Persuasive strategies of an online platform to support healthy behaviour

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Abstract

Chronical heart failure (CHF) is presenting an increasing challenge for the health care sector. Therefore, self-management is getting more important for the treatment of CHF patients. eHealth applications, for example the online ecosystem BENEFIT, might support healthy behaviour. However, it is important to consider what (future) end users of eHealth applications regard as important in the design process to ensure that the applications will be used as intended. Therefore, the aim of this research was to identify the values and needs of patients and health care professionals (HCPs) and to propose promising eHealth design features. For this secondary analysis of qualitative data, a mixed methods approach was deployed to analyze the results of three previous studies. The first study consisted of interviews with 10 patients with chronical diseases and in the second study 16 interviews with HCPs were conducted. In the last study, an app evaluation was done to identify promising persuasion strategies. The results of this study show that patients most often referred to user-friendliness and the availability of data. HCPs expressed the importance of patients' autonomy frequently which is a highly controversial topic in current literature as patient empowerment challenges common practice. Contrary to expectations, few participants expressed worries about data security online. In addition, the findings suggest that patients value accessible communication with their HCP but do not want to increase the workload of the HCPs. Furthermore, examples of promising persuasion strategies for eHealth technologies are given, for instance the possibility for users to set own goals. Limitations of the research include the possible subjectivity of the researcher. As the findings present an extensive overview of the values of both patients and HCPs, these results could be combined into a tool for designing and evaluating future eHealth technologies. In summary, this study demonstrates that eHealth applications should be easy to use, empower the patients, and provide a clear and complete overview of patients' health data. Eventually, it is important to understand the relation between patient autonomy and efficiency of HCPs better to meet the expectations of all stakeholders.

Introduction

The Importance of Self-Management: Prevention of Chronic Heart Failure

In the last years, one could witness changes in the health care sector. Those are mainly related to the aging population that resulted in an increasing demand for health care. Moreover, the working population is decreasing that concludes into a challenge for the health sector to sustain the quality and effectiveness of care. In addition, diseases that are particularly common in the elderly are expected to emerge more often and to demand more resources. Specifically, chronic heart failure (CHF) is identified as a serious disease that is mainly occurring in the elderly. In the Netherlands, approximately 1,6 million people were suffering from cardiovascular diseases in 2017. Notably, with increasing age, the number of individuals affected by CHF is rising extensively (Volksgezondheid en Zorg, 2019).

CHF can be caused by hypertension and coronary artery diseases and is encouraged by obesity, diabetes, and high levels of lipids, e.g. cholesterol (Bundkirchen & Schwinger, 2004). Additionally, smoking, an unhealthy diet, and little physical activity are risk factors. By adopting a healthier lifestyle, approximately 80% of premature heart attacks, for example, could be prevented (World Health Organization, 2019b). Research has shown that in 1990 half of the people diagnosed with CHF died within 5 years, mostly because of heart attacks or worsening of their heart failure (Bundkirchen & Schwinger, 2004). As a consequence of the aging population, the number of people who experience chronic heart failure is increasing. It is estimated that this number will grow by 46% by 2030 (Athilingam & Jenkins, 2018). Not only does this lead to more deaths and to lower life quality of those affected, but it also causes the economic impact of CHF to rise enormously. Long and repeated hospitalizations and extensive medication account for these increasing costs (Bundkirchen & Schwinger, 2004).

In order to control CHF, it has been found that self-management and lifestyle interventions are necessary (Jacobson et al., 2018). This entails that patients take their follow-up seriously and monitor their medication and physical changes. In addition, it is crucial that they are on a balanced diet, perform physical activity, and restrain from tobacco. Research has shown that the involvement in self-management of chronically ill patients has several positive outcomes (Talboom-Kamp, 2017). Namely, the quality of life of the patients is increasing and, additionally, they gain more freedom. This leads to financial relief of the health care sector and decreasing demand for stationary

treatment. Yet, self-management is presenting a challenge for many patients and many struggle to incorporate these elements successfully into their and their family's lifestyle. Entrenched habits, a lack of understanding or motivation, or negative attitudes towards the follow-up interventions are possible obstacles that stand in the way of recovery and prevention (Athilingam & Jenkins, 2018).

Due to the aging population and decreasing workforce, it is not possible to assist CHF patients constantly. Consequently, resources management presents a challenge for the health sector. The changing need of the health care and its' patients affects the use and appreciation of technical support in health care (Athilingam & Jenkins, 2018). In the following, technological support by means of eHealth applications are introduced, and its benefits and barriers are closely looked at.

Definition, Benefits, and Barriers of eHealth

eHealth refers to technology that is used to enhance health services. eHealth offers the ability to "improve health, well-being, and healthcare" (van Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018, p. 1) through information and communication technology. Applications for mobile phones, for example, apps that support diets or a fitter lifestyle, or devices that collect data are considered eHealth, too (van Gemert-Pijnen et al., 2018). There is no single definition of eHealth. It is rather viewed as a frame that incorporates the health service, technology, and people. In addition, researchers highlight that eHealth is viewed as a way of thinking about how to further enhance health care by the incorporation of innovative technology (Eysenbach, 2001).

eHealth presents both benefits and barriers. In this section, the benefits of eHealth will be discussed first, followed by the weaknesses of eHealth. In the first place, eHealth is highly accessible (van Gemert-Pijnen et al., 2018). To be more precise, users can look up crucial data or information about their health online at any time of the day. In the case of mobile applications, most people carry their mobile with them the whole day and can access their data or the applications whenever and wherever they want or need to. This functions also as an empowering variable for eHealth users as they, for example, can control and inspect their personal records online. Consequently, users can experience more control of their own health. Additionally, professionals of the health or research and development sector benefit from eHealth, too, as a large amount of data can be collected and analyzed by them without great efforts (Eysenbach, 2001).

In the third place, eHealth can serve as an educational tool (van Gemert-Pijnen et al., 2018). Both physicians and patients can benefit from this as the professionals can access a wider

knowledge base online whereas patients can retrieve medical information and advice from websites or health applications. In addition, eHealth can be used to inform people about diseases and preventive measures. As eHealth is widely accessible, the information can be disseminated easily and effective. Next, eHealth has the possibility to decrease health care costs (Eysenbach, 2001). This can be done by a constructive working relationship of physician and patient that is stimulated through information and communication technology and leads to avoiding unnecessary diagnostic actions. Furthermore, eHealth aims to encourage innovation by involving both patients and professionals in the medical processes. Consequently, eHealth is also expected to increase the quality of care as the healing process of the patients can be enhanced by technology and involves the patients and their informal caregivers better (van Gemert-Pijnen et al., 2018).

On the contrary, there are considerable barriers that might inhibit the positive effects of eHealth. First, there is little evidence that demonstrates the effectiveness of eHealth (Black et al., 2011). Not only the lack of research in general but especially the lack of long-term effects presents a challenge for eHealth. Second, problems with the implementation of eHealth can emerge. There might be human implementation barriers that refer to people being skeptical towards eHealth, especially people who do not know how to use technology properly. In addition, it is difficult to ensure that patients use eHealth tools correctly and for a certain period. A lack of communication between the stakeholders, thus the physicians, the patients, and their informal caregivers might pose a problem of implementation, too. That might result in frustration and abandonment of the technologies (Black et al., 2011).

Yet, little evidence and implementation barriers are not the only challenges that eHealth faces (van Gemert-Pijnen et al., 2018). Namely, many ethical questions arise through the use of technology in health care. To give a few examples, one can think of the data that is collected. This relates to security, privacy, and legal issues. Lastly, eHealth enables patients to look up critical information on the internet. However, not all information online can be trusted. As a result, eHealth deals with reliability issues (van Gemert-Pijnen et al., 2018).

Thus, there are several strengths and weaknesses of eHealth. Regarding the support of CHF patients, eHealth is providing assistance to adjust to and to maintain a healthier lifestyle. There already are a number of eHealth interventions that aim to enhance self-management. Examples are home-monitoring apps, video-conferencing or texting functions to contact other CHF patients, and encouraging interventions that aim to stimulate physical activity (Kauw et al., 2018). A recent study has found that eHealth interventions might decrease hospitalization due to heart failure (Carbo et

al., 2018). Moreover, a slight reduction in total mortality and admissions of CHF patients has been observed. However, the researcher highlighted that there was little evidence and clear trends are yet to be identified. In addition, it was found that the total costs might have increased due to special visits and implementations that were related to eHealth technology (Carbo et al., 2018). Thus, although eHealth is displaying many benefits that would increase the quality of care for CHF patients, more research is needed to identify both strengths and implementation problems of eHealth intervention.

A Holistic Framework to Enhance the Effectiveness of eHealth

Although eHealth promises many improvements in health care, the barriers have a considerable impact on the actual success rate of eHealth. Therefore, it is important that developers of eHealth applications take the needs of the stakeholders into account (van Gemert-Pijnen et al., 2011). To be more precise, information about the skills and expectations of future end users are essential to be able to design eHealth technologies that fit the needs of all stakeholders and ensure the correct long-term use of these technologies. Thus, the tools need to address all stakeholders and the different contexts to obtain desired positive results.

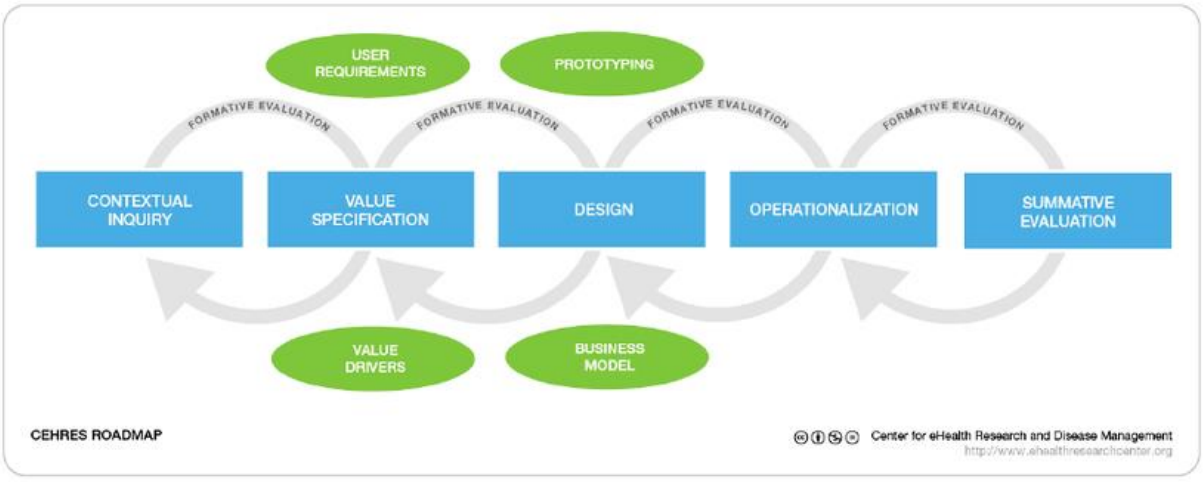
A holistic framework has been created that aims at enhancing the effectiveness of eHealth. It is composed of six pillars (van Gemert-Pijnen et al., 2011). First, the framework requires to involve all stakeholders during the development of eHealth applications. By means of the participatory development process, the needs of all stakeholders can be met, and the satisfaction and successful implementation will be higher. Second, eHealth development should be a dynamic process that involves continuous evaluation. Through reflexive evaluation that incorporates extensive research, the human, organizational and technological variables of eHealth can be improved. Third, it is essential to keep in mind that eHealth is influenced by and has an impact on the specific environment that it is designed for. Thus, the developers need to design the tools as an ecosystem that will be incorporated into health care. The fourth pillar highlights that implementation needs to be tested during development already to recognize and adjust possible issues. Fifth, eHealth is required to use persuasive design. Persuasion increases the chances that patients use technologies on a long term and that the design matches with the users' needs. Finally, eHealth development requires advanced methods to fully understand the impact and drawbacks of technology in health care (van Gemert-Pijnen et al., 2011). The integration and evaluation of data

of various sources and longitudinal research in form of mixed methods design are essential.

Van Gemert-Pijnen et al. (2011) have illustrated the steps of the holistic framework into a Roadmap to provide guidance for the development of eHealth technologies (see Figure 1). In this map, one can see five phases (in blue) that can be intertwined during the development process. The first phase is called *Contextual Inquiry*. At this point, the stakeholders and their environment that poses possible issues can be focused on. Next, the step *Value Specification* implies that the purpose of the new technology should be defined and/or adjusted. In the next phase, *Design*, persuasive elements can be used to develop eHealth technology. To give an example of how to incorporate persuasive elements, usability tests with prototypes can be conducted and the gained knowledge can be added into the design phase. The fourth phase is called *Operationalization*. In this phase, the technology can be implemented in the intended setting for the first time. Often, a business model is created to facilitate operationalization. The last phase, *Summative Evaluation*, can be used as an overall evaluation of the technology and the development process. As one can see in Figure 1, the grey circles stating *Formative Evaluation* visualize the pillar of continuous evaluation during the development process.

Figure 1

CeHRes Roadmap (van Gemert-Pijnen et al., 2011)



Seven Principles of Persuasive Design and the Persuasive System Design Model

The CeHRes Roadmap for the development of eHealth technologies illustrates that persuasive techniques are a vital element of the design of new tools. By applying persuasion, users are convinced to use the eHealth technologies correctly and consistently so that they, their caregivers, and the health care can benefit from it. Persuasion has been defined by Fogg (2003) "as an attempt to change attitudes or behaviours or both (without using coercion or deception)" (p. 15). Importantly, persuasive systems function on a voluntary basis and affect the attitude and/or behaviour of users (Fogg, 2003).

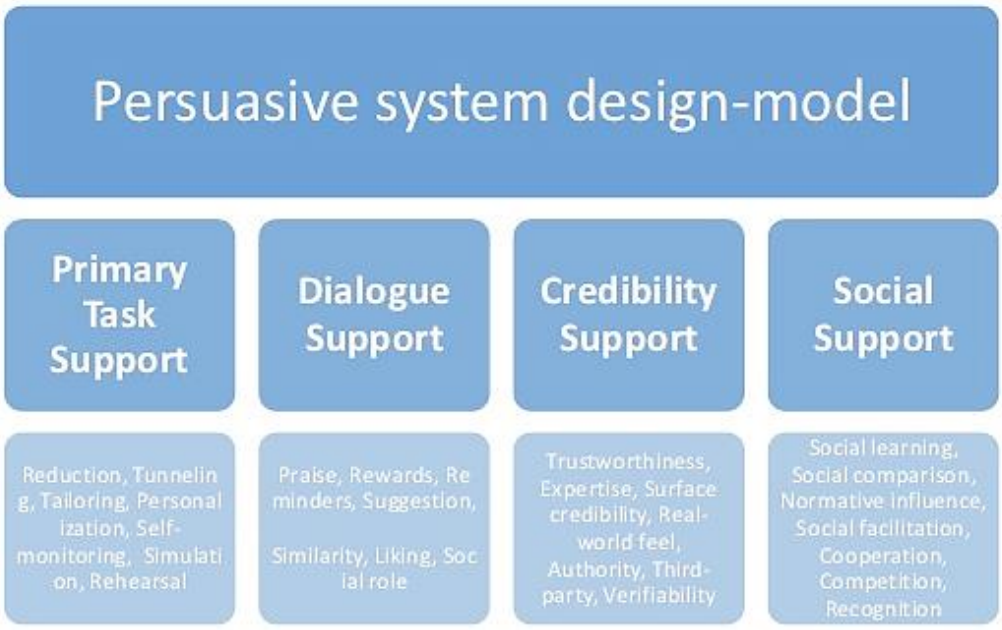
Oinas-Kukkonen& Harjumaa (2009) have stated seven principles that one has to consider when developing an eHealth intervention. First, they highlight the fact that information and communication technology is never neutral. That means that persuasion is a continuing process that is affecting the state of mind and behaviour of people constantly. Second, they mention that organization and consistency is desired by all people. Therefore, a technology that aims to make people commit to something, might have a higher impact. As a third principle, Oinas-Kukkonen & Harjumaa (2009) explain that there are both direct and indirect routes for persuasion strategies. The direct route tends to affect people more, however, it requires more concentration of them. On the other hand, the indirect and unconscious route requires less motivation and less information processing. Therefore, it depends on the target group and the specific context which route achieves better outcomes. According to the fourth principle, persuasion often obtains better results if it is incremental. To illustrate, a series of action implies to persuade people more than a single step. Furthermore, Oinas-Kukkonen& Harjumaa (2009) specify that the persuasion of technology should remain open and faithful. The intention of the developer should be clear at any time. In addition, persuasive systems should be unobtrusive. To put it differently, it should match with the user's lifestyle and not interfere with their actions. Ultimately, the last principle declares that persuasive systems should aim at being user-friendly. If the application is too difficult to use or does not meet the needs and desires of the user, persuasion is expected to be low. Keeping these principles in mind facilitates the development of eHealth technologies.

Additionally, a Persuasive Systems Design model (PSD model) has been designed with regard to the principles to support the design of eHealth interventions (Oinas-Kukkonen & Harjumaa, 2009). In Figure 2, one can see that this model shows four main categories. These categories are persuasion elements that can be used for the design of eHealth technologies. For

each category, several features are given that can be used as persuasive strategies in eHealth Technologies. To give an example, the second category, *Dialogue Support*, is meant to ensure interactivity between the system and its users through feedback. One strategy of this category is praising the users via messages, images, symbols, or sounds (Oinas-Kukkonen & Harjumaa, 2009).

Figure 2

Persuasive System Design model (Oinas-Kukkonen & Harjumaa, 2009)



An Example of eHealth Technology: The Online Platform BENEFIT

Applications such as online platforms, also referred to as Personal Health Records (PHRs), are developed to provide holistic support for patients that are to engage in self-management. Thus, both mental and social factors are integrated into these systems to address the users as a whole. The platforms offer insight into the patients' personal health data and their treatment information (Markle Connecting for Health, 2003). Furthermore, PHRs facilitate the communication between patient and health provider and give educational information related to chronical diseases. Another important aspect of PHRs is to enable the users to involve actively in their recovering process and maintenance of good health. Therefore, PHRs provide services that address self-management such

as peer support services and monitoring applications for eating or physical activity behaviours. By combining these aspects in one ecosystem, PHRs can enhance the life quality of patients and assist health care providers at the same time (Sieverink, 2017).

The focus of this research will lie on the online ecosystem called BENEFIT(Keesman et al., 2018). It is a platform that aims to support CHF patients who have difficulties adjusting their lifestyle and individuals who would like to lead a healthier life. The ecosystem combines several functions, such as eHealth applications that support self-management, online health records that can are easily accessible for patient and health professional, and communication tools for patients and their practitioner (Keesman et al., 2018). Consequently, it should enhance the quality of the patient's life, decrease hospitalization, and assist health professionals in taking measurements and supporting their patients. Thus, the impact of the BENEFIT-project is promising not only for CHF patients but for the prevention of diseases, too.

However, the ecosystem is still in the design process that includes continuing evaluation and incorporation of stakeholders' desires and technological possibilities. The contextual inquiry has displayed the opinion of patients and health care professionals (HCP). By means of analyzing the strengths and weaknesses of various other eHealth interventions, promising persuasion techniques were identified. It is now required to combine the knowledge that has been gained in these studies with the design of BENEFIT and the existing principles of eHealth interventions design to determine which persuasion strategies contribute to the impact of eHealth interventions.

Research Question

In consideration of these aspects, a research question has been formulated:

How can the desires and needs of HCPs and CHF patients be combined into persuasive strategies for eHealth interventions that support patients in their self-management, using the example of the BENEFIT-project?

The sub-questions are:

1) Which aspects of eHealth platforms could potentially contribute to the self-management of rehabilitating CHF patients and support HCPs?

2) Which persuasion strategies of the Persuasive System Design model are most promising in influencing CHF patients' attitude and behaviour in order to support their engagement in self-management?
3) How can these values and persuasion strategies be integrated into the design and implementation of BENEFIT to address the needs of its users and their HCPs better and to enhance self-management?
4) How can these identified persuasion strategies of the BENEFIT platform be generalized in order to implement them in other eHealth interventions?

Methods

Research Design

In order to identify the needs and wishes regarding eHealth applications of all stakeholders, several studies were analyzed and compared in this secondary research of qualitative data. A mixed methods approach has been chosen to analyze the relevant data of these studies. The first study involved 10 patients with chronical diseases who are prospective end-users of the BENEFIT-ecosystem. This study consists of two parts. First, a semi-structured interview was conducted with the participants. In that interview, their experiences of the health care and development of self-management skills as well as their expectations and concerns about eHealth applications were discussed (study 1.1). Then, the eHealth platform 'Mijn HEP' has been used to perform a usability test with the participants to gain insight into their needs and understanding of online platforms (study 1.2). Results from this study were used to determine the needs and values of patients regarding eHealth.

The second study focused on the expectations and needs of HCPs in consideration of eHealth interventions (study 2). Semi-structured interviews were conducted with 16 HCPs of different professions who are involved in the care of chronically ill patients. Lastly, the third study that is incorporated in this research conducted an app evaluation (study 3). To be more precise, several eHealth applications were tested to identify and evaluate used persuasion strategies. These eHealth applications were related and assigned to seven categories, namely Fitness, Smoking, Alcohol, Diet, Relaxation, E-Coach, and Heart Measurements. The data of that research was used to show both positive and negative aspects of eHealth applications and to evaluate these in consideration of the PSD model. All studies received ethical approval by the ethics committee of the University of Twente and the participants were informed about the research and gave their consent.

Data Analysis

In Table 1, an overview of the methods of this study is given (see Table 1). In order to answer RQ1: *Which aspects of eHealth platforms could potentially contribute to the self-management of rehabilitating CHF patients and support HCPs*, a secondary analysis was performed on the data

collected in study 1 and 2. This was done based on the multidisciplinary development approach of Van Velsen, Wentzel, & Van Gemert-Pijnen (2013). First, all quotes by the participants of study 1 and 2 that are related to eHealth and persuasive strategies were identified and examined. Then, attributes and values were formulated for each quote. Attributes are short statements of the needs and demands that were expressed by the participants. Values are the underlying interests or ideals of the participants that, often, are not spoken out directly (Van Velsen, Wentzel, & Van Gemert-Pijnen, 2013). Afterwards, the quotes were grouped on the value level and it was checked if the values and attributes were used consistently. If necessary, they were adjusted. Values could consist out of one or more attributes and the attributes could be assigned to one or more than one values, too. In cases of uncertainness about how to label a specific quote, that quote was highlighted and discussed with an independent researcher to formulate a fitting value out of a more objective view. The independent researcher also checked approximately 10% of the assigned values and attributes to improve the reliability of the chosen values and attributes.

Next, an overview in the form of tables was created that shows the identified values with its attributes, arranged according to the frequency of occurrence the values. High-frequency values are presented first, followed by medium and low-frequency values. In order to determine which category the values should be assigned to, the mean of the frequency of occurrence of each value was calculated. All values with a mean of three or higher were considered high-frequency values as they were reported several times by all participants (see Table 2). Values with a mean between one and three were listed as medium-frequency values because they were referred to by all participants at least once (see Table 3). Ultimately, values with a mean lower than one were appointed to the category of low-frequency values as these values were not expressed by all participants (see Table 4). In total, 15 values have been defined and an overview of the values is displayed in Table 5 (see Appendix A, Table 5). Three high-frequency values were found as well as six medium and six low-frequency values.

In addition, a short explanation of the values is given, enhanced by anonymized example quotations of the participants to visualize the value and its corresponding attributes better. It is stated from which interview the quotes were taken, thus either the number of the patient or HCP that took part in the study is given (e.g. *patient #3* or *HCP #1*). These chosen quotations were considered to be a good representation of the expressions of the group of participants. Furthermore, the comparison between the needs and values of the patients and the health care provides could be emphasized better by means of these selected quotations. As the interviews were conducted in

Dutch, the example quotations have been translated into English by the researcher.

The second research question: *Which persuasion strategies of the Persuasive System Design model are most promising in influencing CHF patients' attitude and behaviour in order to support their engagement in self-management?* was answered by critically assessing the results of the app evaluation of study 3. In addition, the values of RQ1 were compared to the PSD model. This was done by creating a table with the established values and the persuasive strategies of the PSD model as well as the features of study 3. By means of this overview, the results could be compared and assessed.

To answer RQ3: *How can these values and persuasion strategies be integrated into the design and implementation of BENEFIT to address the needs of its users and their HCPs better and to enhance self-management?* the results of RQ1, RQ2, and study 3 were compared and arranged in a table to create an overview. To illustrate how the most promising persuasion strategies could be applied, screenshots of specific apps were added to the results section. Moreover, in accordance with the multidisciplinary requirement development approach of Van Velsen et al. (2013), two requirements were identified. Those are specific technical instructions that can be used to design persuasive technologies. The requirements were presented in the Volere template (Van Velsen et al., 2013). This template is composed of several aspects. First, the requirement receives a number and is assigned to a requirement type: Functional, service, organizational, content or usability, and user experience (Van Velsen et al., 2013). Next, the value(s) and attribute(s) that are related to the requirement are stated as well as the requirement itself with a short description. Furthermore, it is explained why this requirement is needed (rationale) and who expressed the need for it (source). According to the MoSCoW method, the level of priority is indicated (Mulder, 2017). In addition, possible conflicts and the date of creation and adjustment of the requirement are documented. If needed, the fit criteria, thus a measurement to evaluate the success of this requirement is presented. In this study, however, this is not the case.

Lastly, in order to give an answer to the fourth research question: *How can these identified persuasion strategies of the BENEFIT platform be generalized in order to implement them in other eHealth interventions?* the results of the first three research questions were elaborated on by summarizing the findings and determining core themes in the discussion. Furthermore, these core themes were critically evaluated with regard to the research question and existing literature. Lastly, a conclusion was given.

Table 1

Overview of the studies incorporated in this research

Study	Type of Data	Participants	Research Question	Methods	Presentation of Data	Framework
Study 1.1: Patients	Interviews	10 participants with chronical diseases	RQ1, RQ2, RQ3, RQ4	Identification of core topics	Table of attributes and values of patients	Attributes and values of patients can be identified
Study 1.2: Patients	Walkthrough	10 participants with chronical diseases	RQ1, RQ2, RQ3, RQ4	Identification of core topics and comparison data of study 1.1	Addition to Table 1.1	Attributes and values of patients can be identified
Study 2: Health Care Profess-ionals	Interviews	16 HCPs that are involved in the care of CHF patients	RQ1, RQ2. RQ3, RQ4	Identification of core topics	Table of attributes and values of HCPs	Identification of values and attributes of HCPs
Study 3: Apps Evaluation	Rating/ Interviews/ Questionnaire	80 apps	RQ2 RQ3, RQ4	Identification of desired features of eHealth technologies	Table of promising persuasion features	Promising persuasion features are identified

Results

RQ1: Which aspects of eHealth platforms could potentially contribute to the self-management of rehabilitating CHF patients and support HCPs?

The interviews of study 1 and 2 provided a rich data set that elaborates on the needs and wishes of patients and HCPs concerning eHealth. To begin with, the value *User-friendliness* occurred most often and is, therefore, the first high-frequency value. On average, patients referred to this value more often than health care providers did (see Table 2). This value relates to the technical interface of the platform that should be easy to understand and navigate for its users. The attributes *Clarity of functions*, *Clear overview of all data at a glance*, and *Age and experience with technology should be taken into consideration* appeared most often. *Clarity of functions* incorporates comprehensibility about the functions of the chat, the usage and synchronization of wearables, and how to fill in measurements. This attribute was more often reported by patients than by HCPs. *Clear overview of all data at a glance* was more frequently expressed by patients, too. Important aspects of this attribute are a neat and complete overview of the data and the use of colours or graphic demonstrations to highlight important data.

The next attribute *Age and experience with technology should be taken into consideration* was more often found in interviews with the HCPs. Moreover, both patients and HCPs considered a good introduction to the platform as an important attribute while only HCPs explicitly mentioned that the platform should be well-functioning and simple. In addition, both groups of participants stated that the design of the platform could be more appealing and comprehensible if it would be personalized, for example, by adding a profile picture of the users. Three HCPs reported that they desire an algorithm that would check the values and measurements of the patients online and that would give notifications in case of abnormal or critical values. One patient said that she would value a tool to easily print the information of the platform while another participant highlighted his concern that the platform is depending on internet. This participant believed an offline function would be important. Twice, it was voiced that access to training computers might be useful, especially for older patients, so that they could get comfortable with the platform. Lastly, individual participants said that they would value a spelling check in the chat and a search function on the platform in general (see Table 2).

The second high-frequency value is *Autonomy and Empowerment of patients* (see Table 2). Strikingly, HCPs reported this value 67 times whereas patients expressed attributes assigned to this value 19 times only. Most often the attribute *Small, personal, realistic steps* was found. This attribute was used for expressions of HCPs only. It was often related to the planning of the rehabilitation of patients and the importance to start with small and relatively easy changes for the patients. Moreover, the attribute *Creation of (body) awareness in patients* was counted 16 times and occurred more frequently in interviews with the HCPs. To be more precise, this attribute entails that patients should to get to know their body better in order to understand how a heathier life can change their body and well-being. On the other hand, the attribute *Freedom for patients to choose if they want to engage in eHealth and if so, to what extent* was more often identified by patients. It highlights their desire to be able to freely decide if they want to use eHealth applications and to what extent they want to incorporate these applications in their daily life. The attributes *Insights into health values can be stimulating*, *Creation of intrinsic motivation for long-lasting change* and *Responsibility for patients* were more frequently mentioned by HCPs again. The attribute *Responsibility for patients* refers to the wish that patients should be able to take own measurements and that they, for instance, should be in charge of keeping track when they have to go to the doctor. As a last attribute for this value, the need for involving patients in decision-making was expressed by both patients and HCPs (see Table 2).

As a third high-frequency value *Availability and Accessibility of reliable information* has been identified. In Table 2, one can see that it was more frequently referred to by patients but was still very evident in the interviews with the HCPs. The first attribute, *Clear overview of all data at a glance*, is one of the attributes that was assigned to two values, namely to *Availability and Accessibility of reliable information* and *User-friendliness*. To repeat, this attribute was more frequently reported by patients than by HCPs and includes a neat overview with graphic and colourful demonstrations of the health data. Next, patients were more likely to refer to the mobility of the data than the HCPs. To illustrate, the patients asked frequently if they could have access to the platform from several electronical devices. In addition, they indicated their desire for average values on the platform so that they could compare their data. The attribute *Possibility to look up data that was forgotten after consult* was more frequently found in the interviews with the patients compared to the HCPs, as well. On the contrary, the attribute *Information for self-management* was mentioned by HCPs only and it refers to additional information about self-management skills to guide users in their rehabilitation process. The other attributes were found in the interviews of both

groups of participants. One attribute focused on the quality of the data and information on that platform that should be reliable and easy to understand for all users, irrespectively of their level of education and knowledge. Moreover, a few participants stated that the information on the platform could be used to preventively inform and educate not only patients but a broader spectrum of people. Also, it was regarded as important to have a tool to check and monitor the data that patients could fill in in order to avoid manipulation. The last attribute is *Consistent use of the platform by HCP* and it was mentioned by patients and HCPs who are worried that the platform would be less useful if it is not used consistently by all health care providers (see Table 2).

Table 2

High-frequency values: User-friendliness, Autonomy and Empowerment of patients, and Availability and Accessibility of reliable information

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
User-friendliness: The platform is user-friendly. It provides an overview of all data at a glance. There are no technical problems so that patients and HCPs can use the platform without interruptions. It is clear how to use the functions of the platform. Patients are introduced sufficiently to eHealth technology and its functions.			
Clarity of functions	27	21/6 (2.1/0.38)	“But… but what is this about? I can see two chat rooms, but… What is this chat room about? (…) Is this about my diet? Is this about sports?” (Patient #4)
Clear overview of all data at a glance	25	16/9 (1.6/0.56)	"What I would really like to see are graphical documentation of my results. Maybe with red flags so that you can see directly which values need to be looked at." (HCP #15)
Age and experience with technology should be taken into consideration	24	4/20 (0.4/1.25)	"Sometimes, I see those younger patients, younger than 60 in this case, and patients with a higher educational background or higher SES haven a certain attitude, like: ‘I have read this and that', and then they ask me to explain to them what is correct and what is not. People with a lower educational background or older people tend not to search for themselves. Maybe because the information is not adjusted to their level of knowledge?” (HCP #18)

Table 2 (continued)

Attributes	Frequency	Patients / HCP* (mean)	Example Quotation
Sufficient introduction to the platform	11	7/4 (0.7/0.25)	"Imagine someone enrols him- or herself for this, do you send a package to that person with a manual? Or do you call them to explain it?" (Patient #10)
Well-functioning and simple	10	0/10 (0/0.63)	"**What do you mean with 'well-functioning'**? Good question: That messages in the chat are easily sent and received, very basic. And that it is easily accessible. That is important. Imagine you receive a message, just like WhatsApp that you can easily open and just go with it." (HCP #6)
Make platform personal	5	3/2 (0.3/0.13)	"Is this my file? **Yes, indeed, it is.** Oh, maybe this would be clearer if it would say: *My* file. That would sound more friendly." (Patient #6)
An algorithm that gives a notification with abnormal values	3	0/3 (0/0.19)	"It would it be clearer and easier to me if there would be some kind of algorithm that alarms you if there are any problems. You would be losing less time for checking the data and you would not oversee any alarming values." (HCP #12)
Offline platform/possibility to print the information	2	1/1 (0.1/0.06)	"A different technological problem: What if the internet would break down but everything is documented in the online files only? You would be completely dependent." (HCP #5)
Access to 'training-computers' so that patients can get comfortable with technology	2	1/1 (0.1/0.06)	"We need computers in the training rooms. I want them to learn how to log in so that they can do it at home as well." (HCP #13)

Table 2 (continued)

Attributes	Frequency	Patients / HCP* (mean)	Example Quotation
Spelling check in chat	1	1/0 (0.1/0)	"Have you ever tried to read something that was written by someone who is word-blind? That is very exhausting! Mail applications have a spelling check, at least mine does, so it can correct my spelling and I can see how it needs to be written." (Patient #3)
Search function on the platform	1	1/0 (0.1/0)	**"**A search function in the chat would be helpful**."** (Patient #6)
Autonomy and Empowerment of patients: Patients are aware of the various steps of their rehabilitation. Small and realistic steps are essential. Patients feel that they are involved in the treatment and are able to take responsibility for their rehabilitation process. Patients understand why self-management is important and how to engage in self-management successfully.			
Small, personal, realistic steps	18	0/18 (0/1.13)	**"**So, what I have just said, it helps if you make realistic plans together with the patients, so that they don't have to start working on all goals at the same time. I believe that that this is very important. And it should be possible that they choose goals that are important for themselves. It should come from them." (HCP #19)
Creation of (body) awareness in patients	16	4/13 (0.4/0.81)	"Nowadays there is so much information about lifestyle everywhere. So, I believe that if you start feeling better by engaging in a healthier lifestyle, you will keep doing that. That is exactly what I am hearing from my clients. When I am asking, how is it going? They say I feel better; I REALLY feel better." (HCP #5)

Table 2 (continued)

Attributes	Frequency	Patients / HCP* (mean)	Example Quotation
Freedom for patients to choose if they want to engage in eHealth and if so, to what extent	15	10/5 (1/0.31)	"So, what I am saying is, it seems very important to me that if you have the possibility to fill in your data, you should have control about it. Even though I believe there must be someone behind the screens to check the values and contact me if anything goes wrong, but still, all that advice: *You should go running again!* for example... I will decide on my own when I am going to run again." (Patient #3)
Insight into health values can be stimulating	13	2/11 (0.2/0.69)	"**Yeah, so the rewards are not important for everyone?** The platform might be a guide for people. Look I do have an intrinsic motivation to care for my own health, but I think that I could use new insights by having this platform, like: 'Oh yes, I could try this!' Because I don't know everything yet." (Patient #10)
Creation of Intrinsic motivation for long-lasting change	12	1/11 (0.1/0.69)	**"**If the rewards fall away, there might be a group of patients who only engaged in self-management for these rewards. So, it would be best if they would begin to feel healthier and keep living healthy in order to feel the changes. To feel the benefits of a healthy life. So, I would see this as an issue if the rewards would be taken away." (HCP #16)

Table 2 (continued)

Attributes	Frequency	Patients / HCP* (mean)	Example Quotation
Responsibility for patients	6	0/6 (0/0.38)	"By having patients check their own blood pressure, watch educational movies and using these apps and knowing the information about their medication they understand it all better and can dig into it. Thus, more control about their own health." (HCP #12)
Involvement of patients in decision-making	5	2/3 (0.2/0.19)	**"So, you prefer being in physical contact?** Yes, and I believe that you always have to be careful if doctors start talking to each other, but the patient often just sits next to them. Then, you have to say: Hey, I am still here!" (Patient #9)
Availability and Accessibility of reliable Information: Information and data are available at any moment. The information is complete, of good quality, and comprehensible for patients. There is no time limit for checking on the information. Patients' data and their progress cannot be manipulated by them or others.			
Clear overview of all data at a glance	25	16/9 (1.6/0.56)	"I like this, because, as I have already said, I have so many books. Three books for different things, one for my nutritionist, one for my psychological insights, and one for my physical exercise. So, 3 books in total and I even have one for my eating behaviour, too. That's not good, that is too much. If I could all put it into one place, it would be much better." (Patient #4)

Table 2 (continued)

Attributes	Frequency	Patients / HCP* (mean)	Example Quotation
Mobility of data	10	6/4 (0.6/0.25)	**"Do you think that this is a neat overview?** Yes, I think so. And do I have access to this platform from external devices? So that I can check it myself? **What do you mean with external?** Well, my Tablet, for example. **Yes, yes.** Okay, so I could check it and even download it? I would appreciate that." (Patient #6)
Need for reliable data	8	2/6 (0.2/0.38)	**"**Ehm, yeah just a source where people know where this information comes from and that there is not some kind of industry behind it, no pharmacies or such, just reliable information." (HCP #16)
Possibility to compare own data with average data	7	7/0 (0.7/0)	"So, there a several values, for example, the blood pressure. I know how it needs to look like but maybe there are others who don't**? So, you would appreciate it if there would be some kind of average values?** Yes, just in the corner: Average value: … So that people directly know if this is all right or if it is not. To make sure that they do not have to worry." (Patient #7)
Possibility to look up information that was forgotten after consult	7	7/0 (0.7/0)	"Yeah, that is a problem. If I am having a consult with my GP and he is giving me so much information that I am not able to remember all of it afterwards. Then it is very handy if someone else is with me, but if you could check it like this it would be much easier." (Patient #5)

Table 2 (continued)

Attributes	Frequency	Patients / HCP* (mean)	Example Quotation
Comprehensible language	6	5/1 (0.5/0.06)	“Pfuh, yeah this… is difficult. Look, things like an echo, or abdomen, many people do not even know what that is. I do know it, but I am a nurse, so I am not sure about others.” (Patient #3)
Information as a preventive tool	5	1/4 (0.1/0.25)	"But prevention, as well. In Canada they have a lot of information about high blood pressure by the government, via the tv or such, to create awareness and to do so in a big group of people." (HCP #16)
Information for self-management	5	0/5 (0/0.31)	“Another issue is that many people do not know exactly what they are supposed to do. You can give them advice, but you’re still not there and how are you going to support them? I believe that this is where the problem lies.” (HCP #2)
Possibility to monitor data to prevent manipulation	4	1/3 (0.1/0.19)	“I have one point of critic; does anyone control this? I can happily keep on smoking and I can eat my sausage sandwich every day, while I could fill in that I have had cucumbers and two slices of apple.” (HCP #10)
Consistent use of the platform by HCP	4	2/2 (0.2/0.13)	“Look, I can have many conversations and one person says this and the other one that and the third one thinks that all of that is not true… And this is the same with HCPs. I want to prevent that.” (Patient #9)

In the following, the medium-frequency values are presented (see Table 3). First, *Efficiency* was expressed more often by HCPs than by patients and three of its four attributes were named by HCPs only. Specifically, the HCPs highlighted that they need more time to be able to provide good care for their patients. In addition, they stated that they would like to have time to focus on the self-management skills of their patients, too, and not only on the acute problems. One HCP was concerned about the time efficiency for the patients and said that the therapy should fit into the patients' schedule. The attribute *Patients wish less workload for HCP* was found in the patients' interviews only (see Table 3).

Furthermore, the value *Motivation* was more frequently expressed by HCPs. Its first attribute, *Insight into health values can be stimulating*, has been mentioned more often by the HCPs and it is reported in Table 2, as well, for the value *Autonomy and Empowerment for patients*. Furthermore, the need for personal contact and rewards were identified as attributes corresponding to the value *Motivation*, too. Both were used more often by HCPs. The attribute *Reminder function can be stimulating*, however, was named more frequently by patients. In addition, some participants suggested that it can be encouraging to use the platform if a trusted HCP recommends that. The implementation of motivational interviews was also regarded to be stimulating by two HCPs (see Table 3).

Next, the value *Personalized Care* was named 30 times by HCPs and 6 times by patients (Table 3). Most frequently reported was that the information and modules should be adjusted to patients' age, preferences, and environmental context in order to support and inform them better. In addition, the standardization of intake session was mentioned often to discover patients' preferences. Furthermore, the attribute *No (pre-) judgment of HCP* was found. This attribute entails that HCPs should not judge patients, for example, if the patient does not want to quit smoking. The attribute *Adjustment to patients' context* was named by both groups of participants whereas the other two attributes were expressed by HCPs only.

In contrast, one can see that the value *Confirmation* was revealed by patients mainly. Most frequently found was the attribute *Involvement of HCP on platform is important*, followed by *Possibility to look up information that was forgotten after consult* and *Possibility to compare own data with average data*. The importance of the involvement of HCPs was mostly found in the interviews with patients and was assigned to the value *Trust*, as well. The other two mentioned attributes were allocated to the value *Availability and Accessibility of reliable information*, too. Lastly, two HCPs emphasized that the patients should feel safe to discuss their feelings on the

platform (see Table 3).

In similar fashion, the value *Trust* was more frequently used for expressions of patients than HCPs (see Table 3). As already mentioned, one attribute of this value was the involvement of HCPs on the platform to make the patients feel secure. Next, both HCPs and patients regarded the personal contact between patients and their health care providers as important. The last attribute of this value was *HCP should be listening to patients* and its important was highlighted by two HCPs.

The last medium-frequency value, *Continuity of care*, was found in the conversations with HCPs mainly and appeared in the interviews with the patients only once. The first and most frequently occurring attribute was *Maintenance of support after rehabilitation time in clinic*. It was reported by HCPs only. Many of them criticised that they would often loose contact to their patients after the rehabilitation time in the clinic and could not support their acquiring process of self-management skills sufficiently. Consequently, many HCPs requested follow-up sessions. By creating structures in their patients' lives, one HCP hopes to achieve long-term results. This was mentioned by one patient, too (see Table 3).

Table 3

Medium-frequency values: Efficiency, Motivation, Personalized Care, Confirmation, Trust, and Continuity of Care

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
Efficiency: The HCPs have sufficient time and effort for personal care of the patients. Therapy is time-efficient for patients.			
HCP need more time to provide sufficient care	34	0/34 (0/2.13)	**"What do you need to support your patients better with regard to self-management?** Time. Just time." (HCP #6)
Patients wish less workload for HCP	7	7/0 (0.7/0)	"Yeah, I like this. But it seems to be a lot of work for the HCP…" (Patient #8)
Time needed to focus on self-management	4	0/4 (0/0.25)	"Another difficulty is urgency. (…) We are a clinic for strokes but even here self-management is not focused at." (HCP #9)
Therapy should be time-efficient for patients	1	0/1 (0/0.06)	"It is possible that people are very busy: Because of that they might have no time to go to therapy because they lose their whole morning if they have to be here for an hour at 10 am." (HCP #6)
Motivation: Patients feel motivated and inspired to use the platform.			
Insight into health values can be stimulating	13	2/11 (0.2/0.69)	"It provides people with an insight into what they are and what they are not doing and how they can change things. So, for example, that they can compare days where they have been moving a lot to days where they have not. I believe that this is stimulating." (HCP #16)
Personal contact can be stimulating	11	4/7 (0.4/0.48)	"Something with a personal trainer is much more motivating. It is just like this, same for BENEFIT." (Patient #8)

Table 3 (continued)

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
Rewards can be stimulating	9	1/8 (0.1/0.5)	"But my mom, for example, really likes to collect points, from shell and such." (HCP #6)
Reminder function can be stimulating	5	4/1 (0.4/0.06)	"Maybe a reminder, anonymous or not, but imagine that you receive a little message after not having logged in for 2 or 5 days, saying: Hey, where are you? A little invitation." (Patient #4)
Advice of HCP to use platform can be stimulating	3	1/2 (0.1/0.13)	"If I would have been motivated, if my GP would have told me to do it, I would have kept my weight." (Patient #7)
Motivational Interviews	2	0/2 (0/0.13)	"Ehm yes, motivational interviewing, so really looking into how you can motivate people to engage in physical activity and to see if there is any motivation there already and if so, how you can increase it." (HCP #16)
Personalized Care: The rehabilitation process is adjusted to individual needs and the environmental context of patients (e.g. their financial situation, family circumstances) is taken into account.			
Adjustment to patients' context	30	6/24 (0.6/1.5)	"Our patients are older and have more disabilities. If you have had a heart attack you are not necessarily disabled afterwards. This is different with our patients." (HCP #9)
Standardization of Intake	4	0/4 (0/0.25)	"So, it would be good to for BENEFIT to check with the patient what they want to choose. Look at what they prefer, do I like this or that, maybe I don't like to go to the gym but I do like climbing. I hope that this study shows that if you let patients choose, they will be more successful." (HCP #18)

Table 3 (continued)

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
No (pre-) judgment of HCP	2	0/2 (0/0.13)	"It's important not to forget to keep thinking logically, together with the patient. Checking what is possible. If patients have tried to quit smoking 10 times already, it won't work the 11th time." (HCP #7)
Confirmation: Patients feel that they are taken seriously and understood.			
Involvement of HCP on platform is important	17	16/1 (1.6/0.06)	"Menzis is not providing contact with health care providers. If you could do that with BENEFIT, I would be very enthusiastic about it." (Patient #5)
Possibility to look up information that was forgotten after consult	7	7/0 (0.7/0)	"Yeah, that is a problem, if you're having a consult with your doctor and have to listen to so much information, that you cannot remember everything." (Patient #5)
Possibility to compare own data with average data	7	7/0 (0.7/0)	"I miss one aspect, namely average scores. I would like to have those, even though you might know some things, the measurement and standard scales might change over time." (Patient #3)
Patients should feel safe to discuss their feelings via the platform	2	0/2 (0/0.13)	"Many people did not grow up with a mobile phone and are not used to sharing their feelings online. They might not dare to do it now." (HCP #6)

Table 3 (continued)

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
Trust: Patients trust their Health Care Provider to make correct decisions.			
Involvement of HCP on platform important	17	16/1 (1.6/0.06)	"And, I don't know, can the health care provider check these values, too?" (Patient #5)
Personal contact patients – HCP can be stimulating	12	6/6 (0.6/0.38)	"When I sent a mail to people out of the blue, would you like to chat with me, then they are hesitating. On the internet, you know, they don't know me. But if I meet people during the training, they recognize me and say, ahhh so you are the one who sent the mail! Then, they know my face and start chatting with me, too." (Patient #6)
HCP should be listening to patients	2	0/2 (0/0.13)	"I try to make people feel comfortable around me and I try to make the first contact. I let them talk and listen carefully. That is an important prerequisite and it works really well." (HCP #11)
Continuity of care: Patients make use of the platform with the guidance of the HCPs on a long-term. There are possibilities for follow-up sessions for patients and their HCPs			
Maintenance of support after rehabilitation time in clinic	15	0/15 (0/0.94)	"At the moment, our biggest difficulty is that we are losing sight of our patients after their time in the clinic. Especially if we are looking at self-management, I believe that this is the biggest obstacle." (HCP #5)

Table 3 (continued)

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
Possibility for follow-up sessions	10	0/10 (0/0.63)	"I think that this would be fine, to have a follow-up meeting to have sufficient time to discuss the rehabilitation.". (HCP #17)
Creation of structure/habits in patients' lives	2	1/1 (0.1/0.06)	**"So, do you think that a website like this would help you to engage more in your own rehabilitation process?** Yes, I think that it would help to bring a certain structure into people's life." (Patient #8)

In Table 4, the low-frequency values are displayed. Those are *Transparency*, *Social Support*, *Cooperation HCPs*, *Accessibility of Communication*, *Safety and Security*, and *Sufficient Knowledge and Skills*. To begin with, the value *Transparency* consists of four attributes and both patients and HCPs referred roughly equally often to it. The first attribute is the desire of both groups of participants that the patients are informed about the rehabilitation process and can voice their opinion about it. Furthermore, it was found that both patients and HCPs regarded it as important that the HCPs can log into the platform and can monitor the activities and measurements of their patients. Lastly, the attributes *Clarity about the costs of the platform* and *Transparency of rewards* were identified.

Next, the value *Social Support* consisted of several attributes that involved the social environment of the patients and other patients with the same illness. To be more precise, the attribute *Involvement of patients' environment in order to support patient* was identified most frequently. This attribute was found in interviews with HCPs only. On the contrary, *Receiving support by other patients with the same illness* was reported by patients only whereas the advantage of group-therapies was expressed by one health care provider and two patients (see Table 4).

The next value, *Cooperation HCPs*, was mostly expressed by HCPs. A continuous care chain was mentioned by six HCPs. This includes easy and fast referrals. Good communication between HCPs was also evident in the interviews. Additionally, it was stressed several times that professionals of different disciplines should be communicating and working together. Eventually, it was mentioned that the HCPs should provide consistent information (see Table 4).

Furthermore, the value *Accessibility of Communication* was more prominent in interviews with patients. It has two attributes, namely *Chat function for small, practical questions* and *Flexible communication through different means*. The importance of the chat for small questions was highlighted by patients mainly. They specifically stressed that they would prefer to ask simple questions in the chat but would like to contact their health care providers through different means in case of emergencies. The second attribute, *Flexible communication through different means*, refers to one statement of a health care provider who is using Skype as communication tool.

The value *Safety and Security* appeared seven times and was mostly mentioned by patients. It has two corresponding attributes: *Personal data should be secure* and *Clarity about who has access to the data*. Eventually, *Sufficient Knowledge and Skills of HCP* is the last value. It was used four times and expressed by HCPs only. The first attribute referred to extra training sessions for HCPs, for example a training for motivational interviews. The last attribute *Different coaching*

approaches was used once for the remark of one HCP who is applying a certain online coaching method (see Table 4).

Table 4

Low-frequency values: Transparency, Social Support, Cooperation HCPs, Accessibility of Communication, Safety and Security and Sufficient Knowledge and Skills

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
Transparency: Patients are informed about the process of their rehabilitation. There are no secrets between HCP and patients. HCP has access to the data and progress of the patients on the platform.			
Co-determination of patients in rehabilitation process	10	4/6 (0.4/0.38)	"So, together with the patient, we are looking at how to begin with, so that they can decide what exactly they want and what therapy would fit them best." (HCP #7)
Possibility for HCPs to check patients' progress	5	3/2 (0.3/0.13)	"You can see all my data over here, and I think it is very good that my doctor can see this too." (Patient #7)
Clarity about costs of the platform	4	2/2 (0.2/0.13)	"Maybe this is a weird question, but who is going to pay all of this?" (Patient #4)
Transparency of rewards	1	0/1 (0/0.06)	"I believe that a reward system would help a lot, especially if there would be some kind of algorithm so that people exactly know what kind of reward their efforts are linked." (Patient #5)
Social Support: Patients are in contact with other patients and/or family and friends that support them in their rehabilitation process			
Involvement of patients' environment in order to support patient	11	0/11 (0/0.69)	"If you want to quit smoking but your partner or your children are smoking it will be more difficult." (HCP #10)

Table 4 (continued)

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
Receiving support from other patients with the same illness	5	5/0 (0.5/0)	"Yeah, I have seen that on other platforms. That users say: I did this or that. And then one could see what is working well and what is not." (Patient #8)
Group-therapy can be stimulating	3	2/1 (0.2/0.06)	“I always like working in groups. The social aspect of it? Imagine that there are 10 people, and they could talk about similar issues. That would be motivating for me.” (Patient #4)
Cooperation HCPs: Different health care providers communicate with each other and are aware of the whole rehabilitation process of their patients.			
Care chain must continue	6	0/6 (0/0.38)	"It would be good if the program that we have created would be continued. We could start here, and the patients could continue their path in other centres, too. The GP should be involved, as well.” (HCP #2)
Good communication between HCPs of various disciplines	5	1/4 (0.1/0.25)	"Yeah, there should be a good connection with the GP. It would be sufficient if there would be mail contact or such a passport for patients that I was talking about." (HCP #8)
Consistent information of HCP	5	1/4 (0.1/0.25)	“The most important aspect is that everything is consistent. There might be problems if one person says this and the other one that.” (HCP #2)
Accessibility of Communication: Patients have the opportunity to contact their HPC easily.			
Chat function for small, practical questions	12	9/3 (0.9/0.19)	“I think that you won’t ask anything serious via this portal, but for practical questions, it might be helpful. Questions about medications, for example." (Patient #5)

Table 4 (continued)

Attributes	Frequency	Patients / HCP (mean)	Example Quotation
Flexible communication through different means	1	0/1 (0/0.06)	"Intake via Skype conversations. It is beneficial when patients are very busy and work a lot. Then we can skype in the evening." (HCP #6)
Safety and Security: The data and personal information of patients and their rehabilitation process is secure.			
Personal data should be secure	5	4/1 (0.3/0.06)	“It is complicated to secure data. I should be able to have access to it, but if I can access it then others might be able to get into the system, too.” (Patient #6)
Clarity about who has access to the data	2	2/0 (0.2/0)	“So, this is my personal that I can check? Or does only the doctor have access to these files?” (Patient #6)
Sufficient Knowledge and Skills of HCP: HCPs are able to treat and advise the patients well.			
Extra training courses for HCPs	3	0/3 (0/0.19)	"I like this idea, but I am not sure how this can be implemented in reality, how to learn and train to conduct motivational interviews, how to convince patients to stick with their lifestyle changes." (HCP #12)
Different coaching approaches	1	0/1 (0/0.06)	“I have followed a course to become a mindfulness coach who can conduct analysis and therapy online. I can work closely together with one client for one week.” (HCP #6)

RQ2: Which persuasion strategies of the Persuasive System Design model are most promising in influencing CHF patients' attitude and behaviour in order to support their engagement in self-management?

The researchers of study 3 identified promising features for eHealth applications based on several app evaluations and existing literature. Table 6 shows that these features were assigned to three main categories, namely *User-friendliness*, *Change of behaviour*, and *Content of app*. According to the researchers of study 3, the first category, *User-friendliness*, incorporates the need for a clear and straightforward platform that is easy to navigate. Furthermore, the user should be able to adapt the platform and goals that have been. Moreover, links with other apps are desirable. Eventually, the results of study 3 suggest that the design of the app should match to the content of the app. The second category is *Change of behaviour*. In this category, four means to influence the users of eHealth platforms were formulated. To begin with, it was identified that users appreciate the opportunity to set goals and to receive feedback on their behaviour. Additionally, a coach that is guiding and supporting users as well as a reminder function are expected to be stimulating for users. The last category, *Content of app*, includes rewards for users who achieved certain goals. Furthermore, gamification is an important aspect for the participants of study 3, thus, the possibility to incorporate games in the platform that stimulate its users. The possibility to self-monitor one's own behaviour and to adjust the platform to personal preferences are highly valued, too. Lastly, it was found that patients and stakeholders have a need for reliable information and that they like to have the freedom to choose different options on the platform (see Table 6).

In this study, the results of study 3 were evaluated critically. To be more precise, the researcher looked at the names of the categories and checked if these were consistent with the features of each category. One point of critic has been found. Specifically, the second category *Change of behaviour* could have been named differently as this category consists out of features that aim at stimulating the users rather than evoking a change of behaviour immediately. Therefore, the recommendation of the researcher is to change the name of this category into *Stimulating features*. Furthermore, it was evaluated if the features were correctly assigned to one of the three categories. Lastly, the features of study 3 were compared to the results of RQ1 to see if new insights were created (see Table 6).

Table 6

Promising features of eHealth applications that were identified in study 3

Category	Feature	Critical Evaluation of feature	New contribution to this study?
User-friendliness	User-friendliness	Fits to category	No - User-friendliness has been identified in study 1 and 2 already (value *User-friendliness*).
	Navigation	Fits to category	Yes - It specifically highlights the need for easy navigation in the app.
	Adaptability	Fit to category questionable. Might also fit to C*ontent of the app* as the content is adapted to needs of the individual user. Overlap with features *Ability to set goals*, *Choices*, and *Personalization*.	No - It matches the content of the value of *Autonomy and Empowerment of Patients* and *Personalized Care*.
	Link with other apps	Fits to category but might fit to *content of app*, too, as new contents are integrated into the app through these links.	Yes - The link with other apps has not specifically identified in study 1 and 2.
	Design	Fits to category	Partly - This feature is connected to the attribute *Clear Overview of all data at a glance* of the value *User-friendliness*. However, the focus on the decorative pattern is new.
Change of behaviour	Ability to set goals	Fit to category questionable. Might fit to *User-friendliness*, too. Overlap with features *Adaptability, Choices,* and *Personalization*.	Partly – This feature is related to the attribute *Small, personal, realistic steps* of the value *Autonomy and Empowerment for patients*
	Feed-back on behaviour	Fits to category	Partly – This feature is related to the attribute *Rewards can be stimulating* of the value *Motivation*
	Coach	Fits to category	Partly – This feature is related to the attribute *Personal contact can be stimulating* of the value *Motivation*

Table 6 (continued)

Category	Feature	Critical Evaluation of feature	New contribution to this study?
	Reminder	Fit to category questionable. Might fit to *User-friendliness*, too.	No – The promising effect of a reminder function has been identified in study 1 and 2 already (value *Motivation*).
Content of App	Rewards	Fit to category questionable. Might fit to *Change of behaviour* better.	No – The promising effect of rewards has been identified in study 1 and 2 already (value *Motivation*)
	Gamification	Fit to category questionable. Might fit to *Change of behaviour*, too.	Yes – Games to stimulate users have not been explicitly reported in study 1 and 2.
	Self-Monitoring	Fit to category questionable. Might fit to *Change of behaviour*, too.	Partly – This feature is related to the attribute *Insight into health values can be stimulating* of the value *Motivation*.
	Personalization	Fits to category. Overlap with features *Adaptability*, *Ability to set goals*, and *Choices*.	No – it matches the content of the value *Personalized Care*.
	Information	Fits to category.	No – It matches the content of the value *Availability and Accessibility of reliable information.*
	Choices	Fits to category. Overlap with features *Adaptability*, *Ability to set goals, and Personalization.*	Party – This feature is related to the attribute *Freedom for patients to choose if they want to engage in eHealth and if so, to what extent* of the value *Autonomy and Empowerment of patients.*

In the following, the values that were found in the first part of this study are compared to the features that were identified in study 3 and to the persuasion strategies of the PSD model (see Table 7). For each value, the corresponding PSD strategy and the related features of study 3 are presented. It was observed that there are a few values that did not fit to any PSD strategy nor to any features of study 3.

Table 7

Identified values compared to PSD strategies and features of study 3

Values	PSD-Model Strategy	Rationale	Features of study 3
User-friendliness	Primary Task Support: e.g. *Tunneling, Reduction*	*Tunneling*: User should be guided through the platform and rehabilitation process. *Reduction*: Use of platform should be easy and without unnecessary steps.	User-friendliness Navigation Design
Availability and Accessibility of reliable information	System Credibility Support: *e.g. Trustworthiness, Expertise, Verifiability;* Social Support: *Normative Influence*	*Trustworthiness*: The information on the platform should be reliable. *Expertise:* Health information should be up to date. *Verifiability*: The information on the platform should be reliable and justified. The user should be able to trace the source of the information. *Normative Influence*: The platform should provide average health values that the users can compare.	Information
Autonomy and Empowerment of patients	Primary Task Support: *e.g. Self-monitoring, Simulation*	*Self-monitoring*: Users should be empowered by having insight into their health values and progress. *Simulation*: Users should be able to see what effect or consequences specific actions, or behaviour changes had.	Possibility to set goals Choices Self-Monitoring
Efficiency	Social Support: *Cooperation*	*Cooperation:* By incorporating different technological application or sharing information with others, the users can work more efficiently.	Links with other apps

Table 7 (continued)

Values	PSD-Model Strategy	Rationale	Features of study 3
Motivation	Dialogue Support: e.g. *Praise, Rewards*; Social Support: e.g. *Social Comparison*	*Praise*: The platform should send motivational messages after the user achieved a goal to stimulate the user. *Rewards*: The platform should offer rewards (e.g. vouchers) to motivate users. *Social comparison*: The platform should enable the user to compare his or her progress with others to stimulate the user.	Rewards
Personalized Care	Primary Task Support: *Personalization, Tailoring,* Dialogue Support: *Similarity*	*Personalization & Tailoring*: The platform should provide information that the user might be interested in. *Similarity*: The design and language of the platform should be adjusted to the age and expectations of its users.	Personalization
Confirmation	Dialogue Support: *Praise*	*Praise*: The users might feel valued and heard by receiving motivational messages and compliments.	Feedback on behaviour
Social support	Social support: e.g. *Social Facilitation,*	*Social Facilitation*: The user should be able to see that others are working towards the same goal on the platform to feel encouraged.	Gamification
Trust	System Credibility Support: e.g. *Authority*	*Authority*: The HCPs should be involved in the platform.	
Transparency	System Credibility Support: *Verifiability*	*Verifiability*: The source of information should be traceable and the advice of the platform and HCPs should be justified.	
Cooperation HCPs	Social support: e.g. *Cooperation*	*Cooperation*: The communication between HCPs should be facilitated through the platform.	

Table 7 (continued)

Values	PSD-Model Strategy	Rationale	Features of study 3
Accessibility of communication Continuity of care Sufficient Knowledge and Skills of HCP Safety and Security			Coach

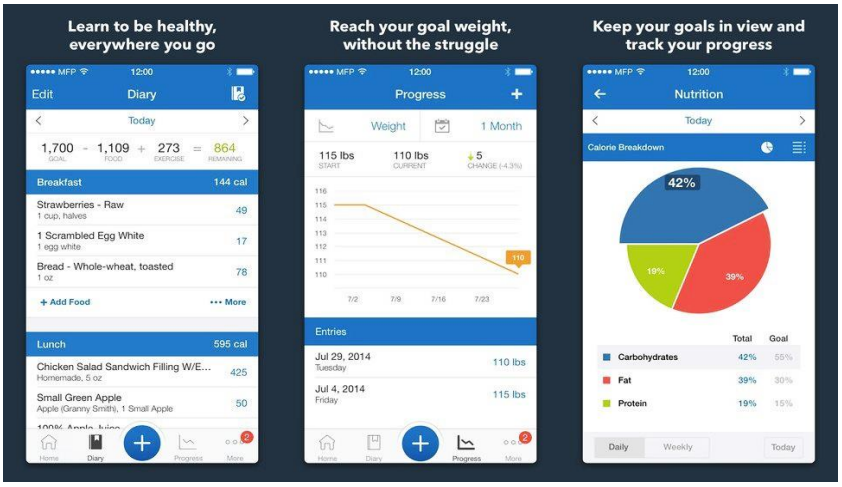
RQ3: How can these values and persuasion strategies be integrated into the design and implementation of BENEFIT to address the needs of its users and their HCPs better and to enhance self-management?

In Table 8, examples of persuasive strategies that have been used in already existing apps are compared to the identified values of RQ1 and the features of study 3. These apps were chosen out of the 80 apps that were evaluated in study 3 as they were considered to fit well to specific values. Screenshots of those example apps are displayed in the Appendix. To illustrate the findings better, a few examples are given.

To begin with, for the value *User-friendliness* one can look at the fitness app *MyFitnessPal* (see Figure 3). The use of the functions in this app are clear. To illustrate, the function *Diary* invites its users to keep records of their day, just like one would expect of a diary. Specifically, the users are asked to write down what they ate during that day. In addition, the layout of the application is neat and easy to understand, for instance the diary function is divided into breakfast, lunch, and dinner. Furthermore, the app provides a clear overview of the food that the user has been eating but also of his or her progress. To help the users understand the data, colorful graphic demonstrations are displayed. This is an example for the attribute *Clear overview of all data at a glance* of the value of *User-friendliness* and *Availability and Accessibility of reliable information*. Thus, the app M*yFitnessPal* is a distinguished example for both of these values.

Figure 3

Example of the values User-friendliness and Autonomy and Empowerment of patients: MyFitnessPal (MyFitnessPal, 2019)



Another example is the app *Google Fit* and its ability for users to choose goals or define their own ones (see Figure 4). This is an illustration for the value *Autonomy and Empowerment of patients* and the feature *Possibility to set goals*. In Figure 4, one can see that the user can easily decide which goal he or she wants to pursue. Furthermore, the value *Confirmation* and the feature *Feedback on behaviour* could be achieved by displaying stimulating messages after the user has completed his or her goals or a session successfully. To illustrate, the app *Headspace* uses a short but motivating text message to make the users feel assured and supported (see Figure 5). By feeling heard, the belief in themselves and their own abilities of the users might be increased and encourage them. Therefore, Figure 5 also serves as an example of the value *Motivation*.

Figure 4

Example of value Autonomy and Empowerment of patients: Google Fit (Google Play, 2019b)

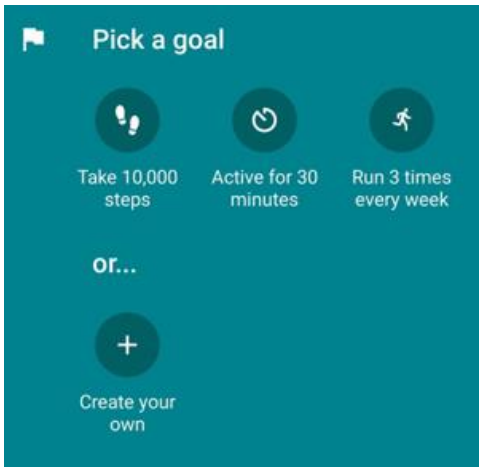


Figure 5

Example of value Confirmation and Motivation: Headspace (Headspace, 2019)

The last example that has been chosen fits to the feature *Design* that was identified in study 3 and was assigned to the value *User-friendliness*. One can look at the design of the relaxation application *Calm* (see Figure 6). In accordance with the goal of this app, namely, to encourage and facilitate meditation, the app displays a soothing background that shows a sea surrounded by mountains. This environment is expected to be associated with peace. In addition, the dominating colour of this display is blue which is often linked with calmness (Cherry, 2019).

Figure 6

Example of the feature Design and value User-friendliness: Calm (Calm, 2019)

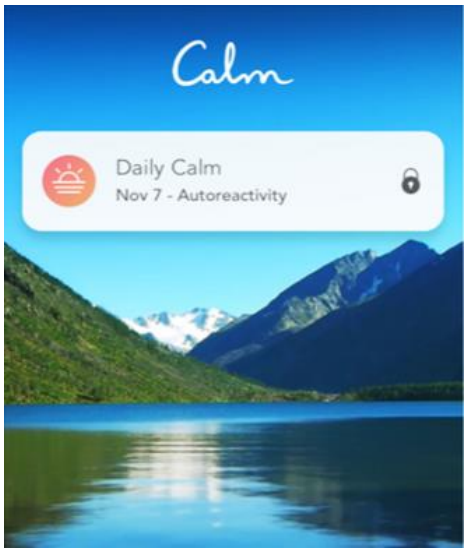


Table 8

Values with examples of apps of study 3

Values	Features of study 3	Example App	Explanation
User-friendliness	1. User-friendliness 2. Navigation 3. Design	1. Fit in 30 dagen 2. Stappenteller 3. Calm	1. The app is straightforward and neatly arranged. The goal of the app is clear. (see Appendix B, Figure 7). 2. The navigation through the app is simple and clear (see Appendix B, Figure 8). 3. The design of Calm complies to the objective of the app (see Appendix B, Figure 9).
Availability and Accessibility of reliable information	1. Information	1. Menzis samen gezond	1. The app provides a clear and reliable overview of one's data (see Appendix B, Figure 10).
Autonomy and Empowerment of patients	1. Possibility to set goals 2. Choices 3. Self-Monitoring	1. Google Fit 2. Fit in 30 dagen 3. Mijn Eetmeter	1. The user can set goals and adjust those if needed (see Appendix B, Figure 11). 2. The user can choose training sessions out of many options (see Appendix B, Figure 7). 3. The user can monitor his/her eating habits by filling them into the app and having the data presented in a clear overview (see Appendix B, Figure 12).
Personalized Care	1. Personalization	1. Kwit	1. The user can fill in specific information about his/her person and smoking behaviour. By adding that information, the app is slightly adjusted for the users' specific needs (see Appendix B, Figure 13).

Table 8 (continued)

Values	Features of study 3	Example App	Explanation
Confirmation	1. Feedback on behaviour	1. Headspace	1. The behaviour of users is monitored, and positive feedback is given when a session has been completed successfully (see Appendix B, Figure 14).
Efficiency	1. Links with other apps	1. Menzis Samen Gezond	1. The user can connect Menzis with other apps to combine data and create overview and save time.
Motivation	1. Rewards	1. Actify 2. Menzis samen gezond	1. The user can engage in challenges and earn points. With these points, the user receives a discount in stores or cinemas, etc. (see Appendix B, Figure 15). 2. The user can earn points for successfully engaging in a healthy lifestyle and use these points to buy things (see Appendix B, Figure 16).
Social support	1. Gamification	1. Weight Watchers	1. By means of the Weight Watchers community, the users can exchange experiences and support each other (see Appendix B, Figure 17).
Accessibility of communication	1. Coach	1. Fitbit	1. An eCoach can be activated who motivates and supports the user through messages (see Appendix B, Figure 18).
Sufficient Knowledge and Skills of HCP			
Trust			

Table 8 (continued)

Values	Features of study 3	Example App	Explanation
Transparency			
Cooperation HCPs			
Continuity of care			
Safety and Security			

In addition to the app examples, requirements were formulated by means of the identified attributes and values of RQ1 to answer the third research question. Requirements are specific technical translations of the wishes and interests of (expected) users so that eHealth platforms can be designed accordingly. This was done by using the Volere template (Van Velsen et al., 2013). In Table 9 and Table 10, two requirements were created based on the results of RQ1.

Table 9

Requirement 1

Requirement #: 1	**Requirement type:** Functional
Value: User-friendliness	**Attribute:** Clarity about who is participating in the chat
Description: It should be clearly stated how many people are participating in a chat. The user should be able to see who those participants are by clicking on the name of the participant and being redirected to their profiles. The profile should present basic information and (in case it is an HCP) expertise of the chat participant.	
Rationale: Many patients expressed the need for reliable information and trust in their Health Care Providers. The chat function enables easily accessible communication with the HCP. By presenting more details about (possible) chat participants, the participants know whom they are going to chat with and feel safe.	
Source: Study 1.2: 5:32, 10:30, 6:27, 6:26, 7:34	
Priority: Should	**Conflicts:**
History: created on May 19 2019	

Table 10

Requirement 2

Requirement #: 2	**Requirement type:** Content
Value: Availability and Accessibility of reliable data, User-friendliness	**Attribute:** Possibility to compare own data with average data, Graphics to demonstrate data and show a trend in data
Description: The platform should provide explanatory information (e.g. average values, graphics) for relevant measurements.	
Rationale: Patients stated that they do not always understand the meaning of their health values and data on the platform. By adding additional information in the form of average values or graphic demonstrations, patients can compare their data and better understand the meaning of the values.	
Source: Study 1.2: 3:35, 3:44, 3:45, 3:55, 5:38, 7:51; Study 2: 5:26	
Priority: Should	**Conflicts:**
History: created on May 19 2019	

Discussion

First, the findings are summarized, and the research question is answered. Then, the main findings and unexpected results of this study are discussed. Afterwards, the value of this research for the health care sector is looked at. The next part of the discussion elaborates on the limitations and recommendations for future research. Lastly, a conclusion is given.

Answering of Research Question

This study provides insight into the needs and wishes of both CHF patients and HCPs regarding eHealth. The results show that the value *User-friendliness, Autonomy and Empowerment of patients,* and *Availability and Accessibility of reliable information* occurred most frequently. In addition, there are differences between the two groups of participants and what they consider as important. To begin with, the results of this study suggest that patients attach more importance to user-friendliness, the availability of reliable information, accessible communication, and the feeling of being heard and understood than the HCPs did. On the other hand, the health care providers tend to value autonomy and empowerment of patients and personalized care higher than the patients did. In addition, the health care provider mentioned attributes related to motivation, efficiency, and the continuity of care more often than the patients.

Therefore, persuasive strategies that are related to these values are expected to be successful. By comparing the results of study 3 to these values, the features *Navigation, Links with other apps,* and *Gamification* were found to contribute new input to this study. Furthermore, several PSD strategies and features of study 3 are presented in the results section that are connected to the values. To give an example, the high-frequency value *User-friendliness* is linked to the PSD-strategy *Reduction* or the feature *Navigation* of study 3. A few values could not be connected to PSD-strategies or features of study 3, for example, the low-frequency values *Cooperation HCPs* and *Safety and Security*. It is not entirely clear why this is the case; however, these values might be less important, or it might be possible that these values have less worth for persuasion strategies in general but are more important for the participants of this study in particular. To put it differently, the value *Cooperation HCPs* is very specific for health care providers and might not be relevant for eHealth applications in general.

Moreover, this study displays examples of already existing apps and how these apps

implemented certain persuasive strategies. To illustrate, the app *Google Fit* offers its users the possibility to select and adjust their own goals. In this way, the value *Autonomy and Empowerment of patients* is addressed successfully. Lastly, this study demonstrates that these values can be translated into specific technological requirements that can be incorporated into the design of eHealth applications. In this research, two requirements have been formulated as examples based on the results of the first research question, namely *Clearly showing who is participating in the chat* and *Giving explanatory information for relevant measurements.*

Main Findings

In the following, the main results of this research are elaborated on. To begin with, three values stand out because of their high frequency of appearance, namely: *User-friendliness, Autonomy and Empowerment for patients* and *Availability and Accessibility of reliable information*. This is in accordance with the expectations of this research. To be more precise, *User-friendliness* was expected to occur often as many people are afraid that eHealth applications might not be successful as many of its users do not have the needed technological skills (Black et al., 2011). A straightforward and simple platform could ensure that even low-skilled people will be able to operate the applications.

Furthermore, the second most occurring value is *Autonomy and Empowerment of patients*. This occurrence was also expected as eHealth is supposed to empower patients and give them more control of their own rehabilitation process (Eysenbach, 2001; Hofstede, de Bie, van Wijngaarden, & Heijmans, 2014; Menichetti, Libreri, Lozza, & Graffigna, 2016). However, contrary to expectations, this value was mostly expressed by HCPs instead of patients. There might be different explanations for this finding. First, by interpreting attributes differently, the patients of this research might actually score higher on the value *Autonomy and Empowerment of patients* then they do now. To illustrate, the attribute *Possibility to compare own data with average data* is now assigned to the values *Availability and Accessibility of reliable information* and *Confirmation* whereas it could have been allocated to the autonomy and empowerment of patients, too. Second, research has shown that eHealth can be helpful for HCPs especially as it might facilitate the selection and implementation of realistic goals (Brandt, Søgaard, Clemensen, Sndergaard, & Nielsen, 2018). In addition, eHealth applications are expected to emphasize the importance of small steps and might, therefore, be a welcoming tool for HCPs (Brandt et al., 2018). This fits to the attribute *Small*,

personal, realistic steps that is reported by HCPs only and contributes to the high occurrence of this value. Third, other studies have confirmed that health care providers tend to regard the promotion of patient autonomy as a crucial step towards successful self-management of chronical diseases (Bellicha, Macé, & Oppert, 2017).

Yet, this belief is contradictory to another value that emerged in this study, namely *Efficiency*. The HCPs of this research often complained about not having enough time for their patients. Nevertheless, it might be possible that the use of eHealth applications and the responsibilities that come with it, especially in the introductory phase, would even increase their workload. This aspect was found in other studies, as well (Bellicha et al., 2017). Additionally, it is supplemented by the reluctance of physicians to obtain data through automatic data transfer. Instead, HCPs often prefer to have actual consultations with their patients in order to discuss their measurements and treatment planning (Bellicha et al., 2017).

Another contradicting finding of current research is that HCPs tend to be afraid that patients misinterpret the data that they see online or that they would start questioning the knowledge and skills of their HCPs (Hart, Henwood, & Wyatt, 2004). Some studies even suggest that the empowerment of patients could lead to a loss of control of the doctors and impair the doctor-patient relationship (Grünloh, Myreteg, Cajander, & Rexhepi, 2018). However, this concern is not evident in the results of this research and, therefore, suggests that the HCPs of this study were more progressive and open-minded than the participants of earlier studies.

Eventually, the last high-frequency value of this study is *Availability and Accessibility of reliable information*. According to Eysenbach (2001), eHealth can provide all data at a glance and this can be beneficial for both patients and HCPs. Interestingly, the findings of this research suggest that the two groups of participants appreciate this value for different reasons. To be more precise, the HCPs more often expressed the need for reliable data and information about self-management for patients than the patients themselves. This finding complies to existing literature that implies that physicians tend to worry about how patients search for health-related information online and which information they trust (Rigby, Forsström, Roberts, & Wyatt, 2001). On the other hand, patients more often referred to attributes like *Possibility to look up information that was forgotten after a consult* or *Clear overview of all data at a glance*. These often-occurring attributes are surprising because existing literature suggests that patients rather want to know the answer to a question instead of merely checking their data. Furthermore, patients tend to compare different websites to derive a reliable answer for that specific question (Adams, Bont, & Berg, 2006; Vennik,

Adams, Faber, & Putters, 2014). While doing so, it was found that most of the patients are aware of the difference between expert advice (e.g. from a physician) and the experiences of other patients and value both options (Vennik et al., 2014). This finding could not be confirmed by the results of this study.

Another interesting finding of this research is that the group of patients considered the involvement of their HCPs as very important. In addition, they often stated that they value easy and fast contact with their HCPs for practical questions. This finding is in accordance with previous research (Andreassen, Trondsen, Kummervold, Gammon, & Hjortdahl, 2006; Guo, Guo, Zhang, & Vogel, 2018). To illustrate, if trust has already been established, communication via eHealth technologies is expected to be highly appreciated by patients, mainly because of the lower threshold of communication (Andreassen et al., 2006). Besides, online communication can strengthen the relationship between HCPs and their patients (Guo et al., 2018). However, this aspect is closely connected to patient autonomy and the willingness and possibility of HCPs to engage in eHealth communication (Bellicha et al., 2017; Grünloh et al., 2018; Guo et al., 2018; Hart et al., 2004). Specifically, by having a good relationship to their doctors that is based on trust, (online) communication is enhanced. This enables the patient to take over more responsibility of the interaction with their HCP and their self-management. Contrary to previous research that highlights the concerns of HCPs regarding online communication mostly, the results of this study show that patients do value easy contact to their HCPs but are worried about the workload of them at the same time. This might be connected to the increasing public discussion about work stress and its negative consequences, including burn-out, that has just been acknowledged as an "occupational phenomenon" by the World Health Organization (World Health Organization, 2019a). Nonetheless, a clear explanation for this conflict could not be found in existing literature.

Moreover, this study suggests that neither the patients nor the HCPs worry a lot about the security and safety of their data online. Nor are the costs of eHealth applications a recurrent value. This is a contradicting finding as some other authors state that both security aspects and costs of the technologies are a point of concern for (future) end users (Showell, 2017). However, the same lack of concern about these features has been identified and questioned in other studies, too (Sieverink, 2017). One possible explanation has been given by Sieverink (2017) who compares this finding with Maslow's Hierarchy of Needs (Maslow, 1970). That entails that more basic features of the technology, for example, user-friendliness, are more important at first. Only if those

basic requirements are met, abstract demands are worried about. Nevertheless, other evidence for this clarification has not been found in existing research.

Research Implications

The findings of this study elaborate on the wishes of patients and HCPs. Therefore, an extensive overview is given that includes various aspects that range from technical aspects (e.g. *User-friendliness, Safety and Security*) to the feelings of patients and health care providers (e.g. *Trust, Cooperation HCP*s). Naturally, the attributes and values that were found in this study should be checked and compared to other studies by an independent researcher first. If approved, the results could be used as the basis for a tool, for instance a checklist, to facilitate the design of persuasive eHealth technologies. This checklist could consist of several categories, e.g. one category for each value so that all important needs of both patients and HCPs are covered. Eventually, the list could be applied in the design process of future eHealth technologies so that no important features are missed. Moreover, a checklist like this could be linked to the CeHRes Roadmap by van Gemert-Pijnen et al. (2011) as part of the continuous evaluation of the whole development process of eHealth technologies. Finally, the checklist could be used to evaluate existing eHealth applications to identify strengths and weaknesses and, if needed, adjust them.

Limitations and recommendations

During the data analysis, strengths and weaknesses of this study were recognized. A strong aspect of this research was the availability of a broad data set that included the perspective of various stakeholders. This enabled an extensive insight into the mindset of possible future users of eHealth applications and their expectations. However, limitations of this research include the lacking consistency of the interview scheme for the data collection as each study used its own interview scheme. Consequently, the fit of the interview schemes and the research question of this study might not be ideal. To illustrate, some topics were discussed that did not contribute to the aim of this study whereas other aspects were left out in the interview that might have been relevant for answering this research question. Moreover, the three studies that were combined in this research did focus on different aspects in particular. This made it more difficult to compare and coordinate the results.

Another limitation is the subjectivity of the researcher as it was a qualitative analysis of one researcher only. Although part of the formulated attributes and values were checked by an independent researcher to ensure higher reliability, the data analysis was highly depending on the interpretation of the main researcher. Thus, it is advised to work in a team of several researchers in future studies to prevent subjectivity better.

Lastly, it was not looked at how often certain participants mentioned a specific value. Therefore, it is not clear if a value did frequently occur because it was regarded as important by many participants or if it was mentioned several times by one participant only. It is advised to control this factor in future research to prevent misinterpretations of the data set.

Conclusion

This study elaborated on the wishes and needs of patients and HCPs of eHealth applications. While both highlighted their need for well-functioning and comprehensible technology often, the other points of attention varied between the groups. To fulfill the desires of patients, the platform should integrate reliable and accessible information and confirmation should be imparted to them. On the contrary, HCPs stressed that patients should be empowered to achieve more responsibility for their own rehabilitation. Interestingly, a contradiction of patient empowerment including online communication and the efficiency of HCPs is shown in this study. This conflict is found in other studies, too.

Furthermore, these values can be translated into technical requirements in order to design persuasive eHealth technologies. Two requirement examples and various examples of already existing apps are presented in this study. Additionally, based on the identified values a checklist could be designed that may assist the development and evaluation progress of eHealth applications. Especially the continuous evaluation process of the CeHRes roadmap might be facilitated through this overview of relevant values.

Important limitations of this study are the possible subjectivity of the results and the clarity about how often certain values were mentioned by participants. These aspects should be considered in future research. Despite of these limitations, this study provides a wide-ranging overview of the needs and wishes of patients and HCPs regarding the use of eHealth applications and offers possibilities to translate these values into persuasive design features.

Reference List

Actify. (2019). Welkom bij Actify. Retrieved from https://www.actify.nl/

Adams, S., Bont, A. d., & Berg, M. (2006). Looking for answers, constructing reliability: An exploration into how Dutch patients check web-based medical information. *International Journal of Medical Informatics, 75*(1), 66-72. doi:https://doi.org/10.1016/j.ijmedinf.2005.07.036

Andreassen, H. K., Trondsen, M., Kummervold, P. E., Gammon, D., & Hjortdahl, P. (2006). Patients Who Use E-Mediated Communication With Their Doctor: New Constructions of Trust in the Patient-Doctor Relationship. *Qualitative Health Research, 16*(2), 238-248. doi:10.1177/1049732305284667

Athilingam, P., & Jenkins, B. (2018). Mobile Phone Apps to Support Heart Failure Self-Care Management: Integrative Review. *JMIR Cardio, 2*(1), e10057. doi:10.2196/10057

Bellicha, A., Macé, S., & Oppert, J.-M. (2017). Prescribing of Electronic Activity Monitors in Cardiometabolic Diseases: Qualitative Interview-Based Study. *Journal of medical Internet research, 19*(9), e328-e328. doi:10.2196/jmir.8107

Black, A. D., Car, J., Pagliari, C., Anandan, C., Cresswell, K., Bokun, T., . . . Sheikh, A. (2011). The Impact of eHealth on the Quality and Safety of Health Care: A Systematic Overview. *PLOS Medicine, 8*(1), e1000387. doi:10.1371/journal.pmed.1000387

Brandt, C. J., Søgaard, G. I., Clemensen, J., Sndergaard, J., & Nielsen, J. B. (2018). General Practitioners' Perspective on eHealth and Lifestyle Change: Qualitative Interview Study. *JMIR mHealth and uHealth, 6*(4), e88-e88. doi:10.2196/mhealth.8988

Bundkirchen, A., & Schwinger, R. H. G. (2004). Epidemiology and economic burden of chronic heart failure. *European Heart Journal Supplements, 6*(suppl_D), D57-D60. doi:10.1016/j.ehjsup.2004.05.015

Calm. (2019). Discover Calm. Retrieved from https://www.calm.com/

Carbo, A., Gupta, M., Tamariz, L., Palacio, A., Levis, S., Nemeth, Z., & Dang, S. (2018). Mobile Technologies for Managing Heart Failure: A Systematic Review and Meta-Analysis. *Telemedicine and e-Health, 24*(12), 958-968. doi:10.1089/tmj.2017.0269

Cherry, K. (2019). The Color Psychology of Blue Retrieved from https://www.verywellmind.com/the-color-psychology-of-blue-2795815

Eysenbach, G. (2001). What is e-health? *J Med Internet Res, 3*(2), e20. doi:10.2196/jmir.3.2.e20

Fitbit. (2019). The fitness app for everyone. Retrieved from https://www.fitbit.com/nl/app

Fogg, B. J. (2003). Chapter 1 - Overview of captology. In B. J. Fogg (Ed.), *Persuasive Technology* (pp. 15-22). San Francisco: Morgan Kaufmann.

Google Play. (2019a). Fitnessuitdaging in 30 dagen. Retrieved from https://play.google.com/store/apps/details?id=com.popularapp.thirtydayfitnesschallenge&hl=nl

Google Play. (2019b). Google Fit: Health and Activity Tracking. Retrieved from https://play.google.com/store/apps/details?id=com.google.android.apps.fitness&hl=en

Google Play. (2019c). Pedometer - Step Counter Free & Calorie Burner. Retrieved from https://play.google.com/store/apps/details?id=pedometer.stepcounter.calorieburner.pedometerforwalking

Grünloh, C., Myreteg, G., Cajander, Å., & Rexhepi, H. (2018). "Why Do They Need to Check Me?" Patient Participation Through eHealth and the Doctor-Patient Relationship: Qualitative Study. *Journal of medical Internet research, 20*(1), e11-e11. doi:10.2196/jmir.8444

Guo, S., Guo, X., Zhang, X., & Vogel, D. (2018). Doctor–patient relationship strength's impact in an online healthcare community. *Information Technology for Development, 24*(2), 279-300. doi:10.1080/02681102.2017.1283287

Hart, A., Henwood, F., & Wyatt, S. (2004). The role of the Internet in patient-practitioner relationships: findings from a qualitative research study. *Journal of medical Internet research, 6*(3), e36-e36. doi:10.2196/jmir.6.3.e36

Headspace. (2019). Your guide to health and happiness. Retrieved from https://www.headspace.com/

Hofstede, J., de Bie, J., van Wijngaarden, B., & Heijmans, M. (2014). Knowledge, use and attitude toward eHealth among patients with chronic lung diseases. *International Journal of Medical Informatics, 83*(12), 967-974. doi:https://doi.org/10.1016/j.ijmedinf.2014.08.011

Jacobson, A. F., Sumodi, V., Albert, N. M., Butler, R. S., DeJohn, L., Walker, D., . . . Ross, D. M. (2018). Patient activation, knowledge, and health literacy association with self-management behaviors in persons with heart failure. *Heart & Lung, 47*(5), 447-451. doi:https://doi.org/10.1016/j.hrtlng.2018.05.021

Kauw, D., Koole, M. A. C., van Dorth, J. R., Tulevski, I. I., Somsen, G. A., Schijven, M. P., . . . Winter, M. M. (2018). eHealth in patients with congenital heart disease: a review. *Expert Review of Cardiovascular Therapy, 16*(9), 627-634. doi:10.1080/14779072.2018.1508343

Keesman, M., Janssen, V., Kemps, H., Hollander, M., Reimer, W. S. o., Gemert-Pijnen, L. v., . . . Evers, A. (2018). BENEFIT for all: An ecosystem to facilitate sustained healthy living and reduce the burden of cardiovascular disease. *European Journal of Preventive Cardiology, 26*(6), 606-608. doi:10.1177/2047487318816388

Kwit. (2019). Be sure to never smoke again. Retrieved from https://kwit.app/en

Markle Connecting for Health. (2003). *Connecting for Health: A public-private collaborative*. Retrieved from https://www.markle.org/publications/1429-personal-health-working-group-final-report

Maslow, A. H. (1970). *Motivation and Personality* (Third ed.): Harper & Row.

Menichetti, J., Libreri, C., Lozza, E., & Graffigna, G. (2016). Giving patients a starring role in their own care: a bibliometric analysis of the on-going literature debate. *Health Expectations, 19*(3), 516-526. doi:10.1111/hex.12299

Menzis samen gezond. (2019). De app waarmee je alles over je gezondheid leert. Retrieved from https://samengezond.menzis.nl/app/

Mulder, P. (2017). MoSCoW Methode Retrieved from https://www.toolshero.nl/project-%20management/moscow-methode/

MyFitnessPal. (2019). Fitness starts with what you eat. Retrieved from https://www.myfitnesspal.com/

Oinas-Kukkonen, H., & Harjumaa, M. (2009). *Persuasive Systems Design: Key Issues, Process Model, and System Features* (Vol. 24).

Rigby, M., Forsström, J., Roberts, R., & Wyatt, J. (2001). Verifying quality and safety in health informatics services. *Bmj, 323*(7312), 552-556. doi:10.1136/bmj.323.7312.552

Showell, C. (2017). Barriers to the use of personal health records by patients: a structured review. *PeerJ, 5*, e3268-e3268. doi:10.7717/peerj.3268

Sieverink, F. (2017). *Opening the Black Box of eHealth: A Mixed Methods Approach for the Evaluation of Personal Health Records.* Enschede: University of Twente Retrieved from https://research.utwente.nl/en/publications/opening-the-black-box-of-ehealth-a-mixed-methods-approach-for-the

Stichting Voedingscentrum Nederland. (2019). Mijn Eetmeter: app and online. Retrieved from https://www.voedingscentrum.nl/nl/thema-s/apps-en-tools-voedingscentrum/mijn-eetmeter-app-online.aspx

Talboom-Kamp, E. P. W. A. (2017). *E-Health in primary care : from chronic disease management to person-centered e-Health : the necessity for blended care*. Leiden University. Retrieved from https://openaccess.leidenuniv.nl/handle/1887/55806

van Gemert-Pijnen, J. E. W. C., Kelders, S. M., Kip, H., & Sanderman, R. (2018). *eHealth Research, Theory and Development: A Multi-Disciplinary Approach*: Routledge, Taylor and Francis group.

van Gemert-Pijnen, J. E. W. C., Nijland, N., van Limburg, M., Ossebaard, H. C., Kelders, S. M., Eysenbach, G., & Seydel, E. R. (2011). A Holistic Framework to Improve the Uptake and Impact of eHealth Technologies. *J Med Internet Res*, *13*(4), e111. doi:10.2196/jmir.1672

Van Velsen, L., Wentzel, J., & Van Gemert-Pijnen, J. E. W. C. (2013). Designing eHealth that Matters via a Multidisciplinary Requirements Development Approach. *JMIR Res Protoc*, *2*(1), e21. doi:10.2196/resprot.2547

Vennik, F. D., Adams, S. A., Faber, M. J., & Putters, K. (2014). Expert and experiential knowledge in the same place: Patients' experiences with online communities connecting patients and health professionals. *Patient Education and Counseling*, *95*(2), 265-270. doi:https://doi.org/10.1016/j.pec.2014.02.003

Volksgezondheid en Zorg. (2019). Hart- en vaatziekten→Cijfers & Context→Huidige situatie. Retrieved from https://www.volksgezondheidenzorg.info/onderwerp/hart-en-vaatziekten/cijfers-context/huidige-situatie#node-prevalentie-hart-en-vaatziekten-naar-leeftijd-en-geslacht

Weight Watchers. (2019). About WW. Retrieved from https://www.weightwatchers.com/us/about-WW

World Health Organization. (2019a). Burn-out an "occupational phenomenon": International Classification of Diseases. Retrieved from https://www.who.int/mental_health/evidence/burn-out/en/

World Health Organization. (2019b). Cardiovascular disease. Retrieved from https://www.who.int/cardiovascular_diseases/en/

Appendix A

Table 5

Values with frequencies

Values	Explanation	Frequency in total (mean)	Frequency Patients*/ HCPs** (mean)
User-friendliness	The platform is user-friendly. It provides an overview. There are no technical problems so that patients and HCPs can use the platform without interruptions. It is comprehensible how to use functions of the platform. Patients are introduced sufficiently to the eHealth technology and its functions.	111 (4,27)	55/56 (5.5/3.5)
Autonomy and Empowerment of patients	Patients feel that they are involved in with the treatment and are able to take responsibility of their rehabilitation process. Patients understand why self-management is important and how to engage in self-management successfully. Patients are aware of the various steps of their rehabilitation.	86 (3,31)	19/67 (1.9/4.19)
Availability and Accessibility of reliable information	Information and data are available at any moment. The information is complete, of good quality, and comprehensible for patients. There is no time limit for checking on the information. Patients' data and their progress cannot be manipulated by them or others.	81 (3,12)	47/34 (4.7/2.12)
Efficiency	The HCPs have sufficient time and effort for personal care of the patients. Therapy is time-efficient for patients.	46 (1,77)	7/39 (0.7/2.44)
Motivation	Patients feel motivated and inspired to use the platform.	43 (1,65)	12/31 (1.2/1.94)

Table 5 (continued)

Values	Explanation	Frequency in total (mean)	Frequency Patients*/ HCPs** (mean)
Personalized Care	The rehabilitation process is adjusted to individual needs and the environmental context of patients (e.g. their financial situation, family circumstances) is taken into account.	36 (1,38)	6/30 (0.6/1.88)
Confirmation	Patients feel that they are taken seriously and understood.	33 (1,27)	30/3 (3.0/0.19)
Trust	Patients trust their Health Care Provider to use the platform and make correct decisions.	33 (1,27)	22/11 (2.2/0.69)
Continuity of care	Patients make use of platform with guidance of the HCPs on a long-term. There are possibilities for follow-up sessions for patients and their HCPs.	27 (1,04)	1/26 (0.1/1.62)
Transparency	Patients are informed about the process of their rehabilitation. There are no secrets between HCP and patients. HCP has access to the data and progress of the patients on the platform.	20 (0,77)	9/11 (0.9/0.69)
Social support	Patients are in contact with other patients and/or family and friends that support them in their rehabilitation process.	19 (0,73)	7/12 (0.7/0.75)
Cooperation HCPs	Different health care providers communicate and are aware of the whole rehabilitation process of their patients.	16 (0,62)	2/14 (0.2/0.88)
Accessibility of communication	Patients have the opportunity to contact their HPC easily.	13 (0,5)	9/4 (0.9/0.25)
Safety and Security	The data and personal information of patients and their rehabilitation process is secure.	7 (0,27)	6/1 (0.6/0.06)
Sufficient Knowledge and Skills of HCP	HCP are able to treat and advise the patients well.	4 (0,15)	0/4 (0/0.25)

* Quotes in total Patients: 195; Participants: 10

** Quotes in total HCP: 257; Participants: 16

Appendix B

Figure 7

Fit in 30 days (Google Play, 2019a)

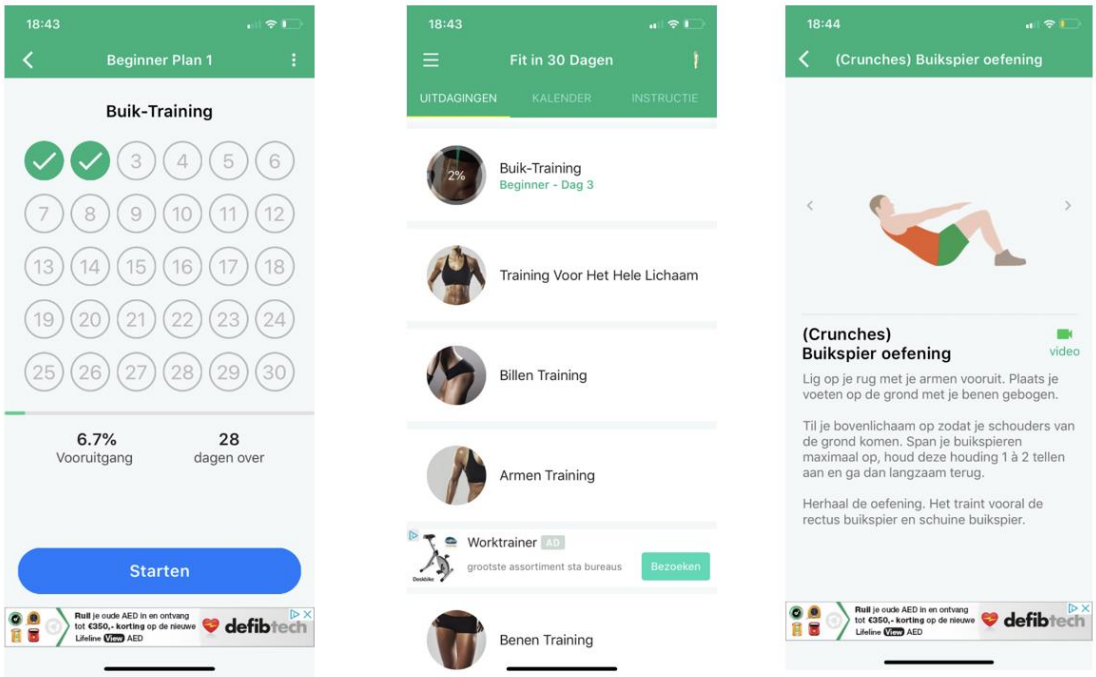


Figure 8

Stappenteller (Google Play, 2019c)

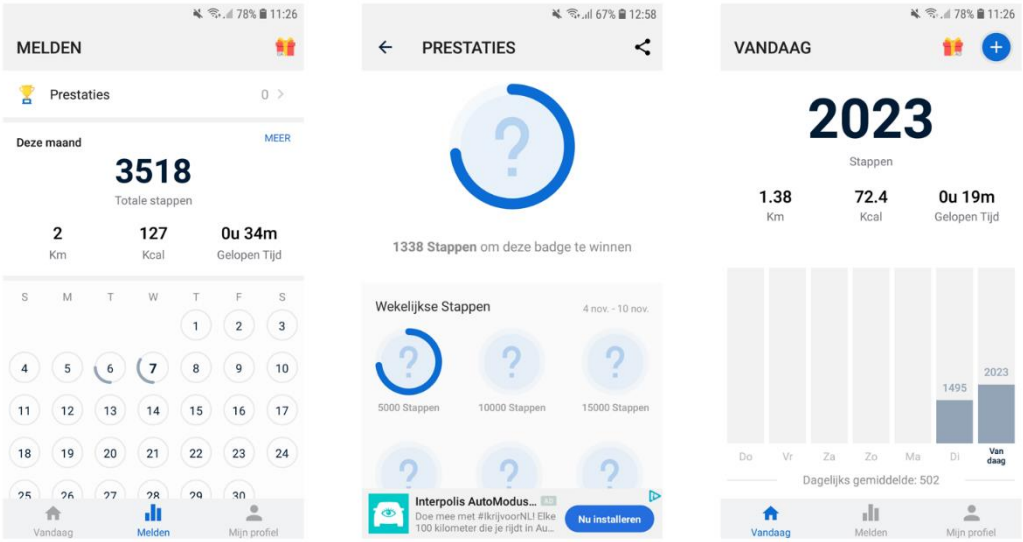


Figure 9

Calm (Calm, 2019)

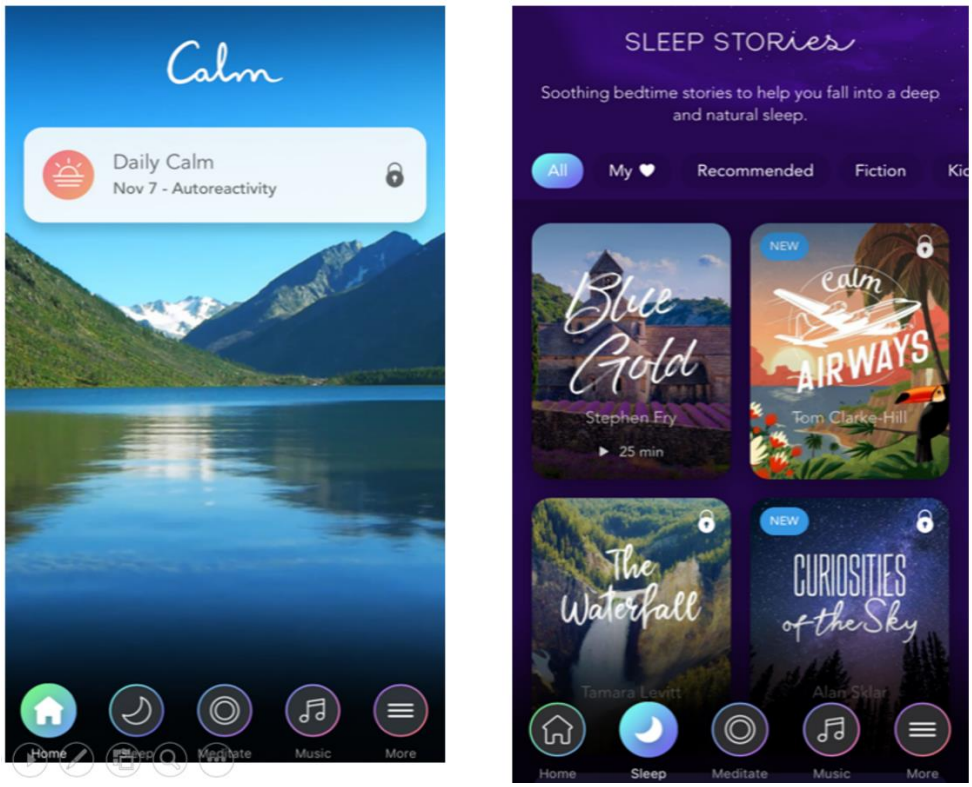


Figure 10

Menzis samen gezond (Menzis samen gezond, 2019)

Figure 11

Google Fit (Google Play, 2019b)

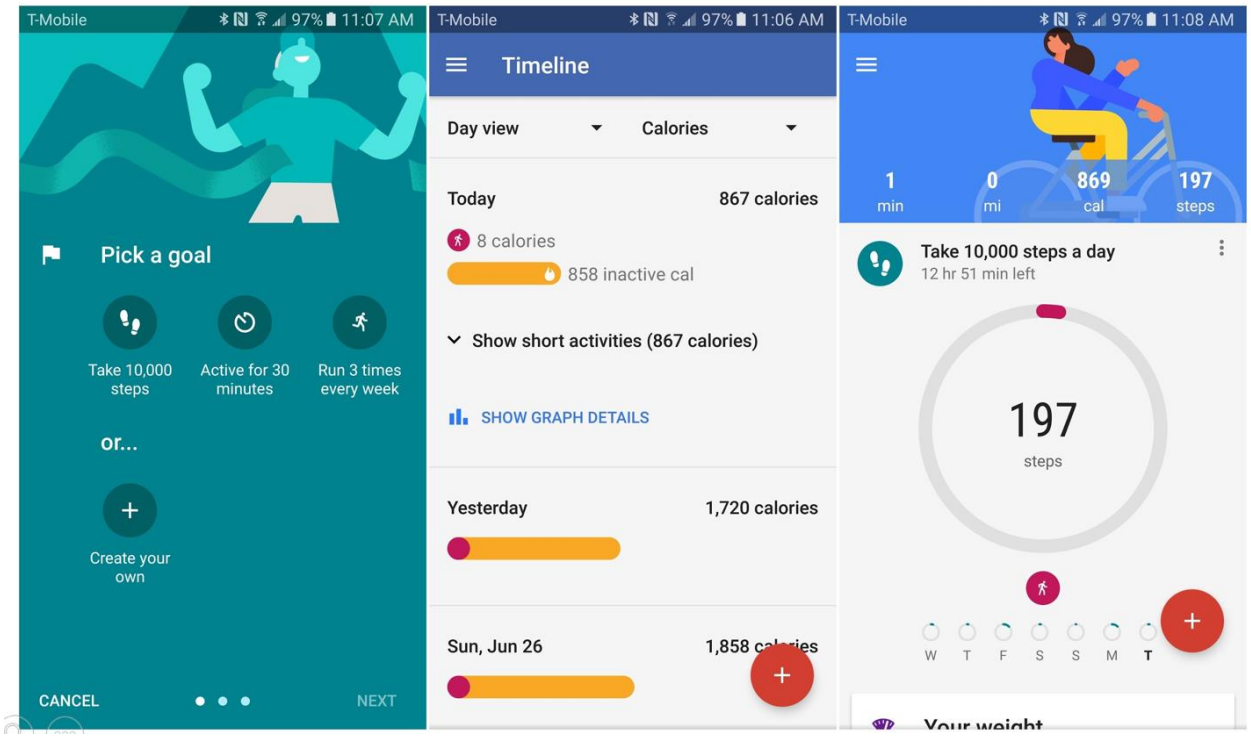


Figure 12

Mijn Eetmeter (Stichting Voedingscentrum Nederland, 2019)

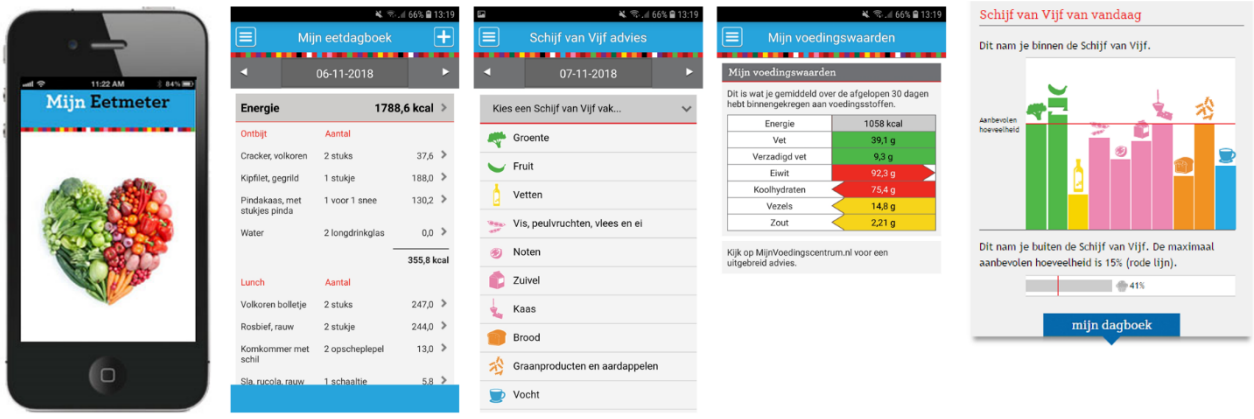


Figure 13

Kwit (Kwit, 2019)

Figure 14

Headspace (Headspace, 2019)

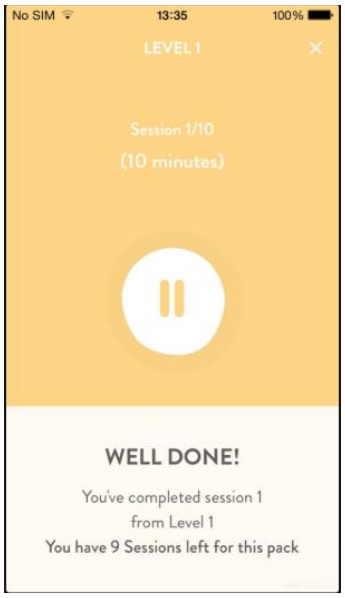


Figure 15

Actify (Actify, 2019)

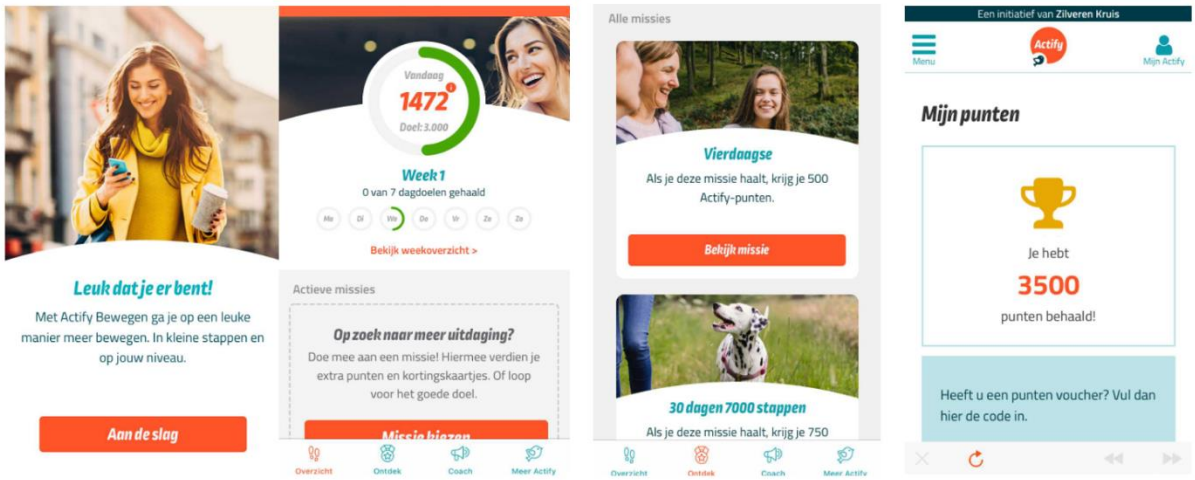


Figure 16

Menzis Samen Gezond (Menzis samen gezond, 2019)

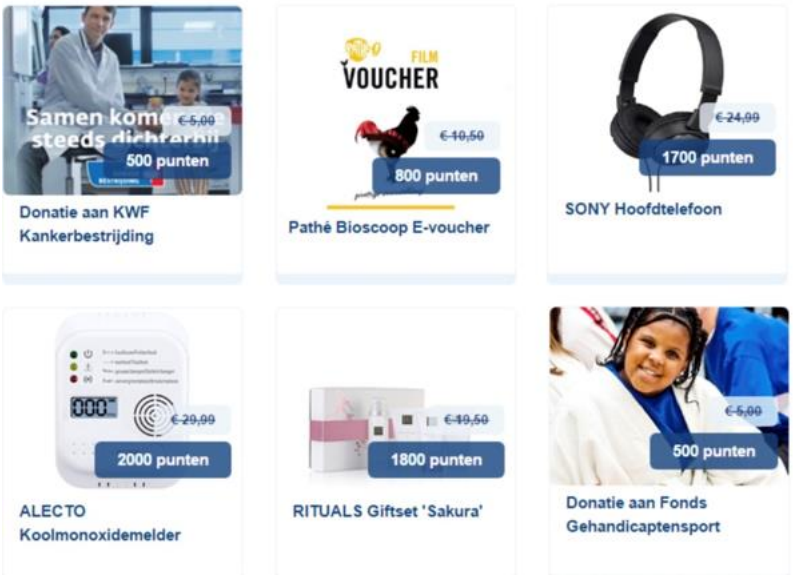


Figure 17

Weight Watchers (Weight Watchers, 2019)

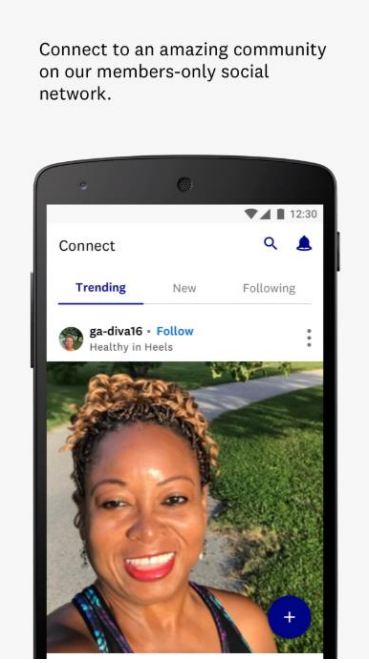


Figure 18

Fitbit (Fitbit, 2019)