behavioral elements to predict if people will use a technology. The model suggests that when a user is presented with a new technology, behavioral intention is formed based on multiple factors such as perceived usefulness, ease of use and other external variables. Perceived usefulness is the degree to which users believe using a technology enhances their task performance. Perceived ease of use is the

extent to which users believe a system would be easy to use. Based on the behavioral intention, the actual system use can be predicted.

Despite the wide use of TAM, the model has been criticized because of its limited predictive and explanatory power and the lack of practical value (Chuttur, 2009). The results of the TAM do show what factors are most important in explaining the acceptance of a technology. However more than just this model is needed to improve the use of a technology such as a patient portal, since the TAM produces very little actionable results and explains only around 40 percent of the variance in the behavioral intention to use the technology (Venkatesh et al., 2003). After the basic model, many derivatives and alternatives of the TAM followed such as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and the Almere model (Heerink et al., 2010). The UTAUT is a model that integrates multiple theories and research studies into one unified theoretical model of user acceptance of technologies. Venkatesh and colleagues (2003) found strong empirical evidence for UTAUT, with three direct factors (performance expectancy, effort expectancy and social influence) that influence the intention to use the technology. In addition, empirical support is found for two direct affectors (intention and facilitating conditions) of the usage behavior. According to UTAUT, gender, age and voluntariness were confirmed to be significant moderators on at least three of the direct effects, whereas the voluntariness of use is only a moderator on the relationship between social influence and behavioral intention. Figure 1 displays the original UTAUT model by Venkatesh and colleagues (2003). An adaptation of the UTAUT model is the Almere model by Heerink et al. (2010). This model does not explain the behavioral intention and use behavior merely on functional evaluation, but also on variables that are related to social interaction. For example, the Almere model demonstrated the importance of attitudinal factors in predicting the acceptance of a technology and that attitudinal factors are partly affected by social factors.

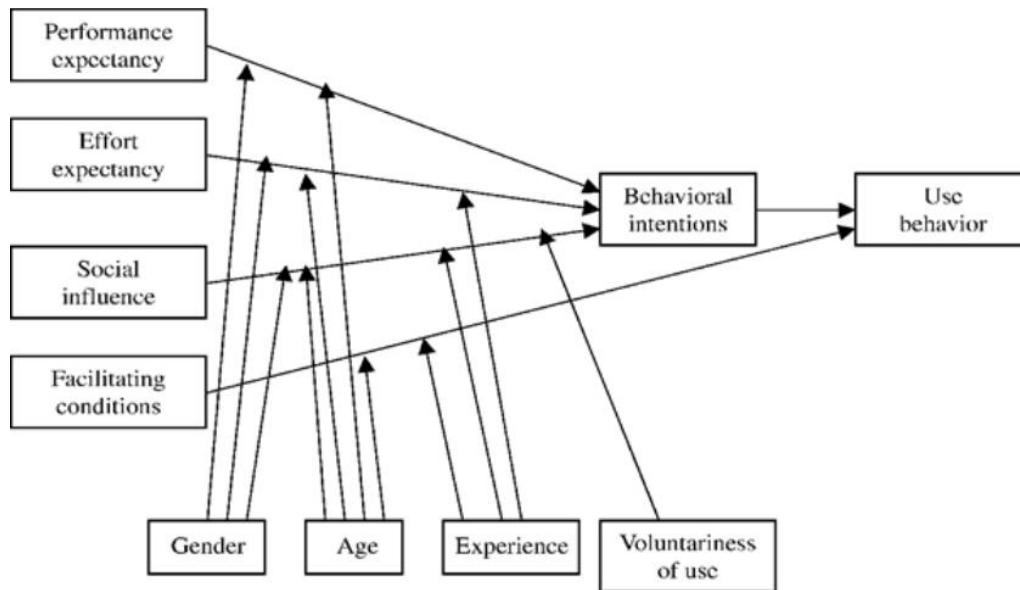


Figure 1. The UTAUT model. Reprinted from “User Acceptance of Information Technology: Towards a Unified View”, by Venkatesh, V., Morris, M., Davis, G. and Davis, F., 2003, Management Information Systems Quarterly, 27(3), page 447.

3.2 Determinants of use of patient portals

A study by Zhang and colleagues (2019) aimed to identify determinants of patients’ intention to use diabetes management apps based on an integrated theoretical model found that performance expectancy and social influence were the most important determinants. However, also facilitating conditions perceived by patients was significant predictor of behavioral intention to use the applications.

In order for any system to become a success, not only functional factors are important, but also a person’s satisfaction with the technology. Philip Kotler and Kevin Keller (2006) define customer satisfaction as: *“a person's feeling of pleasure or disappointment, which resulted from comparing a product's perceived performance or outcome against his/her expectations”* (p. 144). A study by DeLone and McLean (2016) found that the behavioral intention to use a particular system is significantly influenced by user satisfaction. However, since according to Kotler and Keller (2006) the satisfaction is dependent on the expectation of the user, and the fact that the expectation of a user might change during use, use might also have an influence on the satisfaction with a system. A recent study by Silver, Subramaniam and Stylianou (2020) indicated the importance of portal satisfaction and the role it might play influencing the health-seeking behavior of patients. However, this study is solely done with college students as participants. Resulting in patient characteristics such as age, education level and technology literacy might not be representative for the actual sets of patients.

A study by Maillet and colleagues (2015) about nurse satisfaction with an electronic health record system found that conditions facilitating the use of the system gave a positive user experience, which led to higher user satisfaction. The construct, social influence, can be defined as the extent to which users perceive that others who are important to them, such as friends, family and healthcare providers, endorse the technology (Tavares & Oliveira, 2016). Heath and Porter (2017) found that when family members discussed the benefits of portal use with the patient, the patient was more likely to be satisfied with the portal themselves.

Nowadays, computer-literate public can find all kinds of health information on the internet. The demand and interest for online health portals and access to physician web sites has created a new dimension between patients and health care providers. Physicians can improve the quality of clinical decision-making and collaborate better with their patients. However, first an accurate picture of the current e-health consumer should be formed to get a clear understanding of these patients, their capabilities and what can be done to advance the patient portal use.

A review of studies on patient acceptance of health information technologies reveals that personal factors such as age, ethnicity, education level, health status and health literacy strongly influence the usage of an electronic patient portal (Irizarry et al., 2015). Socioeconomic status (SES), including education level, work status and income were found to be factors influencing use or nonuse of an electronic patient portal (Ukoha et al., 2019). Ancker and colleagues (2011) found that use and early acceptance rates of patient portals was highest among low-income population, in particular for patients with chronic diseases (Dendere et al., 2019). Especially repeated portal use has been associated with patients with chronic medical conditions. The systematic research by Dendere and colleagues (2019) also showed that user training and patient-provider communication were among the facilitators of using the patient portal while privacy concerns and lack of encouragement from providers were among the main barriers. Another barrier that is mentioned is anxiety amongst patients associated with viewing their own personal medical information.

A study in 2017 by Price-Haywood and colleagues (2017) stressed that in order to encourage all patients to use a patient portal, the e-health literacy should be sufficient. E-health literacy is defined as the capability to seek, find, comprehend and evaluate health information from electronic sources and apply the knowledge gained to addressing or solving problems (Norman & Skinner, 2006) and is positively associated with both computer literacy and health literacy (Choi & Dinitto, 2013).

3.3 Research question and hypotheses

The previous chapter shows that despite the potential benefits of patient portals, the portals are not used by every patient when offered to them. This research explores the main factors affecting the use of patient portals and the satisfaction of patients with the portals.

The UTAUT model seems a stable basis to start exploring all factors (see appendix A for an overview of the meaning of each construct) that influence the use of patient portals. This is due to its potential applicability of the model to patient-technology interaction and validation as indicated by Heerink and colleagues (2010). All hypotheses described in this chapter are tested in one complete model adapted from the original UTAUT model. If patients perceive using the portal as effortless and the portal will help with self-management of their chronic illness, they are more likely to use the portal (Lazard et al., 2016). This leads us to the following hypotheses:

H1: Perceived effort is negatively associated with patients' portal use.

H2: Perceived performance is positively associated with patients' portal use.

Combining the functional approach of TAM with the more attitudinal approach of UTAUT and the Almere model, it is likely that perceived performance and perceived effort, as well as facilitating conditions and social influence have an effect on the acceptance of patient portals. Facilitating conditions is the construct that describes the resources and support available in a system when performing a task (Venkatesh et al., 2003). Social influence is the extent to which users perceive that important others endorse the technology (Tavares & Oliveira, 2016). Drawing from the previous research into facilitating conditions and social influence (Maillet et al., 2015), we hypothesize the following:

H3: Facilitating conditions are positively associated with portal satisfaction.

H4: Social influence is positively associated with portal satisfaction.

In the context of patient portals, to my best knowledge, very little research is done on the satisfaction of patients using such a system. Building on the findings by Silver, Subramaniam and Stylianou (2020), we explore whether patient satisfaction is associated with portal use, but also if portal use influences satisfaction, as is expected when looking at the definition of satisfaction by Kotler and Keller (2006).

H5: A positive correlation exists between patient satisfaction and portal use.

Since patient characteristics as age, gender, socioeconomic status, disease burden, health and computer literacy seem to affect the use of patient portals (Abd-alrazaq et al., 2019; Heath & Porter, 2017; Silver et al., 2020; Tieu et al., 2015), we explore the effects of six patient characteristics on portal satisfaction and portal use too.

3.4 The hypothesized theoretical research model

On the basis of the above reasoning, we propose the following theoretical model, which integrates social influence, facilitating conditions, perceived effort, and perceived performance and patient characteristics as age, gender, SES, disease burden, health and computer literacy. In this study the relationship between these factors and portal satisfaction and portal use is investigated by means of a survey study conducted among patients using the patient portal *Engage* by *Philips VitalHealth*. Figure 2 illustrates the theoretical model tested in this study. The theoretical model is tested as a whole to see how much of the variance can be explained by the UTAUT variables and the patient characteristics combined and if the relationships are as expected according to hypotheses.

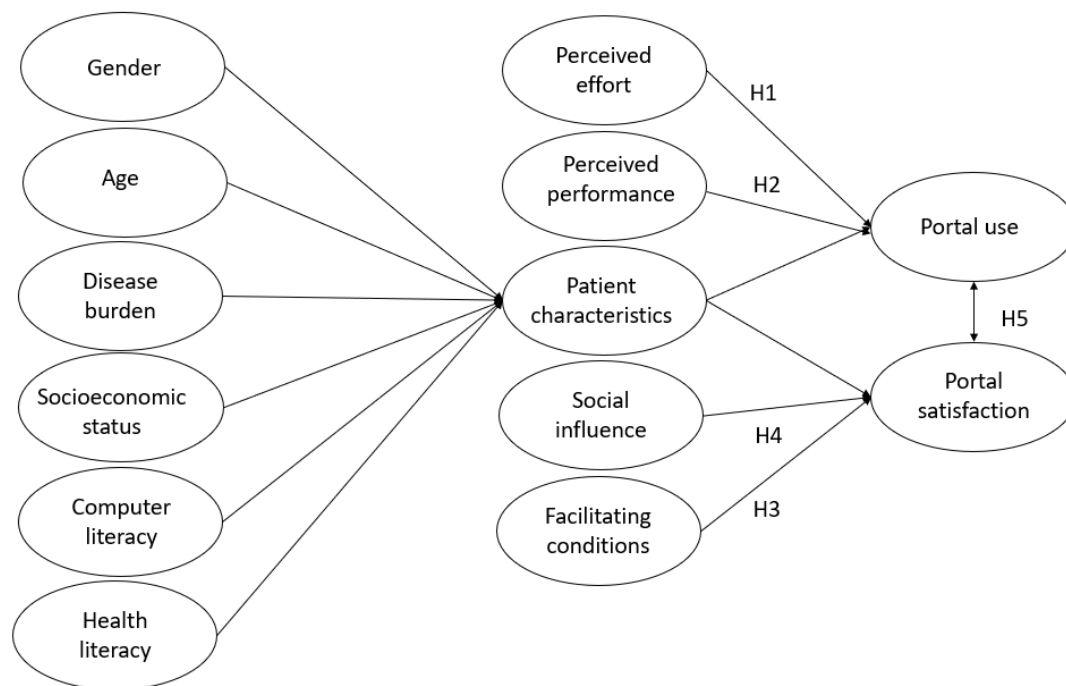


Figure 2. Hypothesized research model based on an adaptation of the UTAUT.

Chapter 4. Methodology

4.1 Participants and design

Four care groups (Gezondheidscentra Nijkerk, Zorggroep Katwijk, Zorggroep Ridderkerk and Ketenzorg Friesland) were selected through convenience sampling. The care groups were asked to invite their patients who use the patient portal Engage by Philips VitalHealth to participate in this study. However, because of the increased workload due to the Covid-19 crisis, only three care groups included patients in this study. The other care group was unable to comply. Participants were patient in one of the following care groups: Gezondheidscentra Nijkerk (N=28), Zorggroep Ridderkerk (N=19) or Ketenzorg Friesland (N=12).

Since the study was a web-based, cross-sectional survey design, the patients were recruited via an email coming from their care group with the request to fill in a survey about their satisfaction and use of the patient portal Engage. In figure 3. the process of recruitment can be seen. In order to test the hypothesized research model, structural equation modeling was performed. Although determining appropriate sample size is of great importance to conduct structural equation modeling, there is no consensus in literature. Some research states that quite small samples (N = 50) can already produce evidence for simple SEM models (Hoyle & Gottfredson, 2015). However, more common is a sample size around N = 100-150 (Bentler & Chou, 1987; Tanaka, 1987). In this research, the aim for the sample size was at least 120 participants, which would be sufficient since the statistical analysis required at least 10 participants for every included construct (Gefen et al., 2000) and at least 10 times more data points than the number of items of the most complex construct in the model (Barclay et al., 1995).

Prior to further data analyses, all variables are examined in order to check for outliers and missing data. Nine participants did not complete the survey, resulting in their removal from the data set.

Patients' answers about perceived effort and health literacy are checked against the reversed items in the questionnaire. For example, patients are asked if they (strongly) agreed or (strongly) disagreed with 'It is often unclear where to find certain features in Engage' and 'It is easy to find features in Engage'. No participants gave contradictory answers in two or more pairs of these kind of questions, so no participants were eliminated.

Therefore, the sample for the final analysis was composed of 50 participants (15 female).

Participants received a gift voucher with a worth of €10, sent to their home address as monetary compensation.

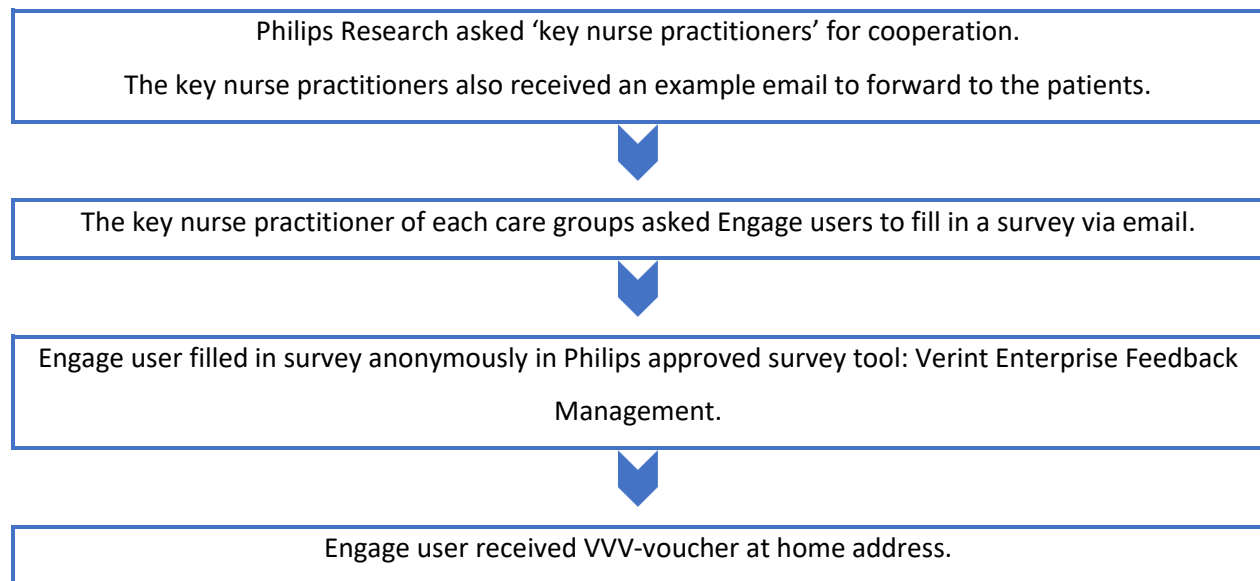


Figure 3. Recruitment process

4.2 Measures

A total of 57 survey items were used to measure the 6 constructs and 6 demographic variables in the research model. Most items were drawn from previously validated measurement instruments, such as in the UTAUT model (Venkatesh et al., 2003) which allowed us to measure the constructs of perceived effort, perceived performance, social influence and facilitating conditions. The demographic variables were measured through items from the following sources: socioeconomic status by items used by the Dutch Central Bureau of Statistics (Shavers, 2007), health literacy was measured by the brief health literacy survey by Chew and colleagues (2004), computer literacy by items from the Pharos Quick Scan (*Quickscan Digitale Vaardigheden van Je Patiënten - Pharos*, 2020) and disease burden was measured through self-created items. Patients mostly responded by Likert Scale-type responses (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

The survey was reviewed by different stakeholders both from a clinical perspective as well as from a business perspective to ensure completeness and understandability. In the end, three researchers from *Philips VitalHealth*, three nurse practitioners from one of the care groups and one person without a professional background in health care gave feedback, to ensure that all questions were relevant and clearly and unambiguously formulated. The language used in the survey had been checked according to

the Dutch b1-language level (*Taalniveau B1 | Rijkswebsites*, n.d.) in order to make sure the survey was understandable for the target group. Based on the feedback from the business perspective, questions about problems, risk and trust were added (questions 11, 25 and 26 in appendix B). Also questions inspired by the outcome driven innovation (ODI) method (Ulwick, 2016) were added. This market research method could reveal hidden opportunities for growth (question 8 in appendix B). Based on the feedback from a domain expert, a question about perceived control (questions 21 and 22 in appendix B) was added, since the level of perceived control over one's disease might influence how often a patient would use Engage. Next to that, questions about when the patient started to use Engage, the possibility for additional instruction and improvements were added to the final questionnaire (respectively questions 15, 16 and 33 in appendix B).

The answers of the first ten respondents were monitored to see if there were any unforeseen problems. The open questions about problems and suggestions were checked as well as the two questions that were each other's negative, to see if the answers corresponded with each other. No changes were made to the survey based on these checks. The final and full version of the survey can be seen in Appendix B.

4.3 Procedure

Users of the Engage patient portal received an email coming from their care group in which they were asked to participate in a study about their satisfaction and use of the patient portal. Participants could click on a link in the email sending them to the click-through informed consent. If they consented, they were redirected to a web-based survey. Both the informed consent as the survey were conducted using the Philips approved survey tool Enterprise Feedback Management (EFM) by Verint. When participants had completed the survey, which took them approximately 20 minutes, they were asked to fill in some additional data in a separate survey in order to send them a VVV-voucher with the value of €10, but also to ensure their privacy.

4.4 Data analysis

The graphs were made in Python using Jupyter Notebook (code can be found in appendix C), a web-based interactive computational environment (Kluyver et al., 2016) and the EFM survey tool. The survey data were analyzed with the Lavaan package in R studio (Rosseel, 2012) using structural equation modeling (SEM). SEM integrates several different multivariate techniques into one model fitting framework. SEM was the appropriate technique for testing whether the relationships within the proposed research model are indeed seen in the data, because SEM makes use of latent variables to

account for measurement error in the data (Byrne, 2012). First, the reliability of each construct was assessed using Cronbach's alpha. Using confirmatory factor analysis, the validity was confirmed of all the reflective indicators based on the UTAUT factors in our measurement model. Using exploratory factor analysis (R- code of factor analyses in appendix D), the validity of the factors that were measured with self-created items were evaluated. In order to test the proposed research model structurally, SEM (R- code in appendix E) was performed. This type of analysis gave the opportunity to analyze the whole model at once instead of testing all the individual hypotheses separately. Theory testing was done with overall and relative model fit tests (RMSEA, CFI, BIC and χ^2 , and the structural parameters estimates: size, direction and significance. First, a simpler model without patient characteristics was tested. Next, alternative models with added latent factors were tested to see if the model fit would increase. Previous studies suggest that the model should be modified to include additional components and relationships to explain more of the variance (Legris et al., 2003).

Chapter 5. Results

5.1 Descriptive analysis

All participants had at least one chronic disease, of which had 31 (62%) diabetes and 28 (56%) high blood pressure. Other disease that were prevalent in the sample were COPD (8 patients), arthrosis (7 patients) and heart failure (3 patients). Furthermore, there were other, less prevalent, conditions amongst the patients. In order to ensure the privacy of the participants, these conditions are not named individually. In table 1, general participants characteristics are shown. 84% of the participants were between 55 and 74 years old, 70% was male and more than half of the participants was retired. In appendix F, the distribution of the answers to all questions can be seen.

Table 1 *Characteristics of study participants (n = 50)*

Age, years	n	(%)
18 – 24	1	(2)
45 – 54	4	(8)
55 – 64	18	(36)
65 – 74	24	(48)
75 – 84	3	(6)
Gender		
Male	35	(70)
Female	15	(30)
Monthly net income		
< €1,000	2	(4)
€1,000 - €2,500	15	(30)
€2,500 - €5,000	14	(28)
> €5,000	2	(4)
Do not know/refused	17	(34)
Education		
Elementary school	2	(4)
High school	18	(36)
Secondary vocational education (MBO)	11	(22)
Higher professional education (HBO)	16	(32)
University	3	(6)
Current work-status		
Full-time (>35 hours)	9	(18)
Part-time	5	(10)
Retired	28	(56)
Work-disabled	5	(10)
Currently no paid work	3	(6)

A one-way between subjects ANOVA was conducted to compare the effect of care group on general satisfaction with the patient portal. It was discovered that there is no significant difference, between the satisfaction of patients from the three different care groups ($F(1, 48) = 2.509, p = 0.12$). Therefore, we believe that it is not necessary to conduct multi group SEM.

Eight out of fifty participants reported that they had never used Engage or that they had quit using the portal. Since patients that quit using the portal are especially interesting when exploring the barriers when using Engage, they are kept in the sample. Two main reasons for quitting were identified based on answers to open questions. Either patients had problems with logging-in, sometimes even after resetting their password, or they did not know what to use the portal for.

Most patients (43 out of 50) reported that they did not think Engage took too much time. From these 43 patients, seven of them reported that Engage even saved them time, since they didn't have to call or e-mail their care professional or had to go to the GP office.

Ten possible benefits of Engage were stated to the participants. In figure 4, the responses of the participants can be seen. About half of the participants in this study clearly see the benefits of Engage (in dark green and light green). However, the other half does not see the benefits (orange and red bars) or is indifferent about the benefits (blue). Patients were most satisfied about the fact that through Engage the care professional can check their home measurement, which gives them confidence. Additionally, Engage facilitates easier communication between patient and care professional. However, only fifteen out of fifty patients felt that Engage gives them more control over their treatment and felt less need to visit their care professional.

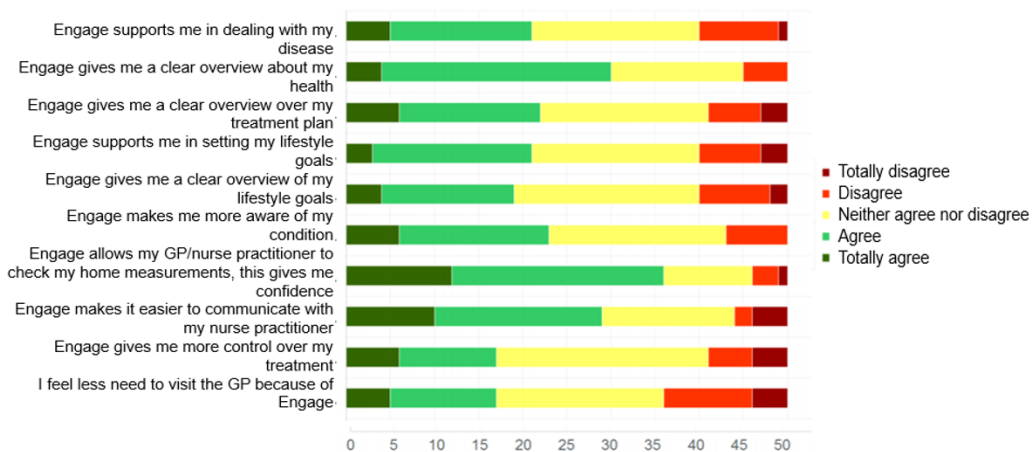


Figure 4. Possible benefits of Engage

Engage holds a variety of features all designed to support patients in managing their disease and keeping track of their measurements and care plan. However, open questions in the survey reveal that the main goals and purpose of Engage are not clear to all patients, as these quotes illustrate:

'I expected more of Engage. I did not communicate with my caregiver through Engage yet, I am not really sure if that should be happening. In my opinion, not every is up-to-date. I was once asked to participate in Engage by my nurse practitioner and I responded affirmative. Thereafter, I got invited and I started using to do's or tasks, however, that's the only thing I used I think. What is the main intention of Engage?' [Female, 45-54 years old]

'What is the intention of the use of Engage. Is this going to replace my nurse practitioner? Or is this an addition to my medical files?' [Female, 45-54 years old]

Looking at whether or not patients become worried when using the patient portal, two findings are worth mentioning. First, only six out of 50 patients are afraid the patient portal will replace their physical consultation with their GP. Second, most patients (86%) did not think differently about their condition after using Engage. The remainder, 14%, became less worried about their condition since they used Engage. No patients became more worried.

Since most score high on the Pharos Quick Scan of computer literacy, not many problems with the use of the patient portal are expected. However, 13 participants have had at least once a problem with logging in and 5 participants had problems with filling out and uploading home measurements. Also, some other features of Engage caused problems with some participants. In figure 5, the problems with different features can be seen. Another problem that became apparent when browsing through the data was the number of features that patient did not use. Figure 5 shows the problems patients face when using Engage. The grey bars represent the number of patients that do not use the corresponding feature in Engage.

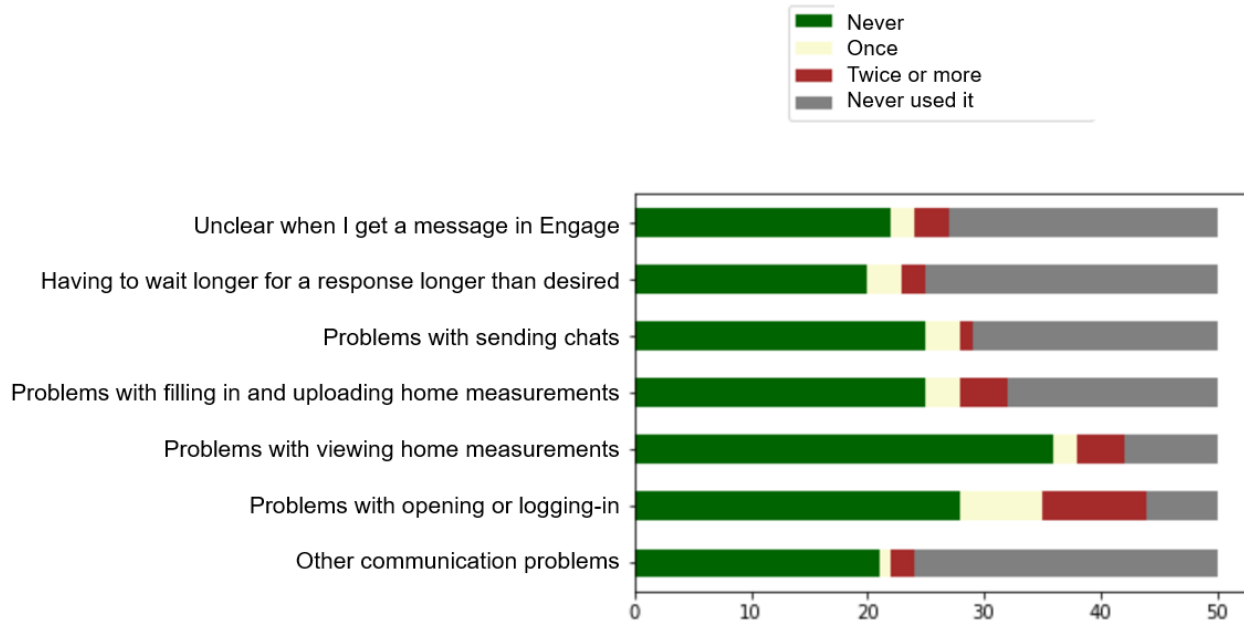


Figure 5. Problems that patients face

The patient portal is promoted by the nurse practitioner to the patient. The nurse practitioner chooses which patients are invited to use the patient portal, and which patients are not included. The nurse practitioner is also in most cases the main point of contact. However, two patients reported that the nurse practitioner did not respond to them when questions were asked.

Additionally, some patients indicated that Engage did not respond to questions too. One patient stated: ‘Engage cannot be reached, the only communication method is an old email address.’ [Male, 65-75 years old]

Other problems that patients faced were not being notified via email when a message was given in Engage, the lack of explanation about the meaning of measurement values and the use of many abbreviations. Next to that, patients were confronted with problems with the interface of Engage. Four patients indicated that the manner in which they had to input their measurement values was devious and that it required unnecessary scrolling over the pages, as the following quotes illustrate:

‘The input field for blood pressure and heart rate cannot be found impulsively. A link on the homepage would be useful.’ [Male, 55-64 years old]

‘The input options are not practical. The screen jumps up after each entry. Graphs are not legible to me, there is far too little distinction.’ [Male, 55-64 years old]

‘Entering measurement data was a problem because it is not directly visible on the screen. The option is given below the graph, so first I must scroll down in order to get the option to register measurement data on my screen. Now that I know that, the problem has been solved.’ [Male, 65-74 years old]

Questions inspired by the ODI method about the current functions in Engage were included. This resulted in the visualization in figure 6, showing the importance of certain features and the satisfaction with these features. The features are ordered from most important to least important. What can be seen is that the first six features are the most important for patients. A majority of patients considers the ability to share home measurements with the NP, the possibility to capture agreements in the care plan, finding relevant information and education, and the chat functionality as very important. Most patients are also quite satisfied with these functionalities. However, in the grey bars it is shown that many functionalities are not yet used by all patients.

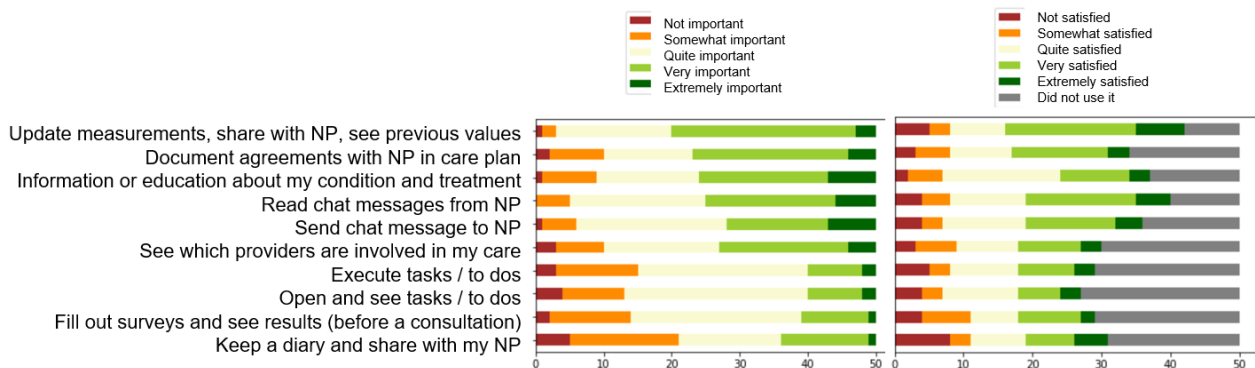


Figure 6. Importance of and satisfaction with features

5.2 Measurement model: checking the constructs

5.2.1 Exploratory Factor Analysis (EFA)

In the questionnaire, 15 items were intended to measure 5 latent variables concerning patient characteristics: disease burden, perceived control, socioeconomic status, computer literacy and health literacy.

Since these patient characteristics items were based on a combination of translated items from validated surveys in literature and self-created items, it is important to examine the factor structure of the current questionnaire. An EFA was performed using Ordinary Least Squared factoring with oblique rotation on the 15 items. This type of analysis was done because it does not assume multivariate normal distribution nor completely unrelated factors.

Five out of six items (in orange in table 2) about computer literacy resulted in a very low spread in answers. Participants hereby indicated that they were able to use a computer, find health related information on the internet, use email and use and download smartphone applications. The only question about computer literacy that the participants differed on was the question if they felt confident about their digital skills to use Engage. This question was used in the further analysis as an indicator of computer literacy.

In the EFA with the resulting ten items, we stepwise discarded items which did not load on any factors. After discarding two out of ten question items (items that have a factor loading below 0.3 in table 2; income and current work-status), we found three factors measuring the patient characteristics in contrast with the expected four constructs. Therefore, the question items were revisited and the factors were re-interpreted based on the items that loaded on them.

Based on the highest loading of each item on the new factors, re-interpretation was done resulting in the following three patient characteristics: patient confidence (3 items; confidence about digital skills, confidence about filling in medical forms, education), health literacy (2 items; problems with written information about condition, help needed with information from GP or hospital) and disease burden (3 items; disease under control, disease burden, perceived influence on disease). In table 2, all item loadings higher than 0.1 are displayed. In green, the item loadings that were included in the final SEM model are highlighted. The standardized Cronbach's α is reported for each factor, since the answer scales for each item are not always comparable.

Table 2 EFA of patient characteristics

Question Items	Derived factors after EFA		
	Confidence	Health literacy	Disease burden
Standardized Cronbach's α	0.71	0.89	0.60
Computer literacy			
Do you use a computer, smartphone or tablet with internet?			
Do you look for information about health or diseases on the internet?			
Do you use e-mail?			
Do you use applications on your smartphone or tablet?			
Are you able to download an application yourself?			
I feel confident about my (digital) skills to use Engage adequately.	0.585	-	-

Health literacy			
How often do you have problems with understanding written information about your disease?	-	1.003	-
How often do you need help with reading information from the hospital or the GP?	-	0.769	-
I feel confident when filling in medical forms.	0.902	-	-
Socioeconomic status			
What is your highest level of education?	0.581	-	-
What is your personal monthly net income (the amount you receive every month)?	0.281	-	-0.271
What is your current employment status?	-	-	-
Disease burden			
To what extent do you feel that your illness is well under control?	-0.228	-	0.580
How much of a burden do you experience from your illness(es) during the past month? Please rate between 1 (no burden at all) and 10 (unbearable burden). xDisBur3	0.150	0.151	0.457
Perceived control			
To what extent do you think that you yourself (through behavior) influence how well your disease is under control? xDisBur2	-	-	0.744

5.2.2 Confirmatory Factor Analysis (CFA)

Next, a CFA was conducted to validate the measured constructs and therewith checked whether the items used for each construct coming from the UTAUT: perceived effort, perceived performance, social influence and facilitating conditions, measured them reliably. The model fit for both the CFA as for all the SEM models are tested by several indices (Hooper et al., 2008). The Root Mean Square Error of Approximation (RMSEA) is a commonly used statistic which provides information about the 'badness of fit'. The value of this fit measure ranges between 0 and 1, for which a lower RMSEA value indicates a better model fit. Values below 0.08 are interpreted as a good fit (Taasoobshirazi & Wang, 2016). The Comparative Fit Index (CFI) is used because it is not very sensitive to sample size. The value of the CFI indicates the fit of a target model compared to the fit of an independent null model, for which values ≥ 0.90 are considered a good fit. The χ^2 assess the overall fit of the model and is based on the discrepancy between the sample and the fitted covariance matrices. This measure is sensitive to sample size. Since the H0 of this measure is: the model fits perfectly, a good model fit is represented by an insignificant χ^2 p-value, $p < 0.05$. Lastly, for the SEM models also the Bayesian Information Criterion (BIC) is used. This statistic is mainly used as a criterion for model selection among a set of models. When comparing models, the model with the lowest BIC has the best fit. When looking for the best model, it is possible

that the result is an overfitted representation of the data. The BIC attempts to resolve this problem by giving penalties for increasing numbers of parameters. When the BIC value of one model differs ten points from the other, it is a very strong indicator of the one model being better than the other (Hooper et al., 2008).

The CFA model did converge with low fit indices (RMSEA = 0.134 ($p < 0.05$), CFI = 0.777 and $\chi^2 = 465.622$ ($p < 0.05$)) indicating that the model does not fit the data. Therefore, we submitted the items to simpler versions of CFA, including only the items belonging to their respective construct. For every construct, we discarded items (in orange in table 3) with low loadings until for every simple CFA the χ^2 was insignificant ($p > 0.05$), meaning that the model fits the data. All items that resulted from these simple CFAs were combined in the total CFA which resulted in a better fitting model (RMSEA = 0.069 ($p < 0.05$), CFI = 0.915 and $\chi^2 = 40.21$ ($p = 0.15$)). In table 3, all item loadings of the final CFA are displayed that are higher than 0.1. In green, the item loadings that were included in the final SEM model are highlighted.

Table 3. Outcome of CFA for UTAUT variables and satisfaction score

Question Items	Derived factors after CFA				Satisfaction
	Perceived performance	Perceived effort	Social influence	Facilitating conditions	
Standardized Cronbach's α	0.93	0.79	0.88	0.91	0.86
Perceived performance					
Engage helps me deal with my chronic illness.					
Engage gives me insight into my health.					
Engage gives me a good overview of my treatment plan.	0.846	-0.127	-	0.138	-
Engage helps me set lifestyle goals that I want to work on.					
Engage provides me with a good overview of the lifestyle goals I want to work on.					
Engage makes me better informed about my condition.					
Engage allows my NP/GP to check my home measurements, which gives me confidence.					
Engage facilitates communication with my NP/GP.	0.762	0.303	-	-	-

Through Engage I have more control over my treatment (goals, actions, individual care plan).	0.973	-	-	-	-
By using Engage, I feel less of the need to visit my NP/GP.	0.763	-	0.111	-	-
Perceived effort					
I was successful in using Engage the first time.	-	0.660	-	0.152	0.307
I find Engage easy to use.	0.378	0.555	0.120	-	0.460
I quickly learned how to use Engage.	0.152	0.537	0.177	0.121	-
Engage looks attractive and inviting.					
I often find it unclear where to find something in Engage.					
Social influence					
I feel that my caregivers consider the use of Engage as important.	0.259	-	0.615	-	-
My care provider encourages the use of Engage.	-	-	1.026	-	-
My home environment encourages/supports the use of Engage.					
Facilitating conditions					
When I had a question or a problem with Engage, I was helped quickly and effectively.					
I have been explained how to use Engage.	-	-	-	0.849	-
I have been explained what to use Engage for.	-	-0.134	-	0.965	-
I know where to find an answer if I have a question about using Engage.	-0.102	0.294	-	0.816	-
I received enough support in learning to use Engage.	-	0.106	0.181	0.656	-
Satisfaction					
How satisfied are you with Engage?	-	-	-	-	0.892
I would like to continue using Engage.	-	-	-	-	0.993
Would you recommend Engage to other people with a chronic disease?	-	-	-	-	0.610

90% of participants reported to use Engage for less than 15 minutes per session, which were only the first two answers option out of five. Since the spread was low, we chose to omit this question from the latent variable Use. The latent variable use will only be measured by the item: how frequently do you use Engage?

5.3. Structural model: checking the inter-relationships

In order to test the structural dependencies between the factors, SEM was done with the items that were not eliminated during the EFA and CFA. To prevent multi-collinearity, only factors with low inter-correlation (less than 0.6) and VIF below 10 should be used (O'Brien, 2007). The factors in this study did not have high correlation or VIF scores.

In the first SEM model, figure 7, only the factors of the UTAUT were included. This resulted in a model with a quite decent model fit (RMSEA = 0.097, CFI = 0.916, BIC = 2253.88 and $\chi^2 = 160.54$ ($p < 0.05$)). However, the relationship between facilitating conditions and satisfaction was insignificant (standardized $\beta = 0.114$, $p = 0.484$) and all the predictors of use were insignificant in this first SEM model.

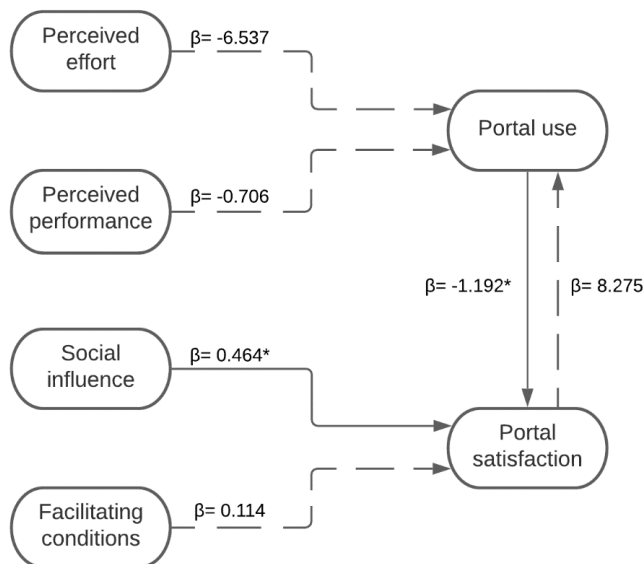


Figure 7. SEM model 1 with UTAUT factors, the significant relationships are indicated by a continuous arrow, while insignificant relationships are shown by a dashed arrow. The standardized beta coefficients are reported, including an asterisk when significant.

To optimize the UTAUT model in the context of patient portals, the patient characteristics were included in the second model to test if this would result in a better fit and give us more information. In the second model the patient characteristics were added in order to predict use and satisfaction with the

portal in a more realistic setting. The more elaborate model, shown in figure 8, resulted in a less optimal model fit according to the CFI, BIC and χ^2 fit measures, however the RMSEA score improved slightly (RMSEA = 0.088, CFI = 0.859, BIC = 3317.24 and $\chi^2 = 402.00$ ($p < 0.05$)). This is to be expected because of the increased number of parameters, which some fit measures penalize. Since all regression coefficients predicting use are insignificant, the model 3 only treats use as a predictor for satisfaction and no longer as an outcome variable.

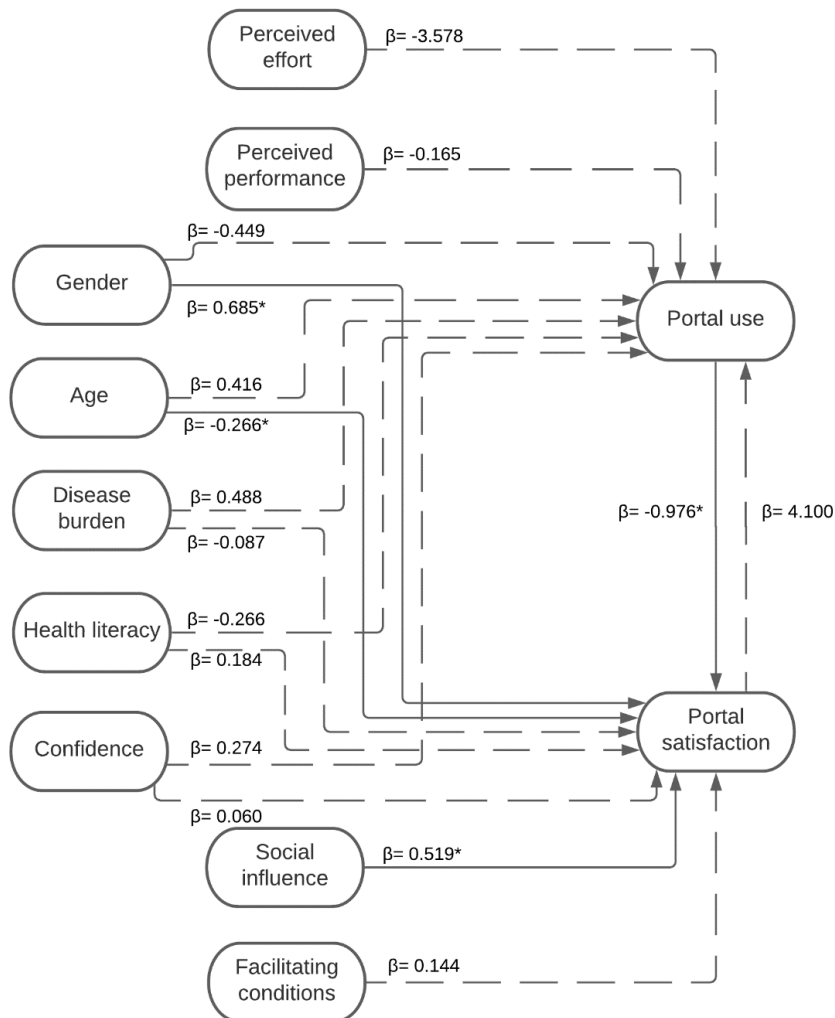


Figure 8. Model 2 with patient characteristics, the significant relationships are indicated by a continuous arrow, while insignificant relationships are shown by a dashed arrow. The standardized beta coefficients are reported, including an asterisk when significant.

When incorporating the patient characteristics that were found in the EFA and removing use as an outcome variable. The following modified model is created (figure 9). An ANOVA between model 2 and 3 shows no statistically significant difference between the model fits ($p = 1.00$). The model fit of the third model is as following: RMSEA = 0.090, CFI = 0.856, BIC = 3322.62 and $\chi^2 = 403.62$ ($p < 0.05$). The removal of use as an outcome variable does not statistically worsen the model fit. Since treating use as a predictor variable decreases the complexity of the model, which is better in the case of small sample sizes, and the fact that it does not decrease the model fit, we choose to continue with use as a predictor.

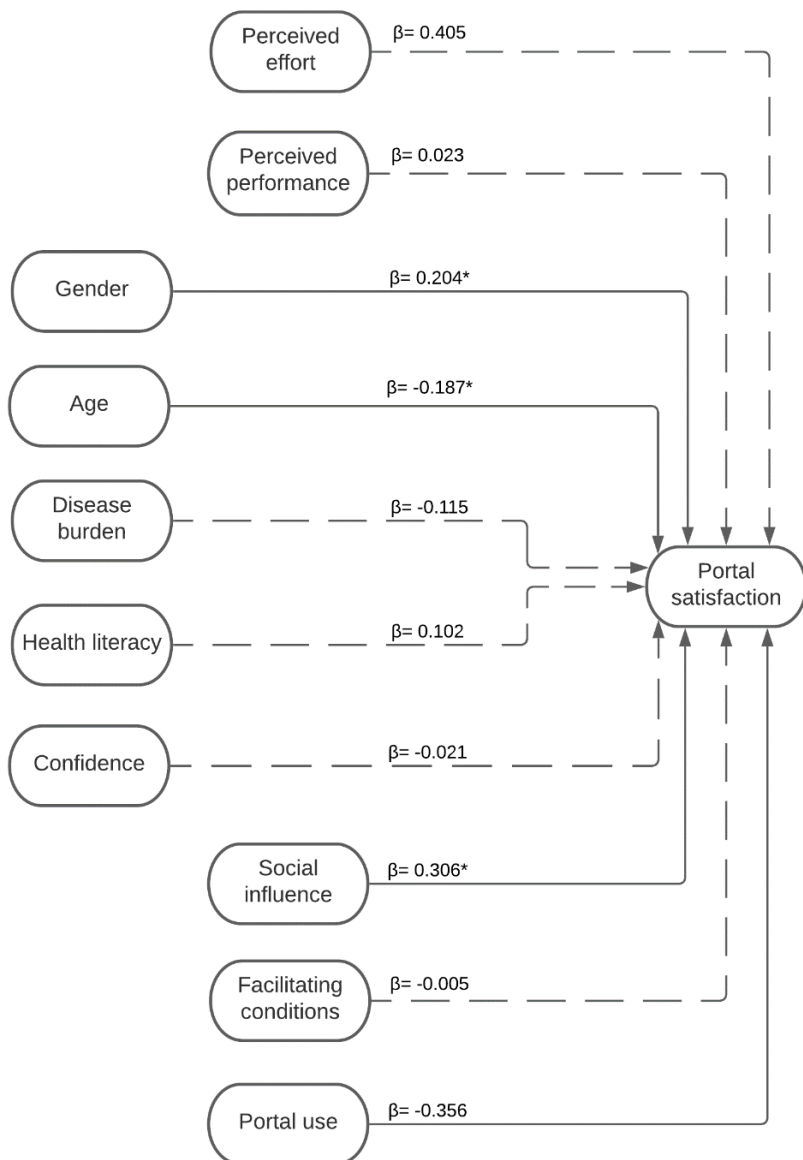


Figure 9. Model 3 with the construct use as predictor, the significant relationships are indicated by a continuous arrow, while insignificant relationships are shown by a dashed arrow. The standardized beta coefficients are reported, including an asterisk when significant.

Since in Lavaan, many covariances between predictors can be seen, we utilized the modification indices to see if there are other relationships in the data than hypothesized. Figure 10 shows the model based on the modifications suggested. The fit of the final model was RMSEA = 0.092, CFI = 0.875, BIC = 3008.04 and $\chi^2 = 328.47$ ($p < 0.05$). An ANOVA shows that the fit of this model is slightly but significantly better than the previous models. The fit is better because the adapted model based on modification indices is a better representation of the situation in the context of patient portals. What can be seen is that some predictors do not have a direct effect on satisfaction with a portal, which was hypothesized, but indirect effects through other variables. For example, facilitating conditions does not have a direct effect on satisfaction, but is mediated through social influence.

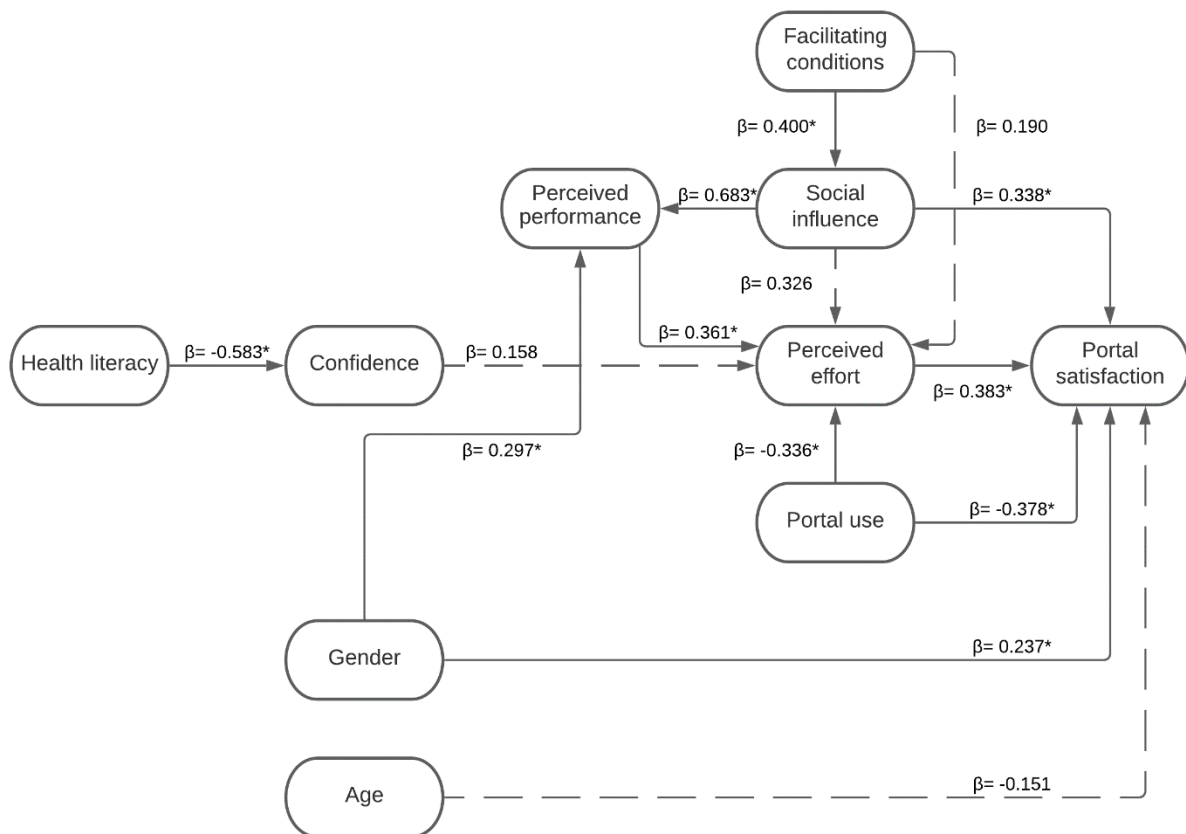


Figure 10. Model 4 based on modification indices, the significant relationships are indicated by a continuous arrow, while insignificant relationships are shown by a dashed arrow. The standardized beta coefficients are reported, including an asterisk when significant.

Figure 10 shows the final SEM model resulting from the adaptations based on the modification indices. As we can see, ten out of fourteen regression coefficients are significant ($p < 0.05$). Our model explains 71.7% of the observed variance in portal satisfaction ($R^2 = 0.717$).

Portal use was negatively correlated with perceived effort ($\beta = -0.336$, $p < 0.05$). According to H1, a relationship between these two factors was expected, however the direction of the relationship is reversed. Portal use is a predictor of perceived effort, but the data did not significantly support H1, in which perceived effort predicts portal use. According to H2, a positive association was expected between perceived performance and portal use, however in the model based on the empirical data, no such relationship was found.

According to H3, a direct, positive association between facilitating conditions and portal satisfaction was expected. This relationship was also not found in the resulting model. However, an indirect effect mediated by social influence was found between facilitating conditions and portal satisfaction. Meaning that if patients knew where to find help when using the portal, the extent to which they thought that people who are important to them endorse the portal increased. According to H4, a positive association between social influence and portal satisfaction was expected. This relationship is indeed seen in the model ($\beta = 0.338$, $p < 0.05$), so the data support H4. Thus, patients who are encouraged to use the portal, are more satisfied with the portal.

According to H5, a positive correlation is expected between patient satisfaction and portal use. However, the model shows a uni-directional, negative relationship between portal use and satisfaction ($\beta = -0.378$, $p < 0.05$). In other words, we did not find that patient who are more satisfied, use the portal more. On the contrary, we found that patients who use the portal more are less satisfied with Engage.

Next, the effects of patient characteristics on portal use and portal satisfaction were explored. No direct relationships were found. Yet, health literacy negatively correlates with patient confidence ($\beta = -0.583$, $p < 0.05$) and confidence is positively related to perceived effort, however insignificantly ($\beta = 0.158$, $p = 0.170$). These results do not support the expectation that patient characteristics influence the portal use and portal satisfaction. The negative relationship between health literacy and confidence makes sense when looking at the items measuring health literacy. The items measure how often a patient needs help when reading medial information and how often they face problems when reading medical information. A high score on the construct health literacy means they need help with understanding medical information. In other words, the negative relationship between the construct health literacy and patient confidence means that people with a higher health literacy have more

confidence when using Engage. Since perceived effort was measured as the extent to which people think Engage is easy to use, the insignificant, positive relationship between confidence and perceived effort entails that people who have more confidence when using Engage, score higher on perceived effort which means they think Engage is easier to use than people who have low confidence.

The SEM model gave us information about other relationships. Perceived effort was positively correlated with portal satisfaction ($\beta = 0.383$, $p < 0.05$). In other words, patients who perceive the portal as easier to use, are more satisfied with the portal. Perceived effort is influenced by facilitating conditions ($\beta = 0.190$, $p = 0.146$), social influence ($\beta = 0.326$, $p = 0.087$) and perceived performance ($\beta = -0.361$, $p < 0.05$). However, only the last relationship is significant, meaning that if the perceived performance can predict the perceived effort. In other words, if the perceived performance of Engage increases, patient perceive the use of Engage as easier. Facilitating conditions had a positive correlation with social influence ($\beta = 0.400$, $p < 0.05$), which had in turn a positive relationship with perceived performance ($\beta = 0.683$, $p < 0.05$). In other words, if patients knew where to find help in the portal, they had a higher feeling of social influence which in turn increased their perceived performance of Engage.

Furthermore, the patient characteristic gender had a positive relationship with perceived performance ($\beta = 0.297$, $p < 0.05$), meaning that females perceived a higher performance than males. Gender also had a direct, significant effect ($\beta = 0.237$, $p < 0.05$) on portal satisfaction, again meaning that females were more satisfied with the portal than males. Lastly, a just insignificant direct effect of age was found on portal satisfaction ($\beta = -0.151$, $p = 0.078$), which points into the direction that older people are less satisfied with Engage than younger people.

Chapter 6. Conclusion and Discussion

The motivation driving this study was found in the question what factors influence the use of and satisfaction with a patient portal. The Universal Theory of Use and Acceptance of Technology (UTAUT), which is widely used in Information Communication Technology (ICT) acceptance research, was applied in the medical domain in the context of patient portals. First, the main findings of the descriptive analysis as well as the structural equation modeling are described. Then, the implications are discussed and suggestions for portal optimization are done. Lastly, the limitations of this study and the potential for future research are discussed.

6.1 Main findings

6.1.1 Descriptive findings

From the descriptive results we can conclude that patients are in general quite satisfied with the use of Engage, about half of the patients values the features of Engage as beneficial and most patients are not afraid Engage will replace their consultation time with the health care professionals. Especially the feature of uploading home measurements was appreciated by patients. The fact that care professionals could check their values, gave them confidence. Another clear benefit of Engage was that for some patients the use of Engage saved time, because they felt that they had to call and visit the health professionals less often. This positive outcome could decrease the number of visits and therewith reduce the costs of health care without diminishing the quality of care.

Engage is meant as an extension of the regular health care and should ease the communication between patient and health professional. Next to that, Engage could replace parts of the traditional care by facilitating remote care which could reduce the number of less face-to-face consultations. Patients did voice that Engage facilitated easier communication between patient and care professional. Nevertheless, we see some clear room for improvement, since some patients feel that the information on Engage is not always up-to-date and the nurse practitioner does not always respond to their questions.

Another important problem that should be addressed is the lack of explanation to the patient about the exact purpose of Engage. Since this information is missing, some patients are confused about what they should use Engage for, indicating the need for clear instruction.

Additionally, we can conclude that, in this sample, the patient had a high level of computer literacy. This is also reflected in the fact that patients hardly faced any problems when using Engage.

However, despite the high level of computer literacy, large numbers of patients had trouble with logging-in, which is especially detrimental for first time users.

Open answered questions gave us insights in what features in Engage should be improved and how the interface affected the usability of certain features. We learned that there is some specific hassle with entering home measurements, which is undesirable since this is the most important feature of Engage according to the patients. The main problem with this feature was the location of the data entry, patient reported that this was not intuitively located and that they had to scroll down for every separate entry.

The answers to questions inspired by the outcome driven innovation method yield that patients are satisfied about (most of) the features that they find important. A majority of the patients considers the chat functionality, the ability to share and review home measurements, the education and information, and the possibility to capture agreements in the care plan as very important and indicate that they are quite satisfied with these features. However, we see that many features in Engage are not yet being used by all patients, including sending and receiving chat messages from the nurse practitioner and filling out and uploading home measurements. Many patients do not know of the existence of many features or they do not use them. So, the opportunity for Engage does not necessarily lie in the fact that some features should be improved, but in stimulating the use of the existing features.

6.1.2 Measurement model

Forty-six different questions from a variety of questionnaires regarding patient satisfaction and acceptance of technology were selected. It was intended to measure perceived effort, perceived performance, social influence, facilitating conditions, satisfaction, use and the patient characteristics: age, gender, SES, disease burden, perceived control, computer and health literacy. After dropping some items and re-interpreting some factors, the 25-item questionnaire showed good quality in terms of adequate internal consistency, all Cronbach's alphas were above 0.60. Even though most items were extracted from validated surveys, the Cronbach's alpha for disease burden was questionable low. This problem might be caused by the data that is used, since the variance of some items is quite low. This results in the core problem that it is nearly impossible to covary with other items. Low covariance leads to low correlation, of which the Cronbach's alpha is based upon. Also, the small sample might be a reason for low internal consistencies in the latent variables, since a few outliers in the data already have a huge effect.

Since the questions on computer literacy showed such a small spread, only one question about patients' computer skills confidence using Engage was used. The small spread, so only patients who could use all the options given in the survey, is likely caused by the manner in which patients are recruited to use the patient portal. The nurse practitioners choose which patients they deem suitable to use Engage, resulting in Engage being used only by patients with advanced computer skills.

6.1.3 Structural component

Some of the overall fit indices, RMSEA = 0.092 and CFI = 0.875, indicated that the fit of the final structural model was quite decent. Although the other fit statistics were almost in acceptable range, the χ^2 was significant, suggesting the null hypothesis of a perfect fit between the model and the empirical data can be rejected. Since this measure is quite sensitive to sample size, and our sample size was low, we did utilize this model to infer our conclusions. First, we discuss the relationships of the predictors, social influence, facilitating conditions, effort expectancy and performance expectancy, then we discuss the effects of patient characteristics.

Previous research found statistically significant antecedents of portal satisfaction in social influence, facilitating conditions, effort expectancy and performance expectancy (Silver et al., 2020). These four factors had a direct effect on portal satisfaction. In our particular study, we did not find the exact same results. The factors perceived effort and social influence did have a direct effect on portal satisfaction. However, perceived performance and facilitating conditions, contrary to our initial supposition, did not have a significant relationship with portal satisfaction. This might be explained by the fact that Silver and colleagues (2020) used performance expectancy and effort expectancy as predictors, where our participants voiced their perceived performance and perceived effort. The participants in the study of Silver and colleagues (2020) were not given the opportunity to form an opinion based on actual use, where our participants did have this opportunity. Another possible explanation for the different findings is that Silver and colleagues used students in their research, whereas we had actual patients as participants. A high score for perceived effort indicates that patients think Engage is easy to use, the positive relationship between perceived effort and portal satisfaction is as expected, if the usability of the portal is better, the patients are more satisfied with the portal. The direct relationship between social influence and portal satisfaction is also intuitive, meaning that if patients think their social circle finds the use of Engage important, they are more satisfied with the portal. This could be explained by the fact that if nurse practitioners find Engage a valuable tool, they stimulate the patient more to use it, resulting in a heightened satisfaction of the patients with the portal. We did not find a direct effect of performance on satisfaction as Silver and colleagues did, however, we

did find an indirect effect of perceived performance on satisfaction mediated by perceived effort. One option to explain this relationship could be that patient who think Engage has a high performance, find Engage easier to use than patients who think Engage does not perform well. Which could be caused by the extent to which the nurse practitioner explains both the benefits of Engage as well as how patients should use the portal. Lastly, the fact that we could not find a direct relationship between facilitating conditions and portals satisfaction as Silver and colleagues found, could be explained based on the manner in which facilitating conditions is measured. We measured facilitating conditions as the amount of support available when using the system by asking the patients if they know where to find help in case of questions and if they receive enough explanation when first using the portal. Silver and colleagues measured if the portal was compatible with other technologies, resulting in a different interpretation of the construct. To my best knowledge, the relationship between facilitating conditions, as we have measured it, and social influence is not found in previous research. Facilitating conditions is the perception on how much help is available when using the patient portal. Social influence is the construct measuring the degree to which the patient perceives that important others believe he or she should use the system. The relationship that we found might be explained by patients who receive more help from their nurse practitioner, which increases the facilitating conditions, also feel that the nurse practitioner finds the use of the patient portal more important, thus increasing the social influence. This stresses the importance of the explanation and external motivation given by the nurse practitioners.

Social influence heavily influences perceived performance (standardized $\beta = 0.683$). We did not find this in any other previous study. However, in the context of Engage, this can be explained. The nurse practitioner is the person who offers the use of Engage to the patients. If the nurse practitioner stresses how important it is that the patients uses the patient portal (higher social influence), they probably do this by explaining the benefits and the features of Engage to the patient. This could lead to a heightened perceived performance, since patients are explained better what to do in Engage. This stresses the importance of the nurse practitioner again in the implementation phase of the portal. If the nurse practitioner explains the portal well, the patients feel an increased perceived performance.

In our hypothesized model (figure 2), we had expected that use and satisfaction had a bi-directional relationship. However, we found that satisfaction with the portal could not significantly predict the portal use. However, portal use does have a negative effect on portal satisfaction. These results indicate that the more often users log-in on the Engage patient portal, the less satisfied they are with the portal. The usage of the portal allows the patient to form an opinion about the portal. In this

case, patients became less satisfied when they used the portal more often. This could be explained by previous research by Huang (2008) who integrates irritation as a factor in the prediction of technology acceptance. We could speculate that irritation is increased by sustained use, which in turn decreases the satisfaction with the portal. In future research, the factor irritation could be added in the research model to see if irritation is a mediator between use and satisfaction.

According to the research by Lazard and colleagues (2016), we expected a negative relationship between effort and portal use (H1). However in H1, perceived effort is a predictor of use. In this study, we found that use was a predictor for perceived effort. If patients used the portal more, they experience the portal as less easy to use. One explanation could be that patients log-in more when they are unsure about how to use Engage.

Most patient characteristics that were measured did not have a significant relationship with other latent factors in the model. In fact, adding disease burden to the model decreased the model fit significantly, resulting in the exclusion of this construct from the final model. The patient characteristic, health literacy, had a negative significant effect on confidence. This is explained by the way health literacy is measured. A high score on health literacy means that the patient requires help with understanding medical information. The negative effect of health literacy on confidence can be explained by the fact that if patients need help with understanding medical information, their confidence with using a patient portal is low. In the final model, confidence does not have a significant effect on perceived effort, however the relationship is positive. One possible explanation could be that patients who have confidence in using a system as Engage, have a high digital literacy and education level, consequently they perceive Engage as easy to use.

The only significant patient characteristic is gender. The males were coded as 1 and the females were coded as 2. The positive effect of gender on perceived performance and portal satisfaction means that females were in general more satisfied with the portal and perceived a higher performance than males. Previous research by Venkatesh and colleagues (2003) found moderating effects of age and gender on the relationships of performance expectancy, effort expectancy and social influence with behavioral intention and a moderating effect of age on facilitating conditions and use behavior. This could also be expected in our study. However, this was not indicated by the modification indices in Lavaan. One explanation for the lack of these moderating effects could be that the model fit would not increase by adding these moderators since it increases the model complexity. Another reason for not finding a moderating effect of age on other relationships in the model was the limited variance in this

variable since 84% of the participants fell in the same two answer categories. In other words, there might be moderating effects involved in explaining the use and satisfaction with patient portals, however, we cannot show that based on the data collected in this research.

In this study, we could not find evidence for use being affected by the other latent variables. However, when reasoning about a possible explanation, it is highly unlikely that use is not affected by perceived effort, perceived performance or satisfaction with the portal. Looking into how use was measured we found a possible explanation for not finding any relationships to portal use. Use was measured with a single item, since the other item that we planned on using for factor showed very little variance. The one item we did use to measure use, did not have a linear scale, which might have caused an unrealistic distribution.

6.2 Implications and suggestions for portal optimization

Findings on some of the determinants of portal satisfaction have important implications for portal optimization and thus need some further consideration. The patient portal Engage could improve on multiple fronts. First of all, we would like to discuss the non-users of the patient portal. The patient portal is offered to the patients by nurse practitioners. These nurse practitioners only invite the patients they think are tech-savvy enough. As a consequence, the portal is only used by patients with advanced computer skills and patients with low computer skills are excluded from participation. Engage should be offered to more patients, we suggest a tool for the nurse practitioner to objectively assess whether a patient will be able to use Engage alone or if the patient needs assistance. If the patient cannot work with Engage individually, we suggest additional explanation or guidance to clarify the main goals of Engage and a training which makes it easier to use Engage. Patients might think Engage is too hard for them, so they might have the skills but are too afraid to try. Since the nurse practitioners are the 'gatekeepers' who decide which patients are offered to use Engage and which patients are not included, some patients that might be able to use Engage do not get the opportunity to do so. Since the nurse practitioners are already over-worked, it might be a good idea for the implementation phase to have a specialized contact person, either somebody from Engage or one person per care group, who can voice the benefits for the patients and helps with all questions, in order to take some load of the nurse practitioners.

In order for both non-users and users to become active on the portal, it is essential for the patient to see the benefits of the portal. Patient reported that they did not know why they had to use Engage. Which could indicate that they do not perceive the patient portal as useful. Another question

some patient had, is if the portal is going to replace consultation time with the care professionals. These questions about the intention of Engage and the replacement of consultation is caused by a lack of information to the patient. If the patient is only offered to use the portal, but is not explained why and how, it will only lead to more questions or even anxiety amongst the patients. Again, a way to do this is be instructing the patient better. The patients showed interested in the following ways of extra instruction: ten patients were interested in a short movie about the main features of Engage. We suggest making disease-specific movies in which it is explained what the main features for a person with that type of disease are in the portal. 24 patients voiced their interest in either a short pamphlet or a more elaborate manual about Engage. Since most patients that use Engage at the moment are between 55 and 74 years old, they might not be of the trial-and-error-generation. The user of Engage would be more interested in reading a complete manual in order to get a grasp on what they could do in Engage. We asked the patients if they would be interested in receiving instruction in a group setting, however current users were not interested in this form of training.

Another important problem we have seen with Engage are problems with logging into the portal. This is both for the current users as for the potential users detrimental. If patients are already not sure about the benefits, then they face a problem with logging in, they might lose interest overall. The manner in which patient can log in, should be easy while ensuring privacy and security. Two-factor authentication ensures this, however it could still lead to log in issues. Yet to avoid non-adoption by patients due to login issues they might experience, we encourage investigating new, secure and user-friendly authentication options that may better suit an older population, for example by using single sign-on or biometrics during authentication (i.e. a photo of a patient's face, a record of a patient's voice or an image of a patient's fingerprint).

As an addition to current standard functionalities and content of the patient portal, additional content should be included to meet the patients' expectations. Some patients suggested that the values of their measurement did not mean anything to them, because they lacked the knowledge of what fell in a normal range. Additionally, the use of unknown, medical terms was frustrating for some patients. A suggestion for optimizing this part for the patients would be to add ranges so patient know if their home measurements are (ab)normal and when they should call the GP's office. Another feature that should be added is for every medical term that is used, a hyperlink on the term should be added with a small explanation of that term.

Some participants voiced their opinion stating that Engage is not an easy program to use, especially for the elderly. Since we do not know what they based this opinion on, we suggest a qualitative, follow-up study with patients in which we would be able to explore where the difficulties lie and how to improve based upon these results.

Based on the results of the structural equation model, perceived effort and social influence are the most important factors in predicting patient satisfaction with the portal. In this small sample, the patient characteristics were not statistically significant predictors of satisfaction with the portal. This is not a bad thing, since we cannot change the patient characteristics, but we can improve the factors related to the portal and to the social influence patients experience. Since social influence and perceived effort turned out to be such important factors in predicting portal satisfaction, we should keep them in mind when improving the implementation strategy of Engage. In order to improve the satisfaction with the portal, the social influence could be increased by involving the home environment of the patient. A suggestion would be the option to fill in the contact information of a family member or other trustee, who receives a message with information about the portal and the option to observe the measurements and tasks in the portal. This way, the home environment can support the patient when using Engage. Also, we should make the nurse practitioner aware of the role they can fulfill in encouraging the patients to use Engage. For example, the patients found it important that the nurse practitioner reacted quickly to their questions and that all the information in the portal was up to date. If nurse practitioners react quickly in the portal, this expresses that the nurse practitioner thinks the use of Engage is important.

In order to have a quick overview of the suggestions for platform optimization, we included a summary;

1. A tool is required to objectively assess whether a patient is able to use Engage.
2. Some workload should be taken of the nurse practitioners by designating a specialized contact person from Engage to which patients can ask their questions.
3. The patients should be better informed about the benefits and features of Engage by viewing disease-specific instructional videos and a clear manual.
4. The log in problems should be resolved by investigating secure and user-friendly authentication options.
5. Engage should have additional features such as explanations about (ab)normal ranges of home measurements and medical terms.
6. Engage should explore usability with the (elderly) target group and see why patients think Engage is a

difficult system to use in order to reduce the perceived effort.

7. The social influence should be increased by involving family and informing nurse practitioners of their importance in stimulating the portal.

6.3 Limitations and future work

In this research, we made use of online surveys. This could have resulted in an inclusion bias, since only patients who read their e-mail and are interested in Engage filled in the survey. Even though the latent factors from the UTAUT and the patient characteristics were measured at a relatively good quality, the self-reported use of the patient portal may suffer from inaccuracies. Therefore, in future research the difference between self-reported use and objective data from Engage should be examined further. Additionally, it would be interesting to conduct a similar study with objective use data as an outcome variable instead of the self-reported use.

Moreover, this study was conducted with users of the Engage patient portal. Although, on one hand, this gives us the opportunity to study the acceptance and the satisfaction with the patient portal in a real-life setting, on the other hand, this recruitment strategy causes an inclusion bias. Since all participants are or were users of the Engage patient portal, this indicates that all participants are indeed computer, smartphone and/or tablet users. In order to distinguish the computer literacy of participants, more in-depth high-level questions were asked than 'Do you use a computer?'. Therefore, the Pharos Quick scan (*Quickscan Digitale Vaardigheden van Je Patiënten - Pharos, 2020*) was used. However, this validated survey was not an adequate measure for the variance in this sample. We realize that the patients in this sample are a very tech-savvy part of the population, which is great for using Engage, however in future research it is important to include patients with a lower computer literacy to reduce the sample bias. In addition, we used e-mail for sampling participants and thus created a selection effect, since patients that are more motivated are more likely to respond to the survey. Earlier work has shown that people with a higher social economic status have a better physical health (Wang & Geng, 2019), stressing the importance of including patients with a low SES in the use of patient portals. For increasing our understanding of the effect of social economic status and computer literacy, it is important to collect data from a more diverse group of patients, and see what factors affect portal use and satisfaction then. In order to collect data from a more diverse group, oversampling in the less prevalent groups of the current sample should be done or a different recruitment strategy than via e-mail should be explored, as for example recruiting patients at the GP's office.

Another problem we face with the real-life setting is that some patients might not see self-management as a benefit, so they might not be interested in using a patient portal at all as they would like to have the patient-provider relationship remain as it was. Since we only used patient that have an account on Engage in the sample, this caused a bias in the representativeness of the patient population. Since patients who don't use Engage because they experience anxiety from patient portals are not included in the sample, we cannot conclude anything about the patients that were not willing to try the portal. Future research should also focus on these patients, since they might experience the most barriers in the uptake of a patient portal.

We identified a limitation in this study concerning sample size. We had planned to recruit at least 120 participants to participate in this study in order to reliably perform structural equation modeling. However, due to the Covid-19 crisis, nurse practitioners were busier and had less time to include new patients in Engage. Another problem was the recruitment strategy, the nurse practitioners had to send out an email to the possible participants of this study. We had planned on a data collection of one month, however after one month, only one care group had sent out the invitation to the study. Numerous reminders via email and telephone and three months later, we managed to get three care groups to send out the initial invitation and at least one reminder to the patients. However, this recruitment strategy did not suffice in reaching the minimal number of participants. Nevertheless, we were able to find some important factors in the satisfaction of patients with the portal. Also, the identified problems and benefits based on the descriptive findings are valuable in the improvement of Engage.

Since we did create a structural equation model based on fifty participants, we risk the problem of overfitting the model on the data. The reliability to test a complex model is low when the sample size is small. Additionally, many fit indices have as limitation that they are only valid when sample size is much larger than the number of parameters in the model. However, we could not comply to these assumptions of the fit indices. Nevertheless, the CFI score of the final SEM model indicated that the model almost represented the empirical data well, even though this index is not very sensitive to sample size.

The data gathering in this study was a one-time survey. However, we expect that the usage of the portal affects the satisfaction and possibly also the factors, indicating that it is a process that we are interested in. The variables are likely to be subject to change and may change through the actual use of

Engage. We propose an alternative follow-up research in which the satisfaction of the patients can be measured throughout a period of time.

6.4 Overall conclusion

Despite some limitations in this study, we have shown that for most patients in this sample, patient portals are a welcome innovation to increase their self-management of their disease and to facilitate remote care. The patients were quite satisfied with the patient portal, but they did face certain problems. Unfortunately, the sample in this research did not represent the entire population well, since only people that were deemed qualified enough by the nurse practitioner were invited to participate in the use of Engage. We did find factors that influenced the satisfaction of patients, however we could not infer conclusions about all predictors of interest. Nevertheless, we found that about half of the patient clearly saw the benefits of the different features in Engage, leaving room for improvement especially in the context of information supply to the patient. Since patient portals might not be easy to use for all patients, we should objectively assess for which patients Engage is suitable to use without additional help and which patients need some additional training. If we can improve certain aspects of patient portals, more patients can enjoy patient portals as a promising solution for remote care.

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Appendix A: Overview of the meaning of each construct

Construct	Definition
Perceived effort	The degree of ease related to consumers' use of technology (Tavares & Oliveira, 2016)
Perceived performance	The degree to which using a technology will provide benefits to consumers in carrying out certain activities (Tavares & Oliveira, 2016)
Social influence	The extent to which consumers perceive that others who are important to them (friends, family, people who share the same disease, GP, specialist) believe they should use the technology (Tavares & Oliveira, 2016)
Facilitating conditions	The support available in the system (Tavares & Oliveira, 2016)
Portal satisfaction	The extent to which patients are satisfied with using the portal in a holistic way
Disease burden	The severity of a disease and its possible impact on daily life (Gidron, 2013)
Socioeconomic status	Status that can be determined by education, work status and income (Shavers, 2007)
Computer literacy	The ability to use computers, tablets or smartphones efficiently (<i>Quickscan Digitale Vaardigheden van Je Patiënten - Pharos, 2020</i>)
Health literacy	"The degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions" (Institute of Medicine, 2004)

Appendix B: Survey items

Hoe tevreden bent u over Engage? Geef een cijfer, tussen de 1 (heel ontevreden) en 10 (heel tevreden).

1	2	3	4	5	6	7	8	9	10
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Hoe vaak gebruikt u Engage?

- (Vrijwel) dagelijks
- Meerdere keren per week
- Ongeveer 1 keer per week
- Enkele keren per maand
- Ongeveer 1 keer per maand
- Ongeveer 1 keer per 3 maanden
- (Bijna) nooit

Als u Engage gebruikt, hoe lang gebruikt u het dan per keer?

- minder dan 5 minuten
- 5-15 minuten
- 15-30 minuten
- 30-60 minuten
- meer dan een uur

Hoe lang gebruikt u Engage al?

- Minder dan 1 week
- 1 week tot 1 maand
- 1 maand tot 3 maanden
- 3 maanden tot 6 maanden
- Langer dan 6 maanden
- Ik ben weer gestopt/nooit begonnen met het gebruik van Engage, want:

Hoe ervaart u de hoeveelheid tijd die u nodig heeft op Engage?

- Het kost me te veel tijd
- Het kost me veel tijd, maar niet te veel
- Het is prima zo
- Het levert me tijd op, omdat ik minder hoeft te bellen of mailen met mijn zorgverlener, of er langs hoeft te gaan

In hoeverre bent u het eens met de volgende stelling:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Ik ga graag door met het gebruik van Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In hoeverre bent u het eens met de volgende stellingen:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Engage helpt mij met mijn chronische ziekte om te gaan.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engage geeft mij inzicht hoe het staat met mijn gezondheid.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engage geeft me een goed overzicht van mijn behandelplan.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engage helpt me bij het opstellen van leefstijldoelen waar ik aan wil werken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engage geeft me een goed overzicht van de leefstijldoelen waar ik aan wil werken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Door Engage ben ik beter op de hoogte van mijn aandoening.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Door Engage kan mijn praktijkondersteuner (POH) en/of huisarts mijn meetwaarden controleren, dat geeft mij vertrouwen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engage vergemakkelijkt het communiceren met mijn praktijkondersteuner (POH) en/of huisarts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Door Engage heb ik meer regie over mijn behandeling (doelen, acties, individueel zorgplan).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Door het gebruik van Engage voel ik minder de noodzaak om mijn praktijkondersteuner en/of huisarts in de praktijk te bezoeken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik ben bang dat de consulten met mijn praktijkondersteuner en/of huisarts vervangen gaan worden door zorg op afstand met Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Belang en tevredenheid van de mogelijkheden van Engage

In de **blauwe, dikgedrukte tekst** ziet u steeds een mogelijkheid in Engage.

Over iedere mogelijkheid stellen we 2 vragen:

1. Hoe belangrijk is dit voor u? Als u deze mogelijkheid in Engage nog nooit heeft gebruikt, probeer dan te bedenken of deze mogelijkheid belangrijk voor u zou kunnen zijn.
2. Hoe tevreden bent u over deze mogelijkheid? Als u deze mogelijkheid in Engage nog nooit heeft gebruikt, vul dan in: 'Nog niet gedaan'.

Goede informatie of educatie vinden over uw aandoening en behandeling, bijvoorbeeld informatie over de medicatie voor uw aandoening.

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Afspraken met mijn praktijkondersteuner (POH) vastleggen in mijn individueel zorgplan (IZP), bijvoorbeeld over medicatie-inname, persoonlijke streefwaarden of leefstijldoelen.

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Thuis)meetwaarden invullen en delen met mijn praktijkondersteuner (POH) en mijn meetwaarden uit het verleden inzien (bijvoorbeeld glucose-/suikerwaarden of bloeddruk).

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Dagboek bijhouden en delen met mijn praktijkondersteuner (POH) (en/of huisarts), bijvoorbeeld met symptomen, voeding of ervaringen.

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Vragenlijst invullen en inzien, bijvoorbeeld ter voorbereiding op een consult.

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Tekstbericht (chat) sturen naar uw praktijkondersteuner, bijvoorbeeld om een vraag te stellen.

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Tekstbericht (chat) lezen van uw praktijkondersteuner, bijvoorbeeld met antwoord op een vraag.

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Het openen en inzien van ToDo's (taken).

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Het uitvoeren en afronden van ToDo's (taken).

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Het inzien welke zorgverleners betrokken zijn bij mijn behandeling.

	Helemaal niet belangrijk	Enigszins belangrijk	Redelijk belangrijk	Zeer belangrijk	Uitermate belangrijk
Hoe belangrijk is dit voor u?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal niet tevreden	Enigszins tevreden	Redelijk tevreden	Zeer tevreden	Uitermate tevreden	Nog niet gedaan
Hoe tevreden bent u over deze mogelijkheid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Welke van de onderstaande uitspraken is het meest op u van toepassing?

- Door het gebruik van Engage ben ik **minder bezorgd** geworden over mijn aandoening dan toen ik Engage nog niet gebruikte.
- Door het gebruik van Engage ben ik **niet anders** gaan aankijken tegen mijn aandoening.
- Door het gebruik van Engage ben ik **bezorgder** over mijn aandoening geworden dan toen ik Engage nog niet gebruikte.

In hoeverre bent u het eens met de volgende stellingen:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Het lukte mij goed om Engage de eerste keer te gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik vind Engage gemakkelijk in gebruik.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik leerde snel om Engage te gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engage ziet er mooi en uitnodigend uit.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik vind het vaak onduidelijk waar ik iets kan vinden in Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Geef aan welke problemen u wel eens met Engage heeft gehad. Als u de actie nog niet gedaan heeft, vult u in: 'Nog niet gedaan'.

	Nooit problemen	1 keer een probleem	2 keer of vaker problemen	Nog niet gedaan
Problemen met het openen of inloggen op Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Problemen met het inzien van meetwaarden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Problemen met het invullen, uploaden of verzenden van meetwaarden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Problemen met het versturen van berichten (chat).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Langer dan gewenst moeten wachten op een antwoord van de praktijkondersteuner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Onduidelijkheid over wanneer ik meldingen krijg per e-mail wanneer er een taak of bericht klaar staat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Andere communicatieproblemen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Heeft u andere problemen ondervonden met Engage? (Deze vraag is niet verplicht)

In hoeverre bent u het eens met de volgende stelling:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens	NVT, geen vraag gehad
Toen ik een vraag of een probleem had met Engage, werd ik goed en snel geholpen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In hoeverre bent u het eens met de volgende stellingen:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Ik heb het gevoel dat mijn zorgverlener(s) het gebruik van Engage belangrijk vinden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mijn zorgverlener stimuleert het gebruik van Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mijn thuisomgeving stimuleert en/of ondersteunt het gebruik van Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In hoeverre bent u het eens met de volgende stellingen:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Als ik Engage wil gebruiken heb ik hulp van een ander nodig.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aan mij is goed uitgelegd hoe ik Engage moet gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aan mij is goed uitgelegd waarvoor ik Engage moet gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik weet waar ik een antwoord kan vinden, als ik een vraag heb over het gebruik van Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik kreeg genoeg ondersteuning bij het leren gebruiken van Engage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Op welke manier zou u meer instructie over het gebruik van Engage willen ontvangen?

- Brochure of folder met uitleg
- Uitleg door een persoon
- Groepsinstructie
- Duidelijke handleiding
- Filmpje
- Anders, namelijk:
- Ik heb niet meer instructie dan ik heb gehad

Beantwoord alstublieft de volgende vragen:

	Ja	Met hulp	Nee
Gebruikt u een computer, smartphone of tablet met internet?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zoekt u wel eens informatie over gezondheid of ziektes op het internet?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gebruikt u e-mail?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gebruikt u wel eens een app op uw smartphone of tablet?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kunt u zelf een app downloaden op uw smartphone of tablet?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In hoeverre bent u het eens met onderstaande stelling:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Ik voel me zelfverzekerd over mijn (digitale) vaardigheden om Engage goed te gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Beantwoord alstublieft onderstaande vragen:

	Nooit	Zelden	Soms	Vaak	Altijd
Hoe vaak heeft u problemen met het begrijpen van geschreven informatie over uw ziekte?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hoe vaak heeft u hulp nodig bij het lezen van informatie van de huisarts of het ziekenhuis?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In hoeverre bent u het eens met de volgende stelling:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Ik voel me zelfverzekerd bij het invullen van medische formulieren.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In hoeverre heeft u het idee dat uw ziekte goed onder controle is?

- Uitstekend
- Zeer goed
- Goed
- Matig
- Slecht

In hoeverre denkt u dat u zelf (door middel van uw gedrag) invloed heeft op hoe goed uw ziekte onder controle is?

- Veel invloed
- Beetje invloed
- Matig invloed
- Weinig invloed
- Geen invloed

Hoeveel last heeft u ervaren van uw ziekte(s) gedurende de afgelopen maand? Geef een cijfer tussen 1 (helemaal geen last) en 10 (ondragelijk veel last).

1	2	3	4	5	6	8	7	9	10
---	---	---	---	---	---	---	---	---	----

Welke chronische aandoening(en) heeft u? (meerdere antwoorden mogelijk)

- Diabetes/suikerziekte
- Hartfalen
- Hoge bloeddruk
- Artrose
- Angststoornissen
- Astma/COPD
- Anders, namelijk:
- Niets

Heeft u wel eens de dosering van uw medicatie aangepast op basis van gegevens uit Engage, zonder overleg met uw zorgverlener?

- Ja, dat heb ik zelfstandig gedaan.
- Ja, maar alleen op basis van eerder gemaakte afspraken met mijn zorgverlener.
- Nee, dat heb ik nooit gedaan.

In hoeverre bent u het eens met de volgende stelling:

	Helemaal oneens	Oneens	Niet oneens en niet eens	Eens	Helemaal eens
Ik vertrouw erop dat in Engage mijn medische gegevens goed beschermd worden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Wat is uw hoogst afgeronde opleiding?

- Basisschool
- Middelbare school (bijvoorbeeld: mulo, ulo, hbs, mss, vmbo, HAVO, VWO, etc.)
- Middelbaar beroepsonderwijs (bijvoorbeeld: MTS, etc.)
- Hoger beroepsonderwijs (bijvoorbeeld: hbo-v, hts, kweekschool, pabo, etc.)
- Wetenschappelijk onderwijs (bijvoorbeeld: universiteit, etc.)

Wat is uw persoonlijk maandelijks netto-inkomen (het bedrag dat u per maand ontvangt)?

- Minder dan €1.000,-
- €1.000,- tot €2.500,-
- €2.500,- tot €5.000,-
- €5.000,- of meer
- Zeg ik liever niet / weet ik niet

Wat is uw huidige werk-status?

- Full-time / voltijd (35 uur of meer per week)
- Part-time / deeltijd (minder dan 35 uur per week)
- Gepensioneerd
- Arbeidsongeschikt
- Ik heb (op het moment) geen betaalde baan

Wat is uw geslacht?

- Man
- Vrouw
- Anders:
- Zeg ik liever niet

Wat is uw leeftijd?

- Jonger dan 18 jaar
- 18-24 jaar
- 25-34 jaar
- 35-44 jaar
- 45-54 jaar
- 55-64 jaar
- 65-74 jaar
- 75-84 jaar
- 85 jaar of ouder
- Zeg ik liever niet

Zou u Engage aanbevelen aan andere mensen met een chronische ziekte? Geef een cijfer tussen 0 (zeer niet) en 10 (zeer wel).

0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

Heeft u nog suggesties om Engage te verbeteren? Mist u nog dingen? (Meerdere opties mogelijk)

- Niets
- Leefstijlcoachingsprogramma's (bijvoorbeeld coach programma voor 'gezond bewegen' of 'gezond eten').
- Mogelijkheid om contact met andere patiënten te leggen (bijvoorbeeld via chat).
- Instellen en aanpassen van meldingen per e-mail (bijvoorbeeld voor chat en meetwaardes).
- Mogelijkheid om zelf relevante informatie te selecteren uit een digitale 'bibliotheek' binnen Engage.
- Videobellen met praktijkondersteuner (of andere zorgverlener).
- Mobiele app voor Engage
- Anders, namelijk:

Appendix C: Python code to create graphs

```
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib.pyplot import *
import numpy as np
%matplotlib inline

df = pd.read_excel("Total_responselabels.xlsx")
cmap = cm.get_cmap('RdYlGn')
```

```
fig, ax = subplots()
order = ['18-24 jaar', '45-54 jaar', '55-64 jaar', '65-74 jaar', '75-84 jaar']
# add: 'Jonger dan 18 jaar', '25-34 jaar', '35-44 jaar', , '85 jaar of ouder', 'Zeg ik Liever niet'
df.iloc[:,108].value_counts().loc[order].plot(ax=ax,kind='bar')
ax.set_title('Wat is uw leeftijd?')
```

```
fig, ax = subplots()
order = ['(Bijna) nooit', 'Ongeveer 1 keer per 3 maanden', 'Ongeveer 1 keer per maand',
        'Enkele keren per maand', 'Ongeveer 1 keer per week', '(Vrijwel) dagelijks']
df.iloc[:,2].value_counts().loc[order].plot(ax=ax,kind='bar')
ax.set_title('Hoe vaak gebruikt u Engage?')
```

```
fig, ax = subplots()
df.iloc[:,1].value_counts().sort_index().plot(ax=ax,kind='bar',rot=3600)
ax.set_title('Mijn tevredenheid met Engage')
ax.set_ylabel("Aantal patiënten", xlabel="Cijfer")
```

```
fig, ax = subplots()
order = ['Het kost me te veel tijd', 'Het kost me veel tijd, maar niet te veel', 'Het is prima zo',
        'Het levert me tijd op, omdat ik minder hoeft te bellen of mailen met mijn zorgverlener, of er langs hoeft te gaan', '-']
df.iloc[:,6].value_counts().loc[order].plot(ax=ax,kind='bar')
ax.set_title('Hoe ervaart u de tijd die u nodig heeft op Engage?')
```

```
#fig, ax = subplots()
#order = ['Door het gebruik van Engage ben ik minder bezorgd geworden over mijn aandoening dan toen ik Engage nog niet gebruikte.
#df.iloc[:,42].value_counts().loc[order].plot(ax=ax,kind='bar')
#ax.set_title('Bezorgd')
```

```
#diabetes = df.iloc[:,85].count('Diabetes/suikerziekte')
# define string
```

```
diabetes = df['Type aandoening (Q42_1)'].value_counts()
hart_en_vaar = df['Type aandoening (Q42_2)'].value_counts()
hoge_bloeddruk = df['Type aandoening (Q42_3)'].value_counts()
artrose = df['Type aandoening (Q42_4)'].value_counts()
angst = df['Type aandoening (Q42_5)'].value_counts()
astma_COPD = df['Type aandoening (Q42_6)'].value_counts()
anders = df['Type aandoening (Q42_7)'].value_counts()
```

```
#diabetes.head()
#hart_en_vaar.head()
#hoge_bloeddruk.head()
#artrose.head()
#angst.head()
#astma_COPD.head()
#anders.head()
```

```

labels = ['Helemaal oneens', 'Oneens', 'Niet oneens en niet eens', 'Eens', 'Helemaal eens']
def make_label_value_pairs(df, labels):
    h=0
    o=0
    n=0
    e=0
    he=0
    for i in df:
        if i==labels[0]:
            h = h+1
        elif i==labels[1]:
            o = o+1
        elif i==labels[2]:
            n = n+1
        elif i==labels[3]:
            e = e+1
        elif i==labels[4]:
            he = he+1
    return ([h, o, n, e, he])

```

```

def make_label_value_pairs_satisfaction(df, labels):
    h=0
    o=0
    n=0
    e=0
    he=0
    nv=0
    for i in df:
        if i==labels[0]:
            h = h+1
        elif i==labels[1]:
            o = o+1
        elif i==labels[2]:
            n = n+1
        elif i==labels[3]:
            e = e+1
        elif i==labels[4]:
            he = he+1
        elif i==labels[5]:
            nv = nv+1
    return ([h, o, n, e, he, nv])

```

```

def make_label_value_pairs_four(df, labels):
    h=0
    o=0
    n=0
    e=0

    for i in df:
        if i==labels[0]:
            h = h+1
        elif i==labels[1]:
            o = o+1
        elif i==labels[2]:
            n = n+1
        elif i==labels[3]:
            e = e+1

    return ([h, o, n, e])

```

```

h = pd.DataFrame(columns=labels)
h.loc['Ik ga graag door met het gebruik van Engage'] = make_label_value_pairs(df.iloc[:,10], labels)
h.loc['Engage helpt me bij het opstellen van leefstijldoelen waar ik aan wil werken'] = make_label_value_pairs
                                                                    (df.iloc[:,14], labels)
h.loc['Engage geeft mij een goed overzicht van de leefstijldoelen waarin ik wil werken'] = make_label_value_pairs
                                                                    (df.iloc[:,15], labels)
h.loc['Door Engage heb ik meer regie over mijn behandeling (doelen, acties, individueel zorgplan)'] = make_label_value_pairs
                                                                    (df.iloc[:,19], labels)
h.loc['Engage helpt mij met mijn chronische ziekte om te gaan'] = make_label_value_pairs(df.iloc[:,11], labels)
h.loc['Engage geeft mij een goed overzicht van mijn behandelplan'] = make_label_value_pairs(df.iloc[:,13], labels)
h.loc['Door Engage ben ik beter op de hoogte van mijn aandoening'] = make_label_value_pairs(df.iloc[:,16], labels)
h.loc['Engage geeft mij inzicht hoe het staat met mijn gezondheid'] = make_label_value_pairs(df.iloc[:,12], labels)
h.plot.barh(stacked=True, cmap=cmap).legend(loc='upper center', bbox_to_anchor=(0.5, 1.5))

```

```

label1 = ['Helemaal oneens', 'Oneens', 'Niet oneens en niet eens', 'Eens', 'Helemaal eens']
h1 = pd.DataFrame(columns=label1)
h1.loc['Engage vergemakkelijkt het communiceren met mijn praktijkondersteuner'] = make_label_value_pairs(df.iloc[:,18], label1)
h1.loc['Door Engage kan mijn praktijkondersteuner mijn meetwaarden controleren, dat geeft mij vertrouwen'] =
    make_label_value_pairs(df.iloc[:,17], label1)
h1.loc['Door het gebruik van Engage voel ik minder de noodzaak om mijn praktijkondersteuner en/of huisarts in de praktijk te bezoeken'] =
    make_label_value_pairs(df.iloc[:,20], label1)
h1.plot.barh(stacked=True, cmap=cmap).legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

label1 = ['Helemaal oneens', 'Oneens', 'Niet oneens en niet eens', 'Eens', 'Helemaal eens']
h1 = pd.DataFrame(columns=label1)
h1.loc['Het lukte mij goed om Engage de eerste keer te gebruiken'] = make_label_value_pairs(df.iloc[:,43], label1)
h1.loc['Ik leerde snel Engage te gebruiken'] = make_label_value_pairs(df.iloc[:,44], label1)
h1.loc['Ik vind Engage makkelijk in gebruik'] = make_label_value_pairs(df.iloc[:,45], label1)
h1.loc['Engage ziet er mooi en uitnodigend uit'] = make_label_value_pairs(df.iloc[:,46], label1)
h1.loc['Ik vind het vaak onduidelijk waar ik iets kan vinden in Engage.'] = make_label_value_pairs(df.iloc[:,47], label1)
h1.plot.barh(stacked=True, cmap=cmap).legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

label1 = ['Helemaal oneens', 'Oneens', 'Niet oneens en niet eens', 'Eens', 'Helemaal eens']
h1 = pd.DataFrame(columns=label1)
h1.loc['Ik weet waar een antwoord kan vinden als ik een vraag of probleem heb met Engage'] =
    make_label_value_pairs(df.iloc[:,63], label1)
h1.loc['Ik ben bang dat de consulten met mijn praktijkondersteuner en/of huisarts vervangen gaan worden door zorg op afstand met Engage'] =
    make_label_value_pairs(df.iloc[:,21], label1)
h1.plot.barh(stacked=True, cmap=cmap).legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

labels1 = ['Helemaal niet belangrijk', 'Enigszins belangrijk', 'Redelijk belangrijk', 'Zeer belangrijk', 'Uitermate belangrijk']
labels5 = ['Helemaal niet tevreden', 'Enigszins tevreden', 'Redelijk tevreden', 'Zeer tevreden', 'Uitermate tevreden',
           '|Nog niet gedaan']

```

```

i = pd.DataFrame(columns=labels1)
i.loc['Dagboek bijhouden en delen met mijn POH.'] = make_label_value_pairs(df.iloc[:,28], labels1)
i.loc['Vragenlijst invullen en inzien, ter voorbereiding op een consult.'] = make_label_value_pairs(df.iloc[:,30], labels1)
i.loc['Het openen en inzien van ToDos (taken).'] = make_label_value_pairs(df.iloc[:,36], labels1)
i.loc['Het uitvoeren en afronden van ToDos (taken).'] = make_label_value_pairs(df.iloc[:,38], labels1)
i.loc['Het inzien welke zorgverleners betrokken zijn bij mijn behandeling.'] = make_label_value_pairs(df.iloc[:,40], labels1)
i.loc['Tekstbericht (chat) sturen naar uw POH.'] = make_label_value_pairs(df.iloc[:,32], labels1)
i.loc['Tekstbericht (chat) lezen van uw POH.'] = make_label_value_pairs(df.iloc[:,34], labels1)
i.loc['Goede informatie of educatie vinden over uw aandoening en behandeling.'] = make_label_value_pairs(df.iloc[:,22], labels1)
i.loc['Afspraken met POH vastleggen in het IZP.'] = make_label_value_pairs(df.iloc[:,24], labels1)
i.loc['(Thuis)meetwaarden invullen en delen met mijn POH en mijn meetwaarden uit het verleden inzien.'] =
    make_label_value_pairs(df.iloc[:,26], labels1)

```

```

i.plot.barh(stacked=True, color=['brown', 'darkorange', 'lightgoldenrodyellow', 'yellowgreen', 'darkgreen'])
i.legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

fig, ax = subplots()
s = pd.DataFrame(columns=labels5)
s.loc['Dagboek bijhouden en delen met mijn POH.'] = make_label_value_pairs_satisfaction(df.iloc[:,29], labels5)
s.loc['Vragenlijst invullen en inzien, ter voorbereiding op een consult.'] = make_label_value_pairs_satisfaction
(df.iloc[:,31], labels5)
s.loc['Het openen en inzien van ToDos (taken).'] = make_label_value_pairs_satisfaction(df.iloc[:,37], labels5)
s.loc['Het uitvoeren en afronden van ToDos (taken).'] = make_label_value_pairs_satisfaction(df.iloc[:,39], labels5)
s.loc['Het inzien welke zorgverleners betrokken zijn bij mijn behandeling.'] = make_label_value_pairs_satisfaction
(df.iloc[:,41], labels5)
s.loc['Tekstbericht (chat) sturen naar uw POH.'] = make_label_value_pairs_satisfaction(df.iloc[:,33], labels5)
s.loc['Tekstbericht (chat) lezen van uw POH.'] = make_label_value_pairs_satisfaction(df.iloc[:,35], labels5)
s.loc['Goede informatie of educatie vinden over uw aandoening en behandeling.'] = make_label_value_pairs_satisfaction
(df.iloc[:,23], labels5)
s.loc['Afspraken met POH vastleggen in het IZP.'] = make_label_value_pairs_satisfaction(df.iloc[:,25], labels5)
s.loc['(Thuis)meetwaarden invullen en delen met mijn POH en mijn meetwaarden uit het verleden inzien.'] =
    make_label_value_pairs_satisfaction(df.iloc[:,27], labels5)

```

```

s.plot.barh(ax=ax, stacked=True, color=['brown', 'darkorange', 'lightgoldenrodyellow', 'yellowgreen', 'darkgreen', 'gray'])
s.legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
ax.axes.yaxis.set_visible(False)
plt.xticks(range(0,51,10))

```

```

fig, ax = subplots()
label5 = ['Nooit problemen', '1 keer een probleem', '2 keer of vaker problemen', 'Nog niet gedaan']
h5 = pd.DataFrame(columns=label5)
h5.loc['Andere communicatieproblemen'] = make_label_value_pairs_four(df.iloc[:,54], label5)
h5.loc['Problemen met het openen of inloggen op Engage.'] = make_label_value_pairs_four(df.iloc[:,48], label5)
h5.loc['Problemen met het inzien van meetwaarden.'] = make_label_value_pairs_four(df.iloc[:,49], label5)
h5.loc['Problemen met het invullen, uploaden of verzenden van meetwaarden'] = make_label_value_pairs_four(df.iloc[:,50], label5)
h5.loc['Problemen met het versturen van berichten (chat).'] = make_label_value_pairs_four(df.iloc[:,51], label5)
h5.loc['Langer dan gewenst moeten wachten op een antwoord van de praktijkondersteuner.']
= make_label_value_pairs_four(df.iloc[:,52], label5)
h5.loc['Onduidelijkheid over wanneer ik meldingen krijg per e-mail wanneer er een taak of bericht klaar staat.']=
= make_label_value_pairs_four(df.iloc[:,53], label5)

h5.plot.barh(stacked=True, color=['darkgreen', 'lightgoldenrodyellow', 'brown', 'gray'], width=0.5, ax=ax)
|.legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

fig, ax = subplots()
label6 = ['Helemaal oneens', 'Oneens', 'Niet oneens en niet eens', 'Eens', 'Helemaal eens', 'NVT, geen vraag gehad']
h6 = pd.DataFrame(columns=label6)
h6.loc['Toen ik een vraag of een probleem had met Engage, werd ik goed en snel geholpen.']=
= make_label_value_pairs_satisfaction(df.iloc[:,56], label6)
h6.loc['Als ik Engage wil gebruiken heb ik hulp van een ander nodig.']=
= make_label_value_pairs_satisfaction(df.iloc[:,60], label6)
h6.loc['Aan mij is goed uitgelegd hoe ik Engage moet gebruiken.']= make_label_value_pairs_satisfaction(df.iloc[:,61], label6)
h6.loc['Aan mij is goed uitgelegd waarvoor ik Engage moet gebruiken.']=
= make_label_value_pairs_satisfaction(df.iloc[:,62], label6)
h6.loc['Ik weet waar ik een antwoord kan vinden, als ik een vraag heb over het gebruik van Engage.']=
= make_label_value_pairs_satisfaction(df.iloc[:,63], label6)
h6.loc['Ik kreeg genoeg ondersteuning bij het leren gebruiken van Engage.']=
= make_label_value_pairs_satisfaction(df.iloc[:,64], label6)

h6.plot.barh(stacked=True, color=['brown', 'darkorange', 'lightgoldenrodyellow', 'yellowgreen', 'darkgreen', 'gray'],
width=0.5, ax=ax).legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

label1 = ['Helemaal oneens', 'Oneens', 'Niet oneens en niet eens', 'Eens', 'Helemaal eens']
h1 = pd.DataFrame(columns=label1)
h1.loc['Ik heb het gevoel dat mijn zorgverleners het gebruik van Engage belangrijk vinden.']=
= make_label_value_pairs(df.iloc[:,57], label1)
h1.loc['Mijn zorgverlener stimuleert het gebruik van Engage.']= make_label_value_pairs(df.iloc[:,58], label1)
h1.loc['Mijn thuisomgeving stimuleert en/of ondersteunt het gebruik van Engage.']= make_label_value_pairs(df.iloc[:,59], label1)
h1.plot.barh(stacked=True, cmap=cmap).legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

fig, ax = subplots()
label6 = ['Altijd', 'Vaak', 'Soms', 'Zelden', 'Nooit']
h6 = pd.DataFrame(columns=label6)
h6.loc['Hoe vaak heeft u problemen met het begrijpen van geschreven informatie over uw ziekte?']=
= make_label_value_pairs(df.iloc[:,79], label6)
h6.loc['Hoe vaak heeft u hulp nodig bij het lezen van informatie van de huisarts of het ziekenhuis?']=
= make_label_value_pairs(df.iloc[:,80], label6)
h6.plot.barh(stacked=True, color=['brown', 'darkorange', 'lightgoldenrodyellow', 'yellowgreen', 'darkgreen', ],
width=0.5, ax=ax).legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

h7 = pd.DataFrame(columns=label1)
h7.loc['Ik voel me zelfverzekerder bij het invullen van medische formulieren.']= make_label_value_pairs(df.iloc[:,81], label1)
h7.plot.barh(stacked=True, cmap=cmap).legend(loc='upper center',bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

```

fig, ax = subplots()
label8 = ['Slecht', 'Matig', 'Goed', 'Zeer goed', 'Uitstekend']
h8 = pd.DataFrame(columns=label8)
h8.loc['In hoeverre heeft u het idee dat uw ziekte onder controle is?'] = make_label_value_pairs(df.iloc[:,82], label8)
h8.plot.barh(stacked=True, cmap=cmap, width=0.5, ax=ax).legend(loc='upper center', bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

fig, ax = subplots()
label9 = ['Geen invloed', 'Weinig invloed', 'Matig invloed', 'Beetje invloed', 'Veel invloed']
h9 = pd.DataFrame(columns=label9)
h9.loc['In hoeverre denkt u dat u zelf (door middel van uw gedrag) invloed heeft op hoe goed uw ziekte onder controle is??'] = make_label_value_pairs(df.iloc[:,83], label9)
h9.plot.barh(stacked=True, cmap=cmap, width=0.5, ax=ax).legend(loc='upper center', bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

fig, ax = subplots()
df.iloc[:,84].value_counts().sort_index().plot(ax=ax, kind='bar', rot=3600)
ax.set_title('Ziekte last')
ax.set(ylabel="Aantal patiënten", xlabel="1 (helemaal geen last) en 10 (ondragelijk veel last)")
#plt.xticks(range(0,10,1))

```

```

h = pd.DataFrame(columns=labels)
h.loc['Ik vertrouw erop dat in Engage mijn medische gegevens goed beschermd worden.']= make_label_value_pairs(df.iloc[:,102], labels)
h.plot.barh(stacked=True, cmap=cmap).legend(loc='upper center', bbox_to_anchor=(0.5, 1.5))
plt.xticks(range(0,51,10))

```

Appendix D: R-script factor analyses

```
# Author: Jjuultje Naber

# load packages
library(foreign)
library(psych)
library(MVN)
library(readxl)
library(lavaan)

# load dataset
EFADData <- read_excel("C:/Users/320097710/Philips/Patient and Caregiver Engagement -
Patient Satisfaction and Experiences Engage/Data analysis/TotalEFA.xlsx")
CFADData <- read_excel("C:/Users/320097710/Philips/Patient and Caregiver Engagement -
Patient Satisfaction and Experiences Engage/Data analysis/Total_export_withoutmissing.xlsx")
EFADData3 <- read_excel("C:/Users/320097710/Philips/Patient and Caregiver Engagement -
Patient Satisfaction and Experiences Engage/Data analysis/TotalEFA_after_CFA.xlsx")
EFADData4 <- read_excel("C:/Users/320097710/Philips/Patient and Caregiver Engagement -
Patient Satisfaction and Experiences Engage/Data analysis/CFA_satis_use.xlsx")
EFADData5 <- read_excel("C:/Users/320097710/Philips/Patient and Caregiver Engagement -
Patient Satisfaction and Experiences Engage/Data analysis/TotalEFA_after_CFA_withSatisfaction.xlsx")

# exploratory factor analysis on disease burden, ses, computer literacy, health literacy
describe(EFADData) #check skew, kurtosis
KMO(EFADData)
fa.parallel(EFADData, fm = "minres", fa = "fa", main="Parallel Analysis Scree Plots",
n.iter=20,error.bars=FALSE,se.bars=FALSE,SMC=FALSE,ylabel=NULL,show.legend=TRUE,
sim=TRUE,quant=.95,cor="cor",use="pairwise",plot=TRUE,correct=.5)

fourfactor <- fa(EFADData, nfactors = 4, rotate = "oblimin", fm = "minres")
print(fourfactor) #correlation between factors should not be higher than 0.85
print(fourfactor$loadings,cutoff=0.3)
fa.plot(fourfactor)# als dit logisch is
fa.diagram(fourfactor)

ScaleConfidence <- data.frame(EFADData[, c("xHeaLit3", "xComLit6", "xSES1")])
psych::alpha(ScaleConfidence, check.keys = TRUE)

ScaleHealthLit <- data.frame(EFADData[, c("xHeaLit1", "xHeaLit2")])
psych::alpha(ScaleHealthLit, check.keys = TRUE)

ScaleDisBur <- data.frame(EFADData[, c("xDisBur1", "xDisBur3", "xPerCon1")])
psych::alpha(ScaleDisBur, check.keys = TRUE)

tenfactor <- fa(EFADData3, nfactors = 4, rotate = "oblimin", fm = "minres")
print(tenfactor) #correlation between factors should not be higher than 0.85
print(tenfactor$loadings)
fa.diagram(tenfactor)

fivefactor <- fa(EFADData5, nfactors = 5, rotate = "oblimin", fm = "minres")
print(fivefactor) #correlation between factors should not be higher than 0.85
print(fivefactor$loadings,cutoff=0.3)
fa.diagram(fivefactor)

ScalePerformance <- data.frame(EFADData3[, c("xPerf3", "xPerf8", "xPerf9", "xPerf10")])
psych::alpha(ScalePerformance, check.keys = TRUE)

ScaleEffort <- data.frame(EFADData3[, c("xEffort1", "xEffort2", "xEffort3")])
psych::alpha(ScaleEffort, check.keys = TRUE)

ScaleSocialInf <- data.frame(EFADData3[, c("xSocInf1", "xSocInf2")])
psych::alpha(ScaleSocialInf, check.keys = TRUE)

ScaleFacCon <- data.frame(EFADData3[, c("xFacCon3", "xFacCon4", "xFacCon5", "xFacCon6")])
psych::alpha(ScaleFacCon, check.keys = TRUE)

satisFactor <- fa(EFADData4, nfactors = 2, rotate = "oblimin", fm = "minres")
print(satisFactor) #correlation between factors should not be higher than 0.85
print(satisFactor$loadings,cutoff = 0.3)
fa.diagram(satisFactor)

ScaleSatisfaction <- data.frame(EFADData4[, c("ySat1", "ySat2", "ySat3")])
psych::alpha(ScaleSatisfaction, check.keys = TRUE)
```



```

#
# confirmatory on effort, performance, social influence, facilitating conditions
cfamodel1 <- ' performance =~ xPerf3 + xPerf8 + xPerf9 + xPerf10
# + xPerf1 + xPerf2 + xPerf4 + xPerf5 + xPerf6 + xPerf7
effort =~ xEffort1 + xEffort2 + xEffort3
# + xEffort5 + xEffort4
socialInf =~ xSocInf1 + xSocInf2
# + xSocInf3
facCon =~ xFacCon5 + xFacCon6 + xFacCon3 + xFacCon4
# + xFacCon1 + + xFacCon2

# satisf =~ ySat1 + ySat2
# + ySat3
# use =~ yUse1 # maybe multiply instead of factor
# + yUse2
# SES =~ xSES1 + xSES2
# + xSES3
# complit =~ xComLit6
# + xComLit1 + xComLit2 + xComLit3 + xComLit4 + xComLit5 #too little variance
#healthLit =~ xHeaLit1 + xHeaLit2 + xHeaLit3
#disBurd =~ xDisBurd1 + xDisBurd2
# + xPercControl

';

```

```

engageFit1 <- cfa(cfamodel1, data = CFADData)
summary(engageFit1, fit.measures=TRUE)

```

```

cfamodel2 <- ' performance =~ xPerf3 + xPerf8 + xPerf9 + xPerf10
# + xPerf1 + xPerf2 + xPerf4 + xPerf5 + xPerf6 + xPerf7
effort =~ xEffort1 + xEffort2 + xEffort5
# + xEffort3 + xEffort4
socialInf =~ xSocInf1 + xSocInf3
# + xSocInf2
facCon =~ xFacCon5 + xFacCon6
# + xFacCon1 + + xFacCon2 + xFacCon3 + xFacCon4

# satisf =~ ySat1 + ySat2
# + ySat3
# use =~ yUse1 # maybe multiply instead of factor
# + yUse2
# SES =~ xSES1
# + xSES2 + xSES3
# complit =~ xComLit6
# + xComLit1 + xComLit2 + xComLit3 + xComLit4 + xComLit5 #too little variance
# healthLit =~ xHeaLit1 + xHeaLit2 + xHeaLit3
# disBurd =~ xDisBurd2
# + xDisBurd1 + + xPercControl

';

```

```

engageFit2 <- cfa(cfamodel2, data = CFADData)
summary(engageFit2, fit.measures=TRUE)

```

```

anova(engageFit1, engageFit2)

```

Appendix E: R-script structural equation model

```
# Author: Juultje Naber

# load packages
library(foreign)
library(psych)
library(MVN)
library(readxl)
library(lavaan)
library(qgraph)
library(semPlot)

# load dataset
MyData <- read_excel("c:/Users/320097710/Philips/Patient and Caregiver Engagement -
Patient Satisfaction and Experiences Engage/Data analysis/Total_export_withoutmissing.xlsx")

# model with only the UTAUT predictors -----
UTAUTmodel <- '
# measurement model
performance    =~ xPerf3 + xPerf8 + xPerf9 + xPerf10
effort         =~ xEffort1 + xEffort2 + xEffort3
facCon        =~ xFacCon3 + xFacCon4 + xFacCon5 + xFacCon6
socInf        =~ xSocInf1 + xSocInf2
use           =~ yUse1
satisfaction   =~ ySat1 + ySat2 + ySat3

# regressions
satisfaction ~ socInf + facCon + use
use ~ satisfaction + performance + effort

# residual correlations
' ;

UTAUTFit <- sem(UTAUTmodel, data = MyData)

summary(UTAUTFit, standardized=TRUE, rsquare=TRUE)
fitMeasures(UTAUTFit, c("cfi", "rmsea", "BIC"))

semPaths(UTAUTFit, what="paths", whatLabels = "stand", rotation = 2, number.cex = 0.75, residuals = FALSE)

# included patient characteristics-----
PatCharmodel <- '
# measurement model
performance    =~ xPerf3 + xPerf8 + xPerf9 + xPerf10
effort         =~ xEffort1 + xEffort2 + xEffort3
facCon        =~ xFacCon3 + xFacCon4 + xFacCon5 + xFacCon6
socInf        =~ xSocInf1 + xSocInf2
use           =~ yUse1
satisfaction   =~ ySat1 + ySat2 + ySat3
confidence     =~ xHealLit3 + xComLit6 + xSES1
healLit       =~ xHealLit1 + xHealLit2
disBur        =~ xDisBur1 + xDisBur2 + xPercControl

# regressions
satisfaction ~ socInf + facCon + use + confidence + healLit + disBur + xGender + xAge
use ~ satisfaction + performance + effort + confidence + healLit + disBur + xGender + xAge

# residual correlations
' ;

PatCharFit <- sem(PatCharmodel, data = MyData)

summary(PatCharFit, standardized=TRUE, rsquare=TRUE)
fitMeasures(PatCharFit, c("cfi", "rmsea", "BIC"))

semPaths(PatCharFit, what="paths", whatLabels = "stand", rotation = 2, residuals = FALSE)
```

```

# excluded use in regression-----
PatCharSimpleModel <- '
# measurement model
    performance    =~ xPerf3 + xPerf8 + xPerf9 + xPerf10
    effort         =~ xEffort1 + xEffort2 + xEffort3
    facCon        =~ xFacCon3 + xFacCon4 + xFacCon5 + xFacCon6
    socInf        =~ xSocInf1 + xSocInf2
    use           =~ yUse1
    satisfaction   =~ ySat1 + ySat2 + ySat3
    confidence     =~ xHealLit3 + xComLit6 + xSES1
    healLit       =~ xHealLit1 + xHealLit2
    disBur        =~ xDisBur1 + xDisBur2 + xPercControl

# regressions
    satisfaction ~ performance + effort + socInf + facCon + use + confidence + healLit + disBur + xGender + xAge

# residual correlations
' ;

PatCharSimpleFit <- sem(PatCharSimpleModel, data = MyData)

summary(PatCharSimpleFit, standardized=TRUE, rsquare=TRUE)
fitMeasures(PatCharSimpleFit, c("cfi", "rmsea", "BIC"))

semPaths(PatCharSimpleFit, what="paths", whatLabels = "stand", rotation = 2, residuals = FALSE)

mi <- modindices(PatCharSimpleFit)
mi[mi$op == "~",]

# modified model-----
ModModel <- '
# measurement model
    performance    =~ xPerf3 + xPerf8 + xPerf9 + xPerf10
    effort         =~ xEffort1 + xEffort2 + xEffort3
    facCon        =~ xFacCon3 + xFacCon4 + xFacCon5 + xFacCon6
    socInf        =~ xSocInf1 + xSocInf2
    use           =~ yUse1
    satisfaction   =~ ySat1 + ySat2 + ySat3
    confidence     =~ xHealLit3 + xComLit6 + xSES1
    healLit       =~ xHealLit1 + xHealLit2
    #disBur        =~ xDisBur1 + xDisBur2 + xPercControl
    gen           =~ xGender
    age           =~ xAge

# regressions
    satisfaction ~ effort + socInf + use + gen + age
    effort ~ facCon + confidence + performance + socInf + use
    socInf ~ facCon
    performance ~ socInf + gen
    confidence ~ healLit
    #use ~ satisfaction

# residual correlations
' ;

ModFit <- sem(ModModel, data = MyData)

summary(ModFit, standardized=TRUE, rsquare=TRUE)
fitMeasures(ModFit, c("cfi", "rmsea", "BIC"))

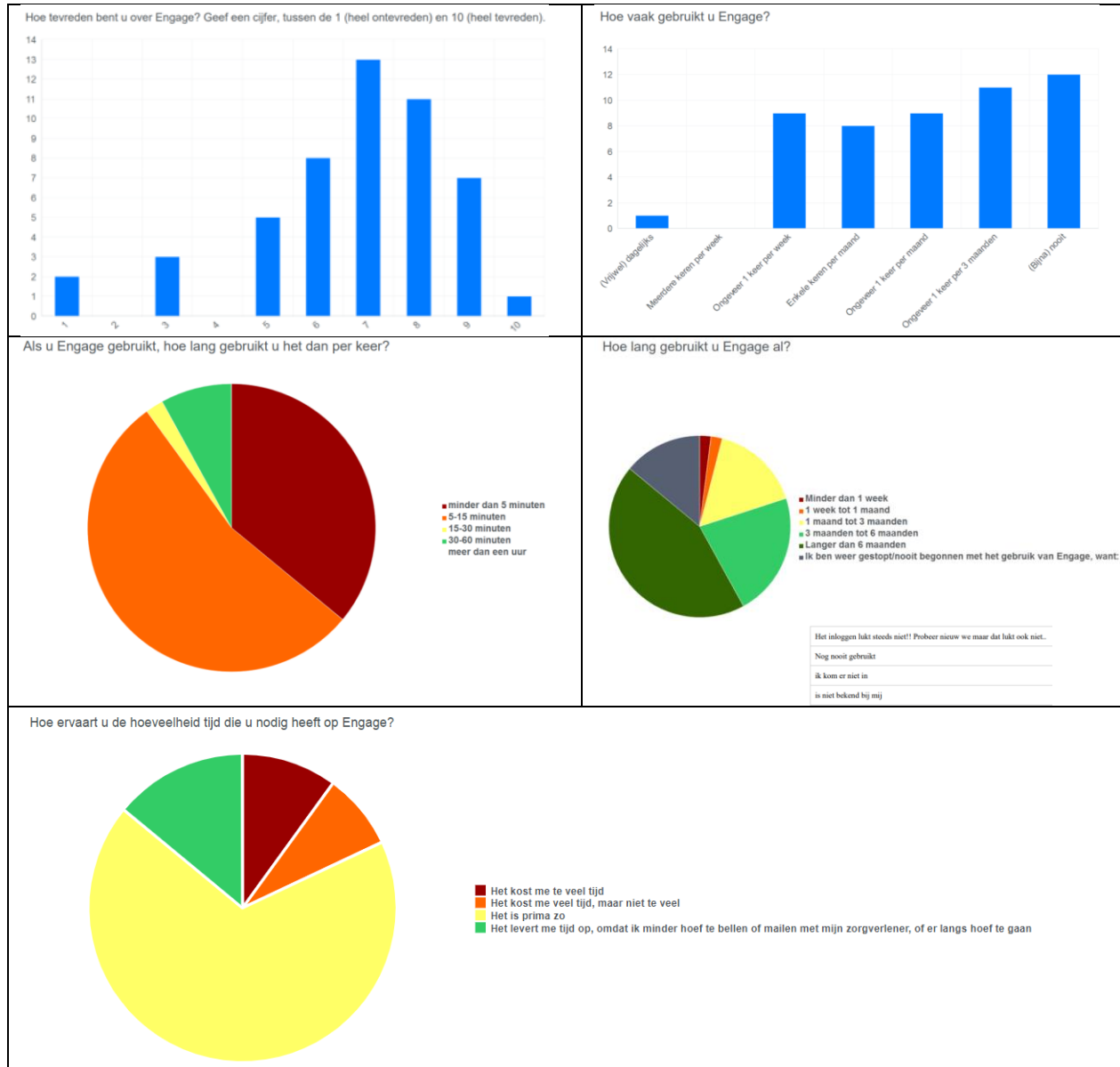
semPaths(ModFit, what="paths", whatLabels = "stand", rotation = 2, residuals = FALSE)

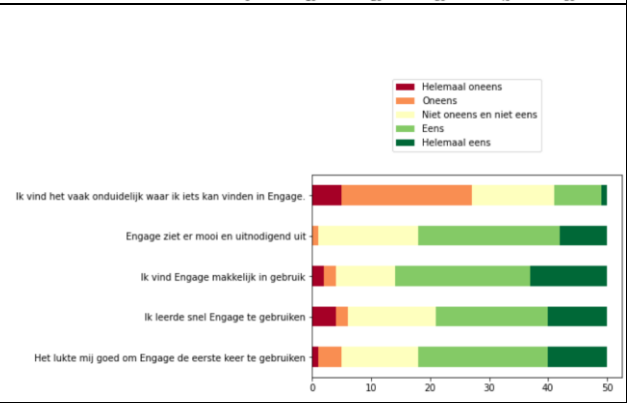
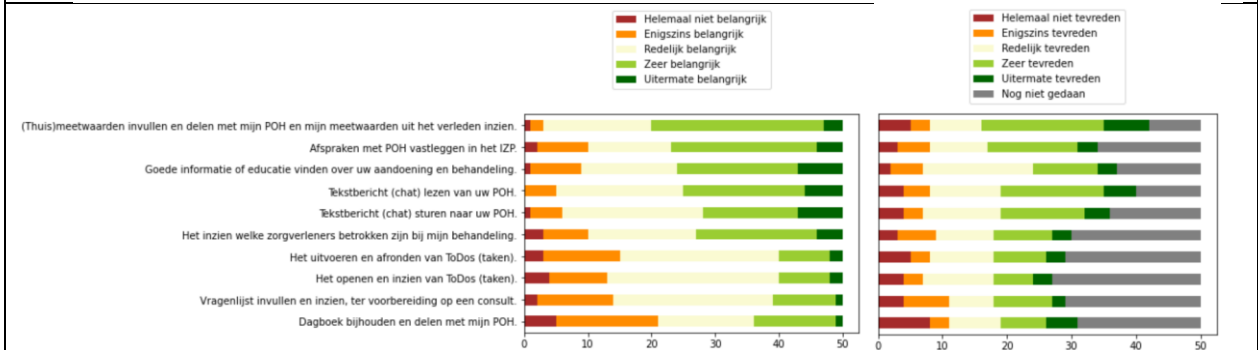
mi <- modindices(ModFit)
mi[mi$op == "~",]

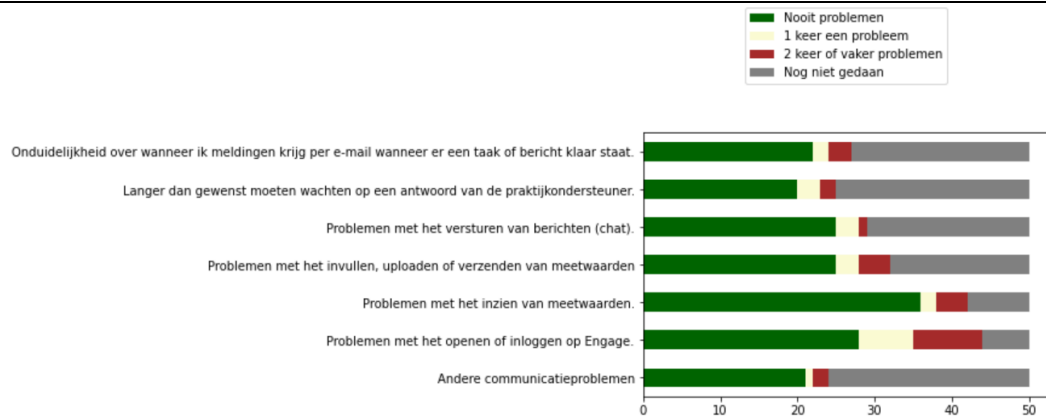
anova(PatCharFit, PatCharSimpleFit, ModFit)

```

Appendix F: Distribution graphs of answers







Response

Geen email gehad dat er een bericht voor mij stond.

Engage met praktijkondersteuner loopt goed. Andere ondersteuners weinig verbinding mee. Stel prijs er op, om na invulling de ingevulde vragenlijst op te kunnen slaan en kunnen uitprinten. Het is moeilijk invullen, omdat ik eigenlijk alleen prima contact heb met een praktijkondersteuner.

Noteren van meetgegevens was een probleem omdat dit niet rechtstreeks op het scherm zichtbaar is. Deze mogelijkheid staat onder de grafiek, ik moet eerst omlaag scrollen om de mogelijkheid de meetgegevens te kunnen registreren op mijn scherm te krijgen. Nu ik dat weet is het probleem opgelost. Geen ondersteuning gevraagd, zelf opgelost.

Wat ik mis is een uitleg van bijvoorbeeld de bloedwaarden. De meeste medische termen zeggen me niets en bovendien kan ik niet nagaan welke bloed waarden (ab)normaal zijn.

todo voorlichtingsfilmpjes wilde in het begin niet starten daar er geen link was. (is later verholpen na versturen chat bericht aan praktijkondersteuner)

Het invulveld bloeddruk en hartslag is niet impulsief te vinden. Een link in de startpagina zou handig zijn.

Problemen door geen uitleg van vele afkortingen.

De keren dat ik kon inloggen, lukte alles goed. Maar nu lukt inloggen weer niet. Kan dat niet anders, misschien code op mobiel?

Op dit moment een probleem met inloggen/wachtwoord wijzigen, vraagt geboorteplaats en dit klopt niet.

nee

Nog niet gebruikt

De meetwaarde van mijn bloedsuiker is voor mij niet zichtbaar. Na contact met de praktijkondersteuner (waar het wel zichtbaar was) een mail gestuurd naar Engage. Ik heb hier nooit antwoord op gehad.

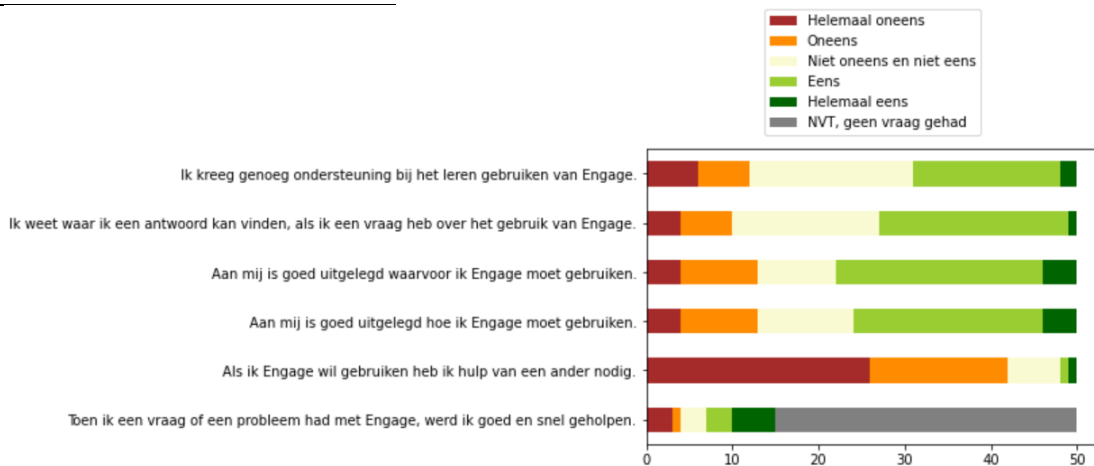
- de invoer opties zijn niet praktisch. scherm spring naar boven na iedere in gave.

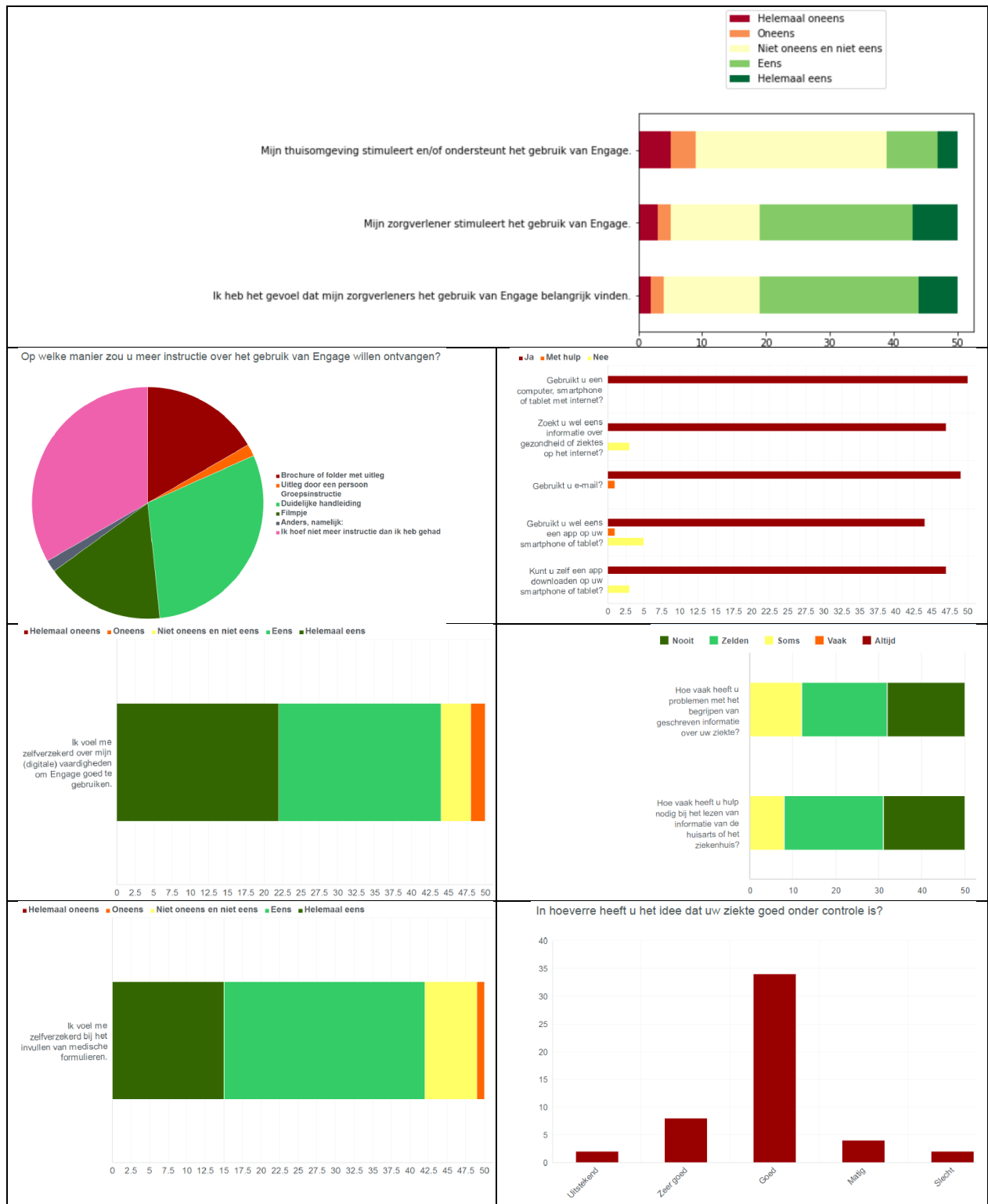
- grafieken zijn niet goed leesbaar. Er is veel te weinig onderscheiding

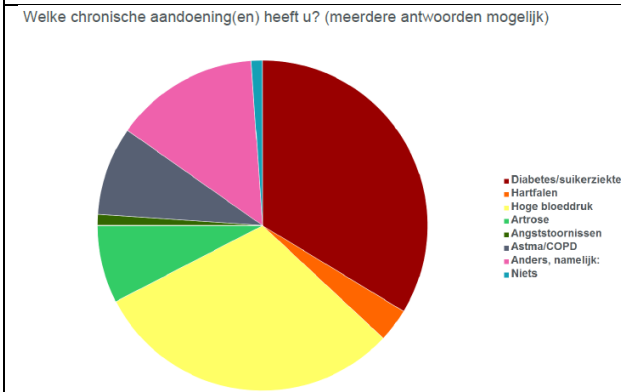
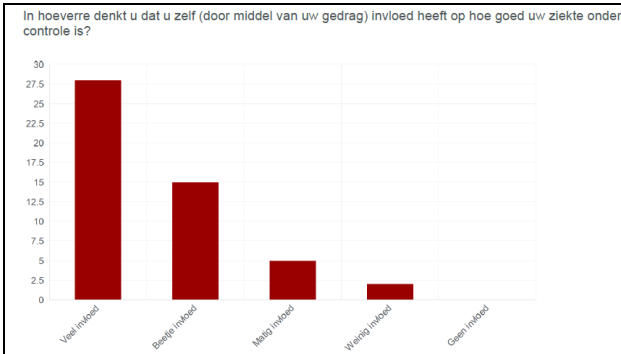
Ik had er meer van verwacht, tot nog toe geen communicatie met zorgverlener, geen idee of dit de bedoeling is. In mijn optiek is niet alles up to date. Ooit een korte vraag gesteld door praktijkondersteuner of ik hieraan mee wilde doen en heb bevestigend geantwoord. Vervolgens uitnodiging gekregen en aan de slag gegaan met de to do's of todos of taken en vervolgens is het daarbij gebleven.

Wat is nu überhaupt de bedoeling van Engage?

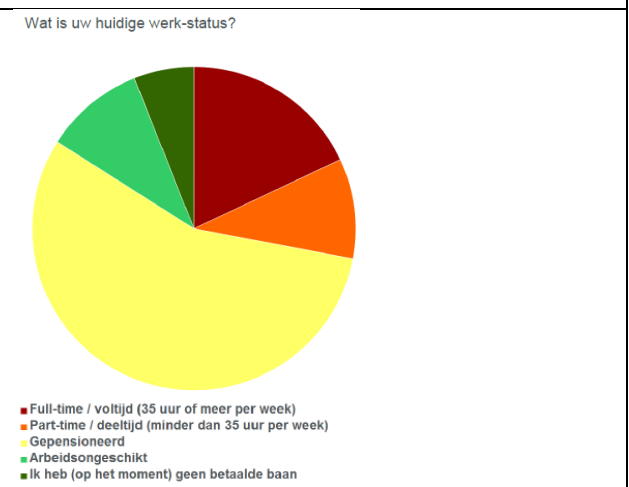
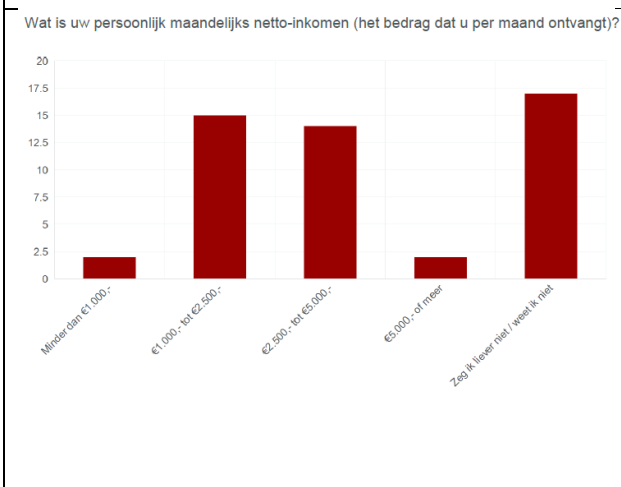
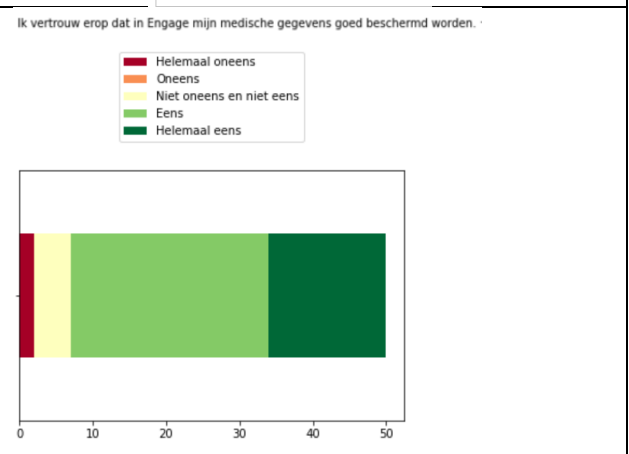
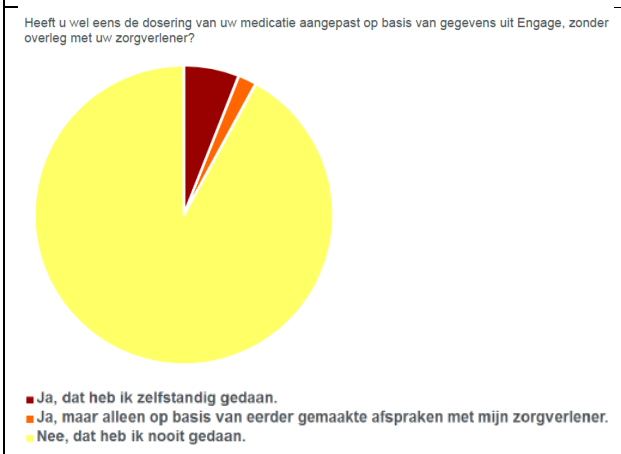
Nee en dat vind ik jammer want hij pakt mijn wachtwoord niet en het lukt mij ook niet om het te veranderen

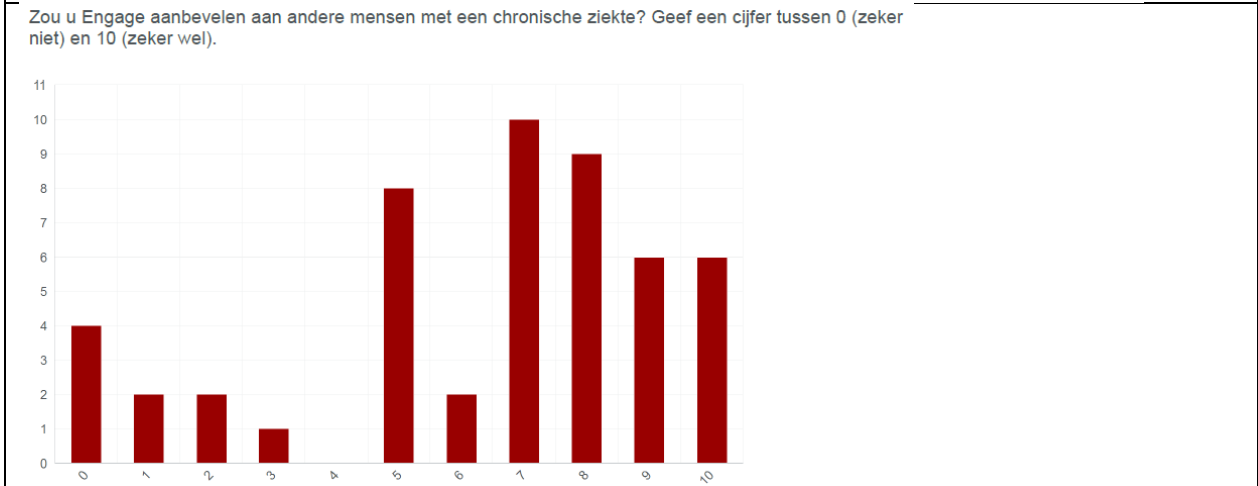
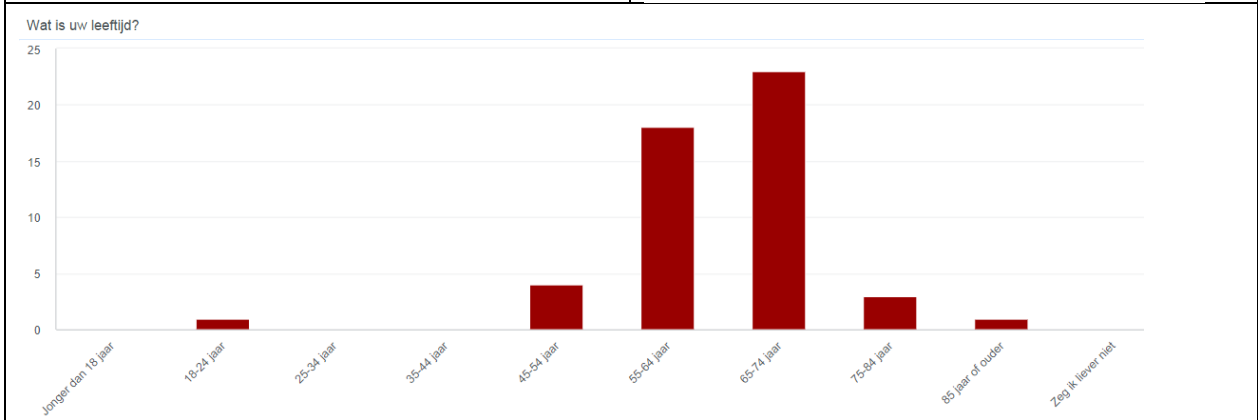
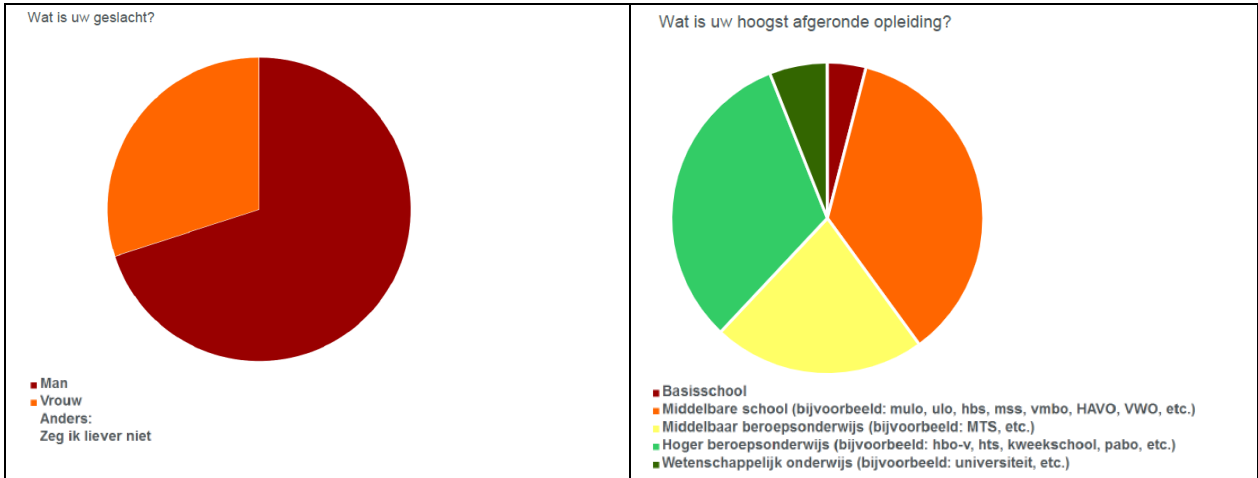






- Verminderde nierwerking en lichte suikerziekte type 2
- CIAP-polyneuropathie
- Ziekte van Crohn, lymfoedeem
- N.A.H. en rechter been amputatie
- prostaatkanker
- Atriumfibrillatie
- Overgewicht
- huidproblemen
- spina bifida
- LDL te hoog
- Kanker
- Crohn





Heeft u nog suggesties om Engage te verbeteren? Mist u nog dingen? (Meerdere opties mogelijk)



- Niets
- Leefstijlcoachingsprogramma's (bijvoorbeeld coach programma voor 'gezond bewegen' of 'gezond eten').
- Mogelijkheid om contact met andere patiënten te leggen (bijvoorbeeld via chat).
- Instellen en aanpassen van meldingen per e-mail (bijvoorbeeld voor chat en meetwaarden).
- Mogelijkheid om zelf relevante informatie te selecteren uit een digitale 'bibliotheek' binnen Engage.
- Videobellen met praktijkondersteuner (of andere zorgverlener).
- Mobiele app voor Engage
- Anders, namelijk:

Misschien te moeilijk voor personen met weinig kennis van gebruik computer.

Wat ik mis is een uitleg van bijvoorbeeld de bloedwaarden. De meeste medische termen zeggen me niets en bovendien kan ik niet nagaan welke bloed waarden (ab)normaal zijn.

Het is gern makkelijk programma, zeker niet voor mensen op leeftijd.

te weinig info gehad over wat de bedoeling is, gaat dit dingen vervangen? niet meer naar praktijk? is dit een aanvulling op?

Koppelen aan de door de huisarts gebruikte app uw zorg online. Daarin kunnen medicijnen worden bijbesteld, afspraken worden gemaakt etc..

Het ziet er leuk uit maar er moeten veel te veel handelingen gedaan worden en er gaat veel tijd zitten om de data in te kloppen

zekerheid dat info in Engage door zorgverleners up to date wordt gehouden.