Evaluation of usability of the application "Geluk en zo" of chronic pain patients

10 EC Theses

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Abstract

Aim: The focus of this study is the intervention app “Geluk en zo”, which is created for chronic pain patients, as a supportive system, while being in treatment in the rehabilitation center Roessingh. The app is based on Acceptance and Commitment Therapy (ACT), which is considered effective in chronic pain disorders. The aim of the study is to investigate the usability of the app through evaluation of user experience.

Method: In order to gain insight into user experiences, chronic pain patients were invited, after a presentation performed by the researchers, to participate in this qualitative research. The application was tested by the patients for 14 days after they gave consent to join the study and a semi-structured interview.

Results: The analysis of the interviews indicated that the users evaluated the usability of the app positively but improvable. Even though not all reminders worked well and more user-interaction is desired due to personalization. None of the participants completed all exercises.

Conclusion: In general, the design of the app is rated positive. The usability of the application “Geluk en zo” is experienced as not satisfactory. To enhance the usability, it is recommended to improve the app. Therefore mixed-method is recommended.

Contents

1. Introduction

In 1965 the Gate Control Theory of Pain (Melzack & Wall, 1965) was introduced leading to a perspective shift on the common view of pain, and chronic pain in particular. Until then, pain was viewed solely as organic and somatic processes. Eventually, psychosocial influences and the impact of experiencing pain were taken into account, which helped to pave the way for chronic pain from a biomedical model to a biopsychosocial model. Recognizing the importance of the dynamic interaction between biological, psychological, and social factors also had an impact on treatment and therapy. Hence, Gate Control Theory of Pain is the basis of our modern understanding of the physiology of pain.

1.1 Chronic pain

One in five Europeans is estimated to be suffering from chronic pain. It is associated with various problems, such as impairing social and family lives, and decreasing productivity at work for those affected, as well as a financial burden for economy and society (Breivik et al., 2006).

According to the International Association for the Study of Pain (IASP) chronic pain "will be defined as pain that persists or recurs for more than three months" (2015). More than 2.2 million people in the Netherlands are suffering from chronic pain (Bekkering et al., 2011). According to a European wide study of Breivik et al. (2006) the prevalence of chronic pain in the Netherlands is 18%, which is still low compared to other European countries.

1.1.1. Consequences of Chronic pain

Chronic pain is a problem for various reasons. One of these is a higher prevalence of other psychiatric disorders that chronic pain patients have in comparison with the general population, meaning the probability of mental disorders in the general population is in the range of 6.5%, versus 16.9% in the chronic pain patient population (Benjamin et al., 2000). In the spectrum of symptoms that chronic pain patients can suffer from, there are some that can also occur in depression and anxiety disorders, such as changes in sleep, appetite, and energy, and decreased interest in social and professional activities (Kreling, Cruz, & Pimenta, 2006). However, chronic pain is often associated with depression and anxiety, among other disorders, either as a cause or consequence. Bair et al. (2003) found a prevalence of 52% of comorbid major depression in a clinical chronic pain population. Breivik et al. (2006) found

19% of depression diagnoses among a Dutch chronic pain patient population. Beside psychological and psychiatric issues resulting from chronic pain, everyday life activities and responsibilities can suffer as a consequence as well, like performing household chores, living independently, performing at work, and attending social activities and interactions (Breivik et al., 2006). Thus chronic pain interferes with mental health as well as emotional and social aspects.

Next to the negative impact that chronic pain has on the patients and their social environment, the society encounters increasing direct costs in health care caused by chronic pain treatments, and moreover, increasing indirect costs caused by patients being less able to work, not being able to attend work, or losing their job due to disabilities (Breivik et al., 2006; Lambeek et al., 2011). According to Breivik et al. (2006) the mean of days missing work within 6 months are 6.8 days in the Netherlands, which is lower than the average of 7.8 days among 16 European countries. It has to be taken in consideration that the mean duration of pain in this Dutch chronic pain population is estimated at 6.5 years. This study also reveals that 29% of Dutch chronic pain patients lost their job as a result of pain. The indirect costs deriving from pain were estimated at 3.9 billion Euro in The Netherlands in 1991 (van Tulder, Koes, & Bouter, 1995). Research on chronic pain and related work loss showed that fear-avoidance beliefs about physical activities are strongly related to work loss (Vlaeyen & Linton, 2000; Waddell et al., 1993).

1.1.2 Mechanism and treatment

Fear avoidance, also referred to as pain avoidance, is perceived as a key element within suffering and disability of pain. Fear avoidance describes behavior that affects various aspects of a pain patients life. The experience of pain can lead to fear and anxiety of movement and physical activity. This can be followed by attempts to reduce pain and fear4444 by controlling it, which can be avoiding behavior, such as withdrawing from social activities (McCracken & Samuel, 2007). The Fear Avoidance Model of Pain (Vlaeyen & Linton, 2012), shown in Figure 1, describes the mechanism of avoidance and persisting pain in some chronic pain patients.

Figure 1. Graphical fear-avoidance model, reproduced from Vlaeyen and Linton (2012).

The Fear Avoidance Model builds upon patients' beliefs about the pain they experience and the interpretation of pain. According to these beliefs pain can be an explicit signal of injury necessarily leading to disability. Pain triggers cognitive, emotional and behavioral responses: Pain is falsely interpreted as a catastrophe and as a signal of serious damage. This leads to fear of injury and pain experience, and results in fear of movement. In addition, the patients tend towards overestimating the extent of pain in future activities. The patients are going to avoid physical movement or activity in order to avoid pain in the further course. However, avoiding pain worsens the problem and extends into hypervigilance, which can be described as an intense alertness and primary focus on physical signals that can be interpreted as signs of pain or injury. Thus, the Fear Avoidance Model includes a positive feedback loop, because the avoiding behavior results in reinforcement due to the absence of pain. The positive feedback only has a short-term benefit, as the long-term effects of persistent avoidance and hypervigilance are increased risk of physical and mental deterioration due to avoidance of physical daily activities. This enhances the vulnerability for more pain and suffering, and paves the way for a reduction in positive experiences, social isolation and low levels of physical activity. The latter is associated with the term "disuse syndrome", which lowers the threshold for the experience of pain (Crombez et al., 2012). In short, chronic pain patients tend to avoid thoughts, feelings, memories, physical sensations, and other internal experiences despite the negative long-term consequences, maintained

through the reinforcement of short-term relief of the discomfort that the avoided unpleasant sensations evoke. This short description matches with the definition of a concept called "experiential avoidance" (Hayes, Strosahl, & Wilson, 1999). The relevance of experiential avoidance as a source of problematic behavior is emphasized in chronic pain and associated with increased pain intensity, depression, and pain-related anxiety (Feldnerr et al., 2006; McCracken & Vowles, 2006). However, experiential avoidance occurs in various other mental disorders, such as major depressive disorder, wherein isolation and suicide can derive from the avoidance of feelings of sadness, guilt and low self-worth. Also, it occurs in social anxiety, as the avoidance of anxiety and concerns of judgments from other people results in the continuous avoidance of social situations. These are only few examples of disorders in which avoidance plays a key role, and regardless on how the targets of avoidance or the resulting behavior may differ, the consequences of avoidance in many disorders, including chronic pain, are long-term discomfort and distress in numerous forms.

1.1.3 Acceptance and Commitment Therapy (ACT)

Thus, addressing avoidance has become a primary focus, especially in more recent, third-wave cognitive-behavioral approaches. Changing avoidance means to include emotional, cognitive, and behavioral aspects of the problem. However, it is the behavioral response in particular that has to change. The mechanism of Acceptance and Commitment therapy (Figure 2), which is one of mentioned third-wave cognitive-behavioral approaches, is responsive to avoidant behavioral change in favor of valued outcomes. The central goal of ACT is psychological flexibility, which is defined as "*the ability to contact the present moment more fully as a conscious human being, and to change or persist in behavior when doing so serves value ends*" (Hayes et al., 2006, p.7). In the process of fear avoidance in chronic pain, hypervigilance and avoidance narrow the ability to contact the present moment, as the focus is on pain perception, and the avoidant behavior is rather serving short-term relief instead of flexible actions in favor of value ends. In order to change avoidance and especially achieve the goal of psychological flexibility, patients learn how to adapt to new situations, activating resources, changing perspectives and to find a balance in competing desires and needs (Hayes et al., 2006). Instead of catastrophizing painful sensations and avoiding these, patients accept and commit to unchangeable aspects of their life, like chronic pain and resulting unpleasant experiences, like fear and physical pain, in such a way as to enable them to focus on their values. ACT consists of six processes that patients go through so as to achieve the goal of it: psychological flexibility (Figure 2).

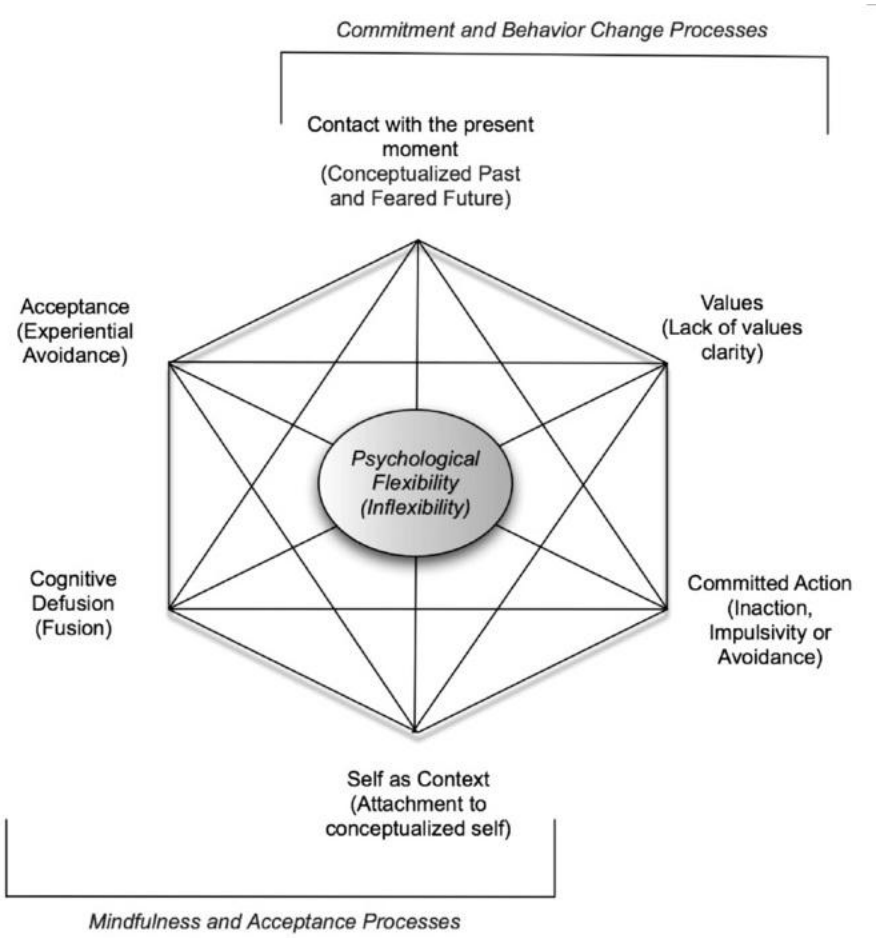

Figure 2. The hexaflex model of Acceptance and Commitment Therapy for psychological flexibility and inflexibility

In the following, the six processes are described and adapted to chronic pain patients. The core process acceptance is about accepting feelings and thoughts. In addition it is taught as an alternative to experiential avoidance. It encourages to embrace and actively experience private events instead of attempts to change frequency and form of the event. In the matter of chronic pain, this means that the patients are given methods helping them to experience fear of pain and injury as a feeling (Hayes et al., 2006), and not giving any meaning to it than just a feeling, and let the pain occurring and expiring.

Cognitive defusion means to view (pain-related) thoughts as thoughts instead of a true reality, and to experience (pain-related) sensations rather than trying change their content. A chronic pain patient could fear the pain occurring before even moving, because he or she imagines the pain worse than it is. So it is important for the patient to defuse from these thoughts in order to give activity and movement a chance.

Contact with the present moment is a mindfulness-based approach referring to be in the here and now, and not being negatively influenced by past or future. This means, in

moments of pain, the patient should learn to get in touch with the pain without attempting to change this event. Mindfulness and experiential exercises are often used in this process in order to gain insight into unhealthy patterns of behavior (e.g. avoidance of movement) that have developed in the past.

The process Self as context is about the absolute awareness by observing oneself from different perspectives and to look at psychological or sensational events, like fear and pain, simply as events that occur. This process focusses on that ability to change perspective and to adopt a point of view that is independent from emotional and physical sensations, like fear and pain (Hayes, Strosahl, & Wilson, 2012).

Values are the intrinsically motivated and free chosen "paths" from different life domains that are leading to a purposeful and meaningful life. In ACT the patients are encouraged to identify with these values regardless of a problem such as chronic pain (McCracken & Yang, 2006).

Committed action is the process in ACT that transforms the chosen values into concrete goals and actions in order to integrate the values in ones' life. Encouraging exercises can be useful to help patients to pursue with actions in line with the identified values (Hayes et al., 2012). For a chronic pain patient, this could mean to engage in meaningful activities again despite fear and pain.

The primary goal of ACT is neither being free of symptoms nor symptom reduction, but about acceptance and mindfulness, creating a meaningful life while accepting pain and other unpleasant sensations (Harris, 2006). Harris (2006) even points out that ongoing attempts of symptom reduction create clinical disorders in the first place. In the matter of chronic pain the mentioned attempts of symptom reduction are described in the Fear Avoidance Model, alongside with the consequences including physical disorders, depression, and anxiety among others.

Acceptance-based treatment can minimize the burden of various disorders. In a meta-analytic review of eighteen randomized controlled trials about the effectiveness of ACT in depression, physical health, distress, and other mental health conditions, Powers, Vörding, and Emmelkamp (2009) found ACT to be more effective than non-active control conditions; however, there was no evidence found that ACT was more effective than established treatments, such as Cognitive Behavioral Therapy (CBT). ACT may as well reduce the burden of chronic pain. Hann and McCracken (2014) reviewed ten studies on ACT-based treatments in chronic pain patients showing superior improvement compared to inactive treatment. Another review of Acceptance-based interventions in chronic pain patients finds ACT

promising as an alternative treatment to CBT treatment (Veehof, Oskam, Schreurs, & Bohlmeijer, 2011). In contrary to traditional CBT treatment, ACT often deviates from the standard protocol and can be applied in shorter forms (Feliu-Soler et al., 2018). This makes ACT-based treatments applicable to be delivered in different formats, such as web-based interventions, which have undergone an expansion in recent years in a broad field of health- and lifestyle contexts (Brown, Glendenning, Hoon, & John, 2016).

1.2 eHealth interventions

eHealth is increasingly used in healthcare and refers to the use of information and communication-based technologies, such as computers or smartphones. The goal of it is to support health and healthcare. The use of eHealth can be divided in front-end and back-end data exchange. While back-end data exchange involves a healthcare practitioner, front-end data exchange involves the patient or client. In the field of eHealth in mental conditions, front-end data exchange is used and often includes web-based programs, information, self-monitoring, peer support, and virtual applications and games (Dritsas et al., 2006). The patient can use these elements in eHealth in order to be supported before, while or after treatment; however, some researchers argue that eHealth can even be an alternative to face-to-face treatment. According to Anderson (2009) web-based therapy can have the same effects in mental health as face-to-face CBT.

The use of eHealth has some advantages, such as low costs for patients and the economy, an easy access to treatment for people with access to the internet, and often the warranty of anonymity (Andrews & Titov, 2010). Time effectiveness is an important factor as well, because of long waitlists in traditional face-to-face treatments that can be simply avoided in eHealth treatments. It is shown that web-based interventions can cause a positive effect in comparison to waitlist control conditions (Horsch et al., 2017, Trompetter et al., 2015). However, eHealth has some disadvantages as well. There are concerns respecting the lack of therapeutic relationship. Guided treatments improve the outcomes, increase adherence and prevent drop-outs (Christensen, Griffiths, Farrer, 2009; Anderson & Titov, 2014). However, unguided treatments are more cost-effective and some studies haven even found small or no effects in therapeutic guidance (Almlöv, Carlbring, Källqvist et al., 2011; Almlöv, Carlbring, Berger et al., 2009). According to Andersson and Titov (2014) the effects that web-based interventions have on patients seem to depend on the individual needs, therefore the most important disadvantages of eHealth interventions is the lack of knowledge (1) in the characteristics of patients who benefit from it and (2) in possible negative outcomes of it.

The benefits of eHealth rise and fall with the usability of the used program or application. Usability is conceptually defined by the International Organization of Standardization (ISO 9241-11 Ergonomic requirements for office work with visual display terminals (VDTs) Part 11: Guidance on usability (1998)) as the extent to a human-made object operates with effectiveness, efficiency, and satisfaction in a specified context (Peevers et al., 2007). It means the quality of a program that enables the user to achieve a goal of his or her own purpose after managing a number of tasks. Usability is a fundamental requirement for an online application intervention, because people do not pursue to use the application when they come across difficulties in the usage, like not finding answers on key questions, or unclear usage. From the user's point of view the usability is important in order to feel capable of using the application and to successfully achieve the aimed goal. For the developer's point of view, it is rather important to create a successful product. An operational definition of usability includes the heuristic framework of Nielsen (1994) which is grouped into five goals of usability: learnability, efficiency, memorability, errors, and satisfaction. In order to determine a better understanding for the evaluation of a web based intervention, in this study the ten heuristics of Nielsen (2012) are used: (1) visibility of system status, meaning that the systems should give feedback to the user within reasonable time, (2) match between system and the real world, in which it is important that the system and the user can communicate on one level, and that it offers information in a modest order, (3) user control and freedom, meaning for the user to have control over their own content, and to be able to reverse or cancel the usage at any time. (4) Consistency and standard is about the request to the users to stay flexible in the use even when some options in the usage result in the same outcome, (5) error prevention concerns a preventive and careful design, (6) recognition rather than recall means the reduction of user memory by clarifying option and actions. The user should not recall information himself in order to be able to use the next part of the application. (7) Flexibility and efficiency of use means that the interface can adapt to the requirements of the user. Someone, who needs more support, while installing or using the app has to have the option to have access to help and support, while an experienced user should get a different interface, (8) aesthetic and minimalist design, this should not contain irrelevant information or options that are barely used, instead the layout should be appealing and clear. (9) Help users recognize, diagnose, and recover from errors means that when an error screen appears the message should be understandable and a solution should be offered. (10) Help and documentation means that information should be concrete, easy to find and focused on the users' task.

These heuristics are relevant in order to improve the impact and uptake of web-based interventions.

1.2.1 ACT-based eHealth interventions and chronic pain

Web-based CBT self-help interventions are seen as a promising approach for treating various conditions, such as chronic pain and related disorders (Cuipers, van Straten & Andersson, 2008), this seems to be applicable to ACT-based eHealth treatments in chronic pain patients as well (Buhrmann, et al., 2013; Trompetter, et al., 2015). ACT-based treatments aim to target different aspects of chronic pain and related psychosocial constructs. Such as in CBT, pain catastrophizing plays an important role in web-based ACT treatment and is targeted in order to be improved. As well as traditional ACT treatment, web-based ACT interventions aim to directly reduce pain interference, and as a result, indirectly reduce depression and anxiety in chronic pain (Dworkin et al., 2005). Even though the pain intensity is not a direct target in ACT-based treatment it still can be reduced as an indirect effect of a web-based intervention as a result of targeting pain acceptance and related psychosocial constructs (Vowles & McCracken, 2008; Trompetter et al., 2015). As mentioned earlier, web-based interventions can be delivered as support after a treatment. As ACT includes active aspects and encourages to specific actions in favor of valued living, web-based applications of ACT can support chronic pain patients in maintaining learned behavior and prevent from recidivism back to negative behavioral patterns (Veehof et al., 2011).

In the context of chronic pain a Dutch eHealth intervention has been developed which is named “Geluk en zo”. The intervention is presented in a form of a smartphone application and should be used for two weeks. It is a short ACT based treatment concept for chronic pain patients used in the rehabilitation center Roessingh. The intervention is an opportunity to increase well-being of the patients by using the concepts of ACT, added with mindfulness exercise with the main focus on action towards values and acceptance.

1.3 Aim of this study

This qualitative study aims to investigate the usability of the ACT-based smartphone application “Geluk en zo” that is used by chronic pain patients, while getting treatment in the rehabilitation center Roessingh. The development of the intervention is user-centered (UCD), which means that it is an iterative design process that focusses on the users and their desires in all stages of design and progress.

The evaluation of the usability is relevant in order to further improve the application

based on the user experiences in the matter of effectiveness, efficiency and satisfaction, as well as learnability, and user interaction. For getting a deep insight as possible, the model of Nielsen (2012) and Van Gemert-Pijnen (2013) was used which includes the important heuristics for testing usability on interventions. These heuristics are used in the interviews that were taken in this qualitative study.

Research question:

How do chronic pain patients evaluate the usability of the online intervention “Geluk en zo” during their treatment?

Subquestions:

How do participants evaluate the design of the app, with regard to aesthetics and layout?

How do participants experience the perceived ease of use?

What do the participants evaluate about user- control, with regard to user- interaction?

2. Methods

2.1. Design

This study is a qualitative research, based on the experiences of chronic pain patients with regard to the usability of an eHealth intervention system. All participants were treated for chronic pain at Roessingh rehabilitation center based on the principles of ACT. Presentations about the app were held for three groups by the two researchers (JS) and (NS), one outpatient group and two inpatient groups. The participants used an app for two weeks, followed by a semi- structured interview.

2.2. Participants

In this section the authorization and setting of the patients for treatment are described. The selection of chronic pain patients for a treatment at Roessingh takes place in an intake interview. In which group patients fit for treatment depends on different factors. Depending on the intake interviews and the personal aims of the patients, a treatment plan was conceptualized and depending on physical and mental conditions the patients were selected for one of the two treatment groups. Furthermore, the length of treatment was planned individually, depending on the personal situation of the patient. Patients, who were quite resilient, were set into the outpatients group for a treatment length of 8 weeks. In the clinical

group were physically low burden patients for a treatment length of 6 weeks.

The required criteria for participation in the study were to be 18 years or older, to be diagnosed with chronic pain, to be treated for chronic pain in the rehabilitation center in Roessingh, agreed to use an online intervention, and to consent to the participation.

Participants of this study were selected after they joined a presentation about the app. The participants were from three different presentation groups, one outpatient group and two inpatient groups. Out of 13 patients, who took part at the presentation, 9 patients agreed to participate. Two patients refused to participate, one patient cried after presentation because her suffering was too high and another patient refused the interview because of personal circumstances. Among the participants were two men (n=2) and seven women (n=7). The participants were Dutch and ranged in age between 24 and 59 years old (mean age= 42, 8). The participants varied in demographic data and they used different mobile systems, as shown in Table 1. The temporal use of the app refers to the information of the users. The app was not used daily during the specified period. Therefore, the information about invested time in usage refers to the period it was used intermittently.

Table 1. *Treatment groups, demographic data, mobile devices, usage of app and given reasons for not completing the app*

Participant	Gender	Age	Treatmentgroup	Mobile device	Invested time in usage	Reason
1	Female	57	Outpatient group	Android	2 weeks	Reminder function
2	Male	24	Outpatient group	iOS	2-3 days	Reminder function
3	Female	57	Inpatient group	iOS	2 weeks	Overwhelmed with app and treatment
4	Female	27	Inpatient group	iOS	1 week	Skipped film, no reminders
5	Male	54	Inpatient group	Android	1 week	Felt forced, to many reminders
6	Female	36	Inpatient group	Android	1 week	Overwhelmed with app and treatment
7	Female	29	Inpatient group	iOS	2-3 Days	Overwhelmed with app and treatment
8	Female	43	Inpatient group	Others	2 Days	Got sick. Paused but program went on
9	Female	59	Inpatient group	Others	4 Days	Reminder function

2.3 Procedure

The researchers prepared a presentation in PowerPoint. Presentations (Appendix 1) about the online intervention app “Geluk en zo” and the aims of the study were given by two researchers to both patient groups. The two researchers have set three appointments for the presentations.

During the presentation it was stated that after using the online intervention an interview has to be taken about the user’s experiences. After the presentation was held, the researchers asked the patients for participating in their study. Participation in the study was voluntary and the participants had to sign an informed consent before installing the app on their mobile phone (Appendix 2). Furthermore, the participants received information on the length of the interview, that their data will be treated confidentially and that they could stop their participation at any time without giving reasons.

Participants were assisted by two researchers to download and install the app. Depending on their mobile devices they could download the app in App Store or Play Store. The app is called “TIIM” – The Incredible Intervention Machine (Figure 3). After entering their email address the participants received a link within a few hours and their applications was activated for usage.

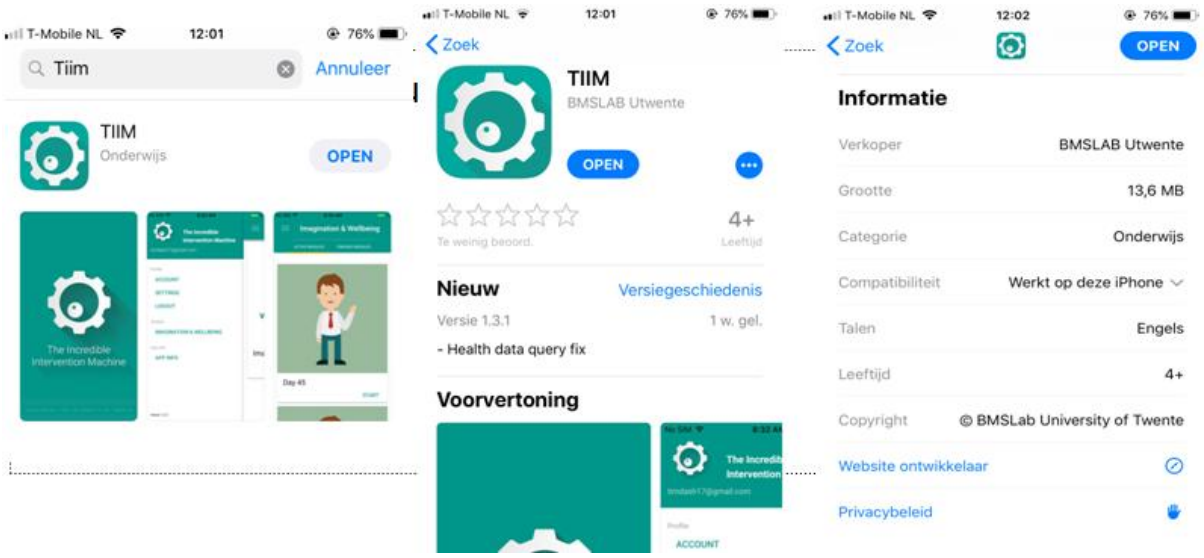

Figure 3. Download of the app in Play Store or App Store

They had the possibility to try the app during their treatment for 14 days. After the participants had gone through the app for 14 days, appointments were set for the interviews. The interviews were divided up between two researchers. One researcher (NS) interviewed

five patients and the other researcher (JS) interviewed four patients. The interviews (Appendix 1) were taken individually, face-to-face in a quiet atmosphere at the rehabilitation center Roessingh. The interviews were recorded while taking place. It was pointed out that the participants should express their opinion about the app freely. The interviews lasted between 30- 45 minutes.

2.4. The app "Geluk en zo"

The app "Geluk en zo" is an ACT-based online intervention created by researchers from the University of Twente. The app is designed to be used for two weeks. The setting of the app consists of different stages and exercises, which are explained in an introductory video. The app "Geluk en zo" is about self-care for your own happiness. The main focus is on values and to find them, to learn them and to discover what makes participants happy. After the registration the participants are able to use the app. The app was tested by the participants over a period of 14 days. The app was designed to send reminders for different parts and exercises. The app started with an introductory video about the use, handling of the app and explanations about happiness and living a life according to values. Further the app offers another video with explanations about the used words for the exercises. The participants should come out of confusion of their thoughts and come in the direction of acuteness of thoughts. That means that they have to decide from what they want to get away from and where they want to go. For the following days the participants received three reminders a day, at different times. They should state their activity of what they were doing and how far this was fitting their goals and values. The purpose of the reminders was to keep the participants thinking about their activities and realize their private motives about their actions. Participants have to go through four levels. The levels have different lengths depending on the time that is intended per level. The first and the third ones are once a day for 30-60 minutes. The second and the fourth one are three times a day with 1-2 minutes time investing. That's the reason why the training is about two weeks. Furthermore the app got the option to "look back" for the participants, to see their own process.

2.5. Materials

In order to comprehend the user experiences and to take interviews, the researchers of this study used the app themselves for two weeks prior to their presentation. They used mobile phones with an iOS operating system. The participants also needed a mobile phone to use the app.

The presentation was made by the researchers with the program Microsoft PowerPoint. On the basis of the experiences the researchers made, research questions from

their own research part and different theories were used for an interview scheme, which has been conceptualized by the researchers. The interview scheme involves different question parts to identify user needs and requirements of the app (Appendix 2). In relation to the layout the participants were asked to what extent they found the app clearly arranged *"To what extent did you find the app well-arranged?"* and in relation to errors they were asked what problems they encounter in the system *"What problems did you encounter in the system?"* . The interview is semi-structured, also called in-depth interview, with more general and predefined questions with the opportunity to continue asking questions to get deeper insight answers. In relation to clarity, participants were asked what made the app clear for them, *"What made the app clear?"*. This is done to get more detail information. Furthermore researchers can ask participants for examples, too see if there are the same or different reasons between them. This kind of interviews gives more detail information, which is important for qualitative research. The interview was developed with reference to the standardized guidelines, how to set up an interview scientifically, and checked by a supervisor. The interviews were taken face-to-face and recorded with an audio-recorder. Afterwards, the interviews were transcribed in Microsoft Word. Therefore the audio recordings were played and typewritten by the researcher. In order to be able to code the transcribed interviews the qualitative program Atlas.ti was used. By typing out the recorded interviews, it stays close to reality during processing and analysis. This increases reliability.

2.6. Data-analysis

The data- analysis from this qualitative research is performed in several steps in an exploratory manner. The numbers of participants were split between the two researchers. The interviews were transcribed by the both researchers. One researcher (NS) transcribed five interviews with the program of amberscript, which is an online support, and the other researcher (JS) recorded and transcribed four interviews using the program Microsoft Word Document. In order to be able to explore qualitative data, a thematic analysis was used in this study, which is an appropriate technique in a clinical context according to Braun and Clarke (2006).

The researchers searched for topics and categories, and divided the interviews into fragments that fit in the research questions. Afterwards, the analyzing program for qualitative research Atlas.ti (version 8) was used. The transcribed interviews were added into the Atlas.ti program, after that unimportant information has been removed. This means that answers that do not relate to the questions and that are not relevant to the research have been removed. This is done to ensure the anonymity of the participants. The researchers gave uniform names

with initials of the participants to the recordings, interviews and transcripts. This is done to find information easier, to avoid bias, confusion and to increase the replicability of the research methods. Subsequently the content of the interviews is analyzed with an inductive approach for developing principal theme and deploying a coding tree. These have been exchanged and compared among the researchers and were also sent to the supervisor.

Afterwards the researcher (JS) went through six steps of analysis from Braun and Clarke (2006). The summarized transcripts were read again and concepts were noted (step 1). Then the first codes were developed by encoding systematically interesting feature in the complete data set and by assigning relevant data to the codes (step 2). In this part both inductive and deductive approaches are used. Identification with interesting data, linking the codes (inductive) and identification of interesting codes, linked to data. This was done with the aim to find possible tensions, inconsistencies and contradictions. In the following step it was searched for topics and motives. Then the codes were combined according to potential motives and topics (step 3). Afterwards it was looked whether the topics and motives are consistent with the coded passages and the entire data material (step 4). This was followed by formulating clear definitions and naming of each topic (step 5). Finally, the result of analysis was prepared. This is done by selection of meaningful examples of a topic and final analysis with reference to the research questions and subsequent preparation of the final scheme (step 6). The final topics are shown in the coding scheme (Appendix 3). The coding scheme includes three topics; it contains codes, definitions of them and comments of participants. After consultation with the two supervisors, further interesting codes were found and added to the coding scheme and analysis of the data. To increase reliability, the data analysis has been checked by two other researchers. The coding scheme has been adjusted afterwards and has once again been controlled by researcher.

3. Results

The results are based on user experiences related to the succeeded use and difficulties with the interface of the app. A coding scheme was used to evaluate the comments of participants with regard to usability and their experiences.

In Table 3. the coding scheme is presented. The used themes are (1) design, which describes the layout and aesthetics of the app, (2) system, which is about how the functions of the app satisfy the users, (3) user-control, is the way the app is capable to adapt to user needs.

Table 3. *Coding scheme with theme, codes and definitions*

Theme	Codes	Definition
1. Design	- Layout - Aesthetics	- Participants comments to visual design of the app, font type, videos - Participants comments on the subjective aesthetics of the design
2. System	- Installation - Learnability - Efficiency - Memorability - Motivation	- Participants are able to install the app - Participants are able to understand and operate the app - Participants trust the app as a source of help - Participants are able to remember perform task after not using the app - Participants positive feelings towards the app (they are motivated to use the app, excited, interested)
3. User-control	- Errors - Prevention - Mobile devices - Overwhelmed	- App offers error management - Feedback messages - Correction in function - User-interaction in personalizing settings / reminder timing - Participants comments to app use parallel to treatment

The following part is about the general impression of using the app in a clinical setting for two weeks. The evaluation of the interviewed participants is described per researcher because a deviation can be seen between the two researchers. Afterwards the majority opinion and the overall impressions of all participants are described.

3.1 General Impression

This part is based on the information provided by the participants (n= 9) of this study. Nine Participants from three different groups took part in this study. Two participants from the outpatients group and seven from the two inpatient groups took part in using the app and joining the interview after two weeks. One researcher (JS) interviewed one participant from the outpatient group and three participants from inpatient group, whereof one participant was male and three others were female. The other researcher (NS) interviewed one outpatient participant and four inpatient participant, whereof one was male and four were females. After that interview, participants were asked, if they would recommend the app to other patients. The interviewed group (n=4) from researcher one (JS) stated that that they would recommend the app to other patients, if the app is revised and improved. All participants (n= 4) of this

group reported problems with the reminder function. On demand how they would grade the app, in the present condition on a scale between 1 and 10, whereby 1 the lowest and 10 the highest grade is, the participants gave at average a 6.5. In the other interviewed group (n=5) from researcher two (NS), two participants would not recommend the app to other patients. The other three would recommend it to others after improving the app. They gave the app an average grade of 5.2. Based on the comments of all participants (n= 9) we get in total an average grade of 5.7.

In general, users (n=9) reported that they were enthusiastic about trying an app throughout the term of treatment. Six of the participants (n=6) joined the study because they reported to be attracted by the name of the app and the presentation of the app. The remaining three of the participants (n=3) reported that they partook in the study because they hoped that it would help them to be able to deal better with their pain. Concerning the code installation app, most of the participants (n=7) reported that installing and commencing the app was easy and clear to them, because of the support from the two researchers. Two others stated that they are highly skilled and could do the whole process without support from the researchers. One of the two participants works as an app administrator and the other participant was familiar in handling online interventions on her mobile phone.

Also, users (n=7) described that they tried to use the app but they did not use the app continuously for two weeks. Three participants used the app in the first week, answered the questions and used the value-based exercises. Two of the three reported that they were not satisfied with of the functionality of the reminders. The third one, who stopped after one week using the app, reported that she felt overwhelmed by using an app while being treated. Furthermore, the other four participants used the app for 2-4 days. The reason for dropping out after 2-4 days, one participant stated to felt overstrained, one dropped out due to illness and two participants missed the reminders. Two participants used the app for two weeks but did not complete all exercises. One of them reported that her reminder did not fully function and she regularly missed the reminders. The other participant received the reminders but reported to be overstrained with treatment and parallel app use.

In summary, five participants indicated that their reminder did not work properly, for three other participants it was felt as a burden and one participant was not able to use the app because of illness. Of all participants (n=9), did none complete all exercises. The majority (n=6) of the participants used most often the exercises related to their values and did only exercises from the first week with many interruptions. When asked what they used most in the

app, no clear answer has been given. The most common answer was the tasks of the first week, which are important for one's own values.

3.2 Evaluation of the design of the app

Related to the design and layout of the app, all nine participants reported that it was good and clear to them. Six of the participants added that they found the design particularly appealing. Most of them (n=6) reported that used colors, the presentation of the categories and the app appeared aesthetically appealing. In addition, the participants (n= 9) evaluate the app as appropriately designed and their comments to visual design of the app including layout, colors and font type are predominantly positive.

"*Good! Yes, I thought ahh how good it looks! Yes, when you look at it for the first time.*"*(m, 54 yr.)*

Related to the buttons, all participants reported that they had no problems because they were clear to them. One participant added that the types of buttons were similar to other buttons from other apps and that this type of buttons is well-known.

"Yes, that was pretty clear, just the general buttons are also the same as you are familiar with from other apps. So that was good." (m, 24 yr.)

All participants recognized the buttons of the app as standardized, so that they did not pose any problems.

"That was clear. I have had no problems with that."(f, 43 yr.)

When questioned about the font type, some participants (n=8) responded that they font type was appealing. What attracted attention during the interview was that the participants (n=4) above 50 years reported that the font type was perfect for them.

"Yes, I thought that was perfect." (f, 57 yr.)

One participant proposed an improvement. She did not find the font type unsuitable but rather obsolete.

"I was thinking maybe a different font type or something. That it seems a bit hipper, which makes it more appealing to you or something. "(f, 29 yr.).

There were also a lot of positive feedbacks (n=8) regarding the color used in the app.

"Yes, what I liked was the use of color." (f, 36 yr.)

The participants (n=8) liked the used green color. One participant added that the chosen color green has calming effects and that she is satisfied with the color because it is a natural one and is user friendly.

Furthermore some participants (n=7), gave positive feedback on the videos. The seven participants liked volume, presentation, quality and the content of the videos.

"Sound was good, yes! You can follow well, quality was good, yes was good."(m, 54 yr.)

One of the participants works as an app assessor and stated that he has to evaluate many videos. From his point of view the videos used in the app are clear and good. Even the six other participants, who were not professionals, reported that the videos of the app were easy to use, appealing and applicable. They experienced the videos as a good support function in the app.

"Oh nice. Also understandable and also applicable." (f, 59 yr.)

One participant could not give any comment about the videos because she missed to watch them. She noted that the function to skip the first introduction video is unsuitable since it is circuitous to rewatch it.

Another participant watched only the introductory video and reported that she has not noticed anything negative. Furthermore, she reported that she could not remember the content of the video because she has a lack of concentration. In summary eight of nine participants watched the videos but only seven could remember and comment to questions about the videos.

3.3.Evaluation of perceived ease of use

This section evaluates what participants reported about the perceived ease of use of the app. Several codes are considered such as installation app, which means to what extent participants can install the app on their mobile devices, learnability, which means to what extent participants are able to understand and operate the app. Efficiency means, to what extent participants trust the app as a source of help and memorability means how participants are able to remember performance after not using the app for a while. Motivation as a code was also taken into account to be able to specify participant's positive feelings towards the app. That can be how interested they are in the app, excited or motivated to use the app (Table 3.).

Concerning the code installation app, accompanied and supported participants (n=7) stated that the installation of the app went well and without difficulty. Other participants (n=2) were able to independently download and install the app. These participants (n=2) were highly skilled in dealing with apps.

Concerning the code learnablilty all participants (n=9) stated that all general information was presented in a good and understandable way. Six participants reported that there was no need for extra explanation. The following statement refers to all given information in the app.

"Information was sufficient for me." (m, 54 yr.)

This is stated by an app assessor expert and also by four other non- experts.

“Yes, very well-arranged. Yes, that looked nice.”(f, 57 yr.)

The question regarding to learnability, to what extent the participant was able to understand and apply the app; four participants indicated that they had no problems.

"Yes, good explanation and questions were also clear." (f, 43 yr.)

These participants used the app with breaks, for one or two weeks. This is the entire period of use. Details about the usage can be found in the Table 1.. Three other participants stated that they could not give a good answer to this because they used the app for 2-4 days, but they would not expect any problems with regard to learnability because of the experiences they made with the app.

"Yes, I thought it was done easily." (f, 36 yr.)

The majority (n=5) reported positively about the menu navigation and one participants added that it was made in a clear manner.

“I thought it was clear eh yes what you still had open and what you still had to do and the completed one. That was well-arranged.”(f, 57a yr.)

To the question relating to what made the app so clear and easy to use for them, most of the participants (n=6) stated that every step was very clear specified.

“Oh yes, the questions were clear. Answering, the send button. Yes, that could all be done."(f, 57 yr.).

Concerning the code efficiency participants were asked if they consider the app as a source of help. Despite not completing all the exercises, some participants (n=7) were sure that the app could be used as a source of help, after the app has been improved. Improvement for personalization in the setting of the app, optimizing the reminder function, fewer tasks at longer intervals and accompaniment by a researcher during the use is desired. The other two participants would not give answer because they have not completed all the exercises in the app. Participants pointed out that they were not able to complete the exercises due to missing reminders.

"Yes, that is not the case. That's because I didn't get any notifications."(v, 27 yr.).

Concerning the code memorability, participants (n=8) were able to give good and accurate information about the app in the interview. That shows that they are able to remember the performance of the app after a while not using it. This is also shown in the widespread and in detail expanded answers from the participants. For privacy reasons, the interviews from the participants are not listed in the appendix. In addition, one participant reported that the speed of the app was good.

"But in the end, the questions were clear and I could type it in, and then it was done. The speed to itself was just fine."(f, 36 yr.)

Concerning the code motivation, all participants (n=9) were excited and motivated in the beginning to use the app. Therefore they give different reasons. Some participants (n=3) would like to have an additional source of help after their treatment, some others would like to support research (n=2) and other participants (n=4) were just convinced of the design after the presentation about the app.

Despite motivation and enthusiasm on the part of participants (n=9), the functions of the app were not fully used. The app use over two weeks did not succeed either. Only 20% participants used the app for two weeks but not completely.

Based on the results it can be stated that many initially motivated participants (n=7) stop using the app. After using the app, the initial motivation was gone.

3.4 User-control

This part describes user-control regarding to what the app offers to the users in error management, feedback messages and corrections. Most of the reported problems are related to the topic of user-control. There was criticism and suggestions for improvement.

Concerning the code Error, there were many different arguments for problems. Some participants (n=5) reported problems with the reminder function. Two of them reported that they had no reminders; two others had too many reminders, at unfavorable times, in the middle of the night. The participants indicate that the reminder functionality limited the user's satisfaction.

"I missed things because I didn't get any reminders and yes there I missed things." (v, 57a yr.)

As a reason they state inconsistency of the reminders at unspecific time.

"Yes, I got almost all of them at night. That was very annoying."(v, 57 yr.)

One reported that she received reminders in the beginning of the intervention, at any time the reminder function stopped. She reported that she checked the settings, where the reminder function was turned on, nonetheless it did not work.

Concerning the code Prevention, suggestions for improvement have been discussed. With regard to the reminders, participants suggest, e.g., an error manager and the opportunity for corrections in functions. The participants frequently report that user interaction is desired, to be able to personalize the app in the settings to their own daily routine in order to feel more support instead of disturbances.

"Perhaps that would have been easier with the app, if it was in my day rhythm." (v, 57 yr.)

In order to increase the app use by preventing errors, participants report that the app should not continue to run until they have finished a task, so that the tasks do not stack.

"I am logged in and the system is already starting and continuing. In fact, it must first wait until you continue and then it will continue."(m, 54 yr.).

One participant indicates that the program was running while he was not working on the app. In his opinion the days should not got through until the exercises are filled in. Furthermore, he would like reminders about the system status. He has the opinion that it would help against lagging behind the exercises.

"Look from my point of view it is better that at one day you get a message about what you have to do and that you get a message the next day about what still is open, so a reminder that you still have to enter something in before you can move on. "(m, 54 yr.).

Concerning the code overwhelmed, some of the participants (n=3) reported that it was too much for them to use the app during their treatment, for which they gave different

explanations. On the one hand they reported that they felt overstrained with the app and on the other hand they reported that the handling of the app was easy. Therefore, they were asked for the reason of feeling overstrained. Some participants (n=3) reported that their treatment is very intense and with an app during their treatment, it felt too much for them. They want more support accompanied by the researchers and wish that the app should be less intense. Instead of 3-5 exercises they would like to do one exercise per day. One participant wished that the researchers should come around and ask how it works and if they need help. Furthermore they would like to use the app after their treatment is finished, as a source of help to recall learned knowledge. They claim that during their treatment they are more likely to be burdened but they can imagine the app as a relief after the treatment. They would like to continue with the app at home and practice learned behaviors and exercises. One of the participants mentioned to prefer the use after the treatment instead of during, since she considers the use more supportive.

“It is too much during treatment. Don't stick with it, it would have been better after the treatment.”(v, 57 yr.).

Additionally, if the app is used during treatment some participants (n=3) wish more time to complete the exercises.

"Look sometimes you have a treatment and the system continues but without having entered something in it" (m, 54 yr.).

Concerning the code overwhelmed, some participants (n=2) reported that they could not use the app for 14 days because they did not have enough time. As a reason for that, the two stated that Christmas holidays were interfering with the time of use and for this reason they had not time to complete the exercises and also they had no motivation. On the demand why they do not have enough time to complete the app in the holidays, although the treatment is stopped, the participants (n=2) reported that they have no desire to continue during Christmas time.

"It is precisely at the Christmas holidays and New Year, which makes no sense" (v, 57 yr.)

Furthermore, they also stated that they are already stressed enough during the Christmas seasons so that they had experienced the use of the app as an additional stress factor. They believe that at another point in time they would have complete the app. Suggestions from the participants (n=2) are to change the time of app usage considering the holiday season.

Concerning the code mobile device, five Participants had suggestions for improvement referring to the functionality of the videos in the app. One disadvantage, related to the video that is frequently reported, is that the participants could not repeat watching the video back in the app once they skipped it.

"It was a shame that I couldn't look back in the app." (V, 57a yr.)

Some participants (n=4) did not like the opportunity to go back to the video on another device using a link.

"... something with a video and you could watch it again but you only had a link for that. I thought it was strange that it was not possible in the app itself" (m, 24 yr.)

Two participants reported that they could not keep the content of the videos in mind, at one time. They reported that they need to re-watch the videos repeatedly on their mobile phones.

"Because you get so much information. Yes, it doesn't stay in your head. And that is why it would have been easier if you still look back, yes." (v, 57 yr.)

One participant did not watch the video. She was insecure if she had skipped it in the beginning of the app or if she did not have the option to watch the video on her mobile phone. To find out if there is a connection between mobile devices and watching videos, she was asked about her mobile device. The researcher told her that other participants could watch the video on the same mobile device. She stated that she was very excited to try out the app, so the possibility that she clicked the video away exists.

She had a more radical suggestion for improvement because she thinks that would help to prevent mistakes and errors. In her opinion, participants should watch the video before they can do anything with the app. Some participants (n=2), who had re-watched the introductory video on their computers, add that other participants would not do this, for convenience. Therefore, they reported that more participants would watch the introductory video again, if it is possible to do that on mobile devices in the app.

On the final question from the interview if the participants would recommend the app the opinion of the participants (n=9) was divided. Some participants (n=7) would recommend the app after it is corrected and optimized.

"Because yes it didn't work for me and also from the experiences of others in my group that it didn't work there either, yes I wouldn't recommend it yet. But the moment it is improved, I really see it as an added value."(m, 24 yr.)

Some other participants (n=2) reported that they are satisfied with the functionality of the app, in the present state, and that they would recommend the app as soon as reminders work properly.

4. Discussion & Conclusion

4.1. Overview

The aim of the study was to gain insight into the user experience and evaluation of the usability of the eHealth app "Geluk en zo" for chronic pain patients.

The user experiences in this study are based on short-term use of the application. It is also worth to be mentioned that none of the participants has completed all exercises in the app.

4.2. Principal findings

On basis of the results the app is rated high and participant's comments are generally positive regarding to the design of the app. The design of the app, with regard to aesthetics and layout are appealing and contemporary to the users. The chosen colors, the font size and the buttons are clear to users. In general, the name of the app is also appealing. In this study it has provoked interest and curiosity to participate in research and to use the app. The interface of the app does not need adoptions. Relating to the heuristics of Nielsen (2012) for evaluating usability, the app uses concepts, which are familiar to the participants and makes the app pleasing in a logical order. Other indicators for engagement of users are the level of motivation, the ease of use and the fit with everyday life (Hardiker & Grant, 2010). Furthermore, the app uses consistent and standard words, what makes the app clear and understandable.

In terms of the perceived ease of use, it can be stated that in generally the participants of this study have understood the interface and menu of the app and trust the app as a source of help, if the reminder function is improved. Furthermore, it can be said that the participants are able to operate the app and they also remember operation of the app after not using it. This is shown by the answers of the participants during the interviews. Additionally, the interviews have revealed that the participants were motivated to use the app. The motivation decreased significantly after trying the app. The majority used the app only during the first week at irregular intervals. Research has shown that patients are motivated to use an app but often fall back into old patterns of behavior (Carroll, Moorhead, Bond, LeBlanc, Petrella & Fiscella, 2017). They found out that successful users of health apps were participants who had an excellent health. Carroll et al., (2017) also shows that using an app successfully is related to differences in gender, age and education. Research about health apps, to change and manage mental health behavior, has

shown that app developers and researcher should take account of three important points to increase the use of a health app (Ernsting et al., 2017). According to Ernsting et al., (2017) these three points are the needs of older people, chronic conditions and people with low health literacy. The results indicate age-related and health- related differences in the use of mobile technologies. The three points apply to the participants in this study, which may be one explanation for the decreasing motivation. It can be stated that the app is user friendly in general but also can be further improved to increase the usability of it. First, it is important to improve the reminder function. Despite initial motivation, participants stopped using the app and did not complete all exercises. The participants gave several reasons. The most common reason was related to reminder functionality and feeling overstrained. According to the usability heuristics from Nielsen (2012) reminders can improve the use of an app and help users to remind them to use the app. Meanwhile a reminder function is standardized in apps where users can enable or disable notifications. Among the areas that need to be improved is the optimization of the reminder system in terms of the duration and frequency of reminders. Lee, Choi, Lee & Jiang (2018) studied the behavioral intervention strategies using mobile health applications for chronic diseases. They stated that automated text reminders are favorable factors in health apps but they add that it needs to be studied if people become tired or irritated by automated messages. Lee et al., (2018) state that users can experience tiredness from automated reminders and health interventions eventually could become ineffective.

In this study, there were automated messages but they arrived irregularly and could not be personalized. The participants indicated that they were irritated and frustrated by the reminders. That can be another explanation for the sudden loose of motivation of the participants of this study. The feeling of being overstrained may also result from the incorrectly working reminder. A study of Syring et al., (2015) compared the effects of textual and video information. The results show that information given by videos caused higher cognitive load compared to using text information. Their research showed a correlation between cognitive load and motivational processes. They also found out that deepening, understanding and storing video information was more effective in watching a video then reading a text. Therefore an introduction video is made to understand the app easier, without reading a long guidance and to keep the motivation of the participants. Some of the participants skipped the introduction video, which is important to understand the app. There were some participants who looked back the video on other devices but

there were participants who have not made the effort to look back the introduction video. The feeling of being overstrained without having watched the introduction video, where everything is explained, is comprehensible. The older participants (≥ 40 years) stated that it is too complicated for them. They are not so well-known with new technologies. Thereby not too fast in the implementation and watching back the videos on other devices is an additional expense for them. That fits in with the research results of Krebs & Duncan (2015), which did a cross-sectional survey about the use of health intervention apps. They found out that the use of health intervention apps depends on age, higher income and greater education. The point that use of health apps is age related could be an explanation for the short time usage and knowledge gap regarding to technique devices of the app in this study. Our research had restrictions in the distribution regarding to age. The majority of the users were older participants and mostly females in all presentation groups, what can be related to their disease.

Another explanation about stop using the app can be the due to high data input load. Participants stated that they felt overstrained with the app. One of reasons of feeling overstrained was that the app contains too many exercises. A systematic review from Lee et al., (2018) on chronic disease showed that the frequency of input into an application system was a burden on participants and affected the attrition rate. The research of Krebs et al., (2015) shows that about half of the app users had stopped using health apps because to high data entry burden, hidden costs and loss of interests. That fits in the previous research of Brenner (2003) that age appears to affect the uptake of eHealth services and the satisfaction behind it. Participants between 50 and 60 years rate interventions as less userfriendly, in contrast to the participants in their twenties (Brenner, 2003). Furthermore, increasing age has been a factor in the reduced use of the internet for health-related information (Mancini et al., 2006).
It is important to identify how to support older participants with mobile devices and apps so that they can stay motivated. Downloading, installation and registration of the app were successful with the support of the two researchers. If the participants had done that themselves, the technical deficits would probably have attracted attention. It should be mentioned that participants were offered to be able to report their questions at any time via email. None of participants wrote an email or asked for help. Which is a pity, because researchers might have found a quick and easy fix for the problem, so they could continue the use of the app.

It is important to motivate the users and keep them motivated through usage. It is also

important to reconsider the support possibilities. Nielsen (2012) stated that the higher the satisfaction of the user is, the higher the motivation to use the app. Another assumption why the participants may have lost their motivation may be due to their dissatisfaction.

Some participants used strategy's to motivate themselves to use the app more often. They tried to integrate the app into their everyday lives and use it when they had time. That did not work out regularly because they forgot it or lost their motivation to use it. That is why it is important to find ways to be able to get motivation at regular intervals. A method of how the app could keep the motivation of participants is by social support (Breton et al., 2011). They can share their strategies, their progress and experiences, which can have a positive impact on the motivation of other users. It can be cost effective and it can relieve the patient but also the professional. It can create a greater sense of life for the helper and it can also help the one who needs help or motivation for not giving up. Also, recognizing and accepting tips from a fellow patient is probably more authentic for the patient because he feels understood and knows that someone empathizes with his feelings. Sharing exercises, common problems or motivational quotes within a closed community of chronic pain patients can help the users to stay focused and motivated. Giving participants the option to share their activities and progress with other app users, increases the daily activity with their app (Munson & Consolvo, 2012). Regarding to the usability of the app, after the first testing by the target group, in terms of the external appearance it was considered as good. In terms of functionality and ways to customize the app, the participants were dissatisfied. Nevertheless, improvement in the area of functionality is still desired. Usability problems were reported in the area of functionality, which decreased the satisfaction with the use of the app. In terms of personalization and user freedom, the app has the potential of improvement, to increase the satisfaction of the user. Participants evaluate that user-interaction and user-control is desired. The results emerge the dissatisfaction of the participants is related to the timing of the reminders. In the current version of the app, participants are able to turn on or to turn off the reminder function. It is desired that the participants can adapt the reminder function individually to their daily routine. The participants want the app to be simple and customizable to their own timescale with the ability to personalize the app in choosing the time for the reminders and exercises by themselves. Solbrig et al. (2017) studies have also shown that personalization in an app is desired.

Also shown in a study is that participants desire apps with boost motivation

notifications, tailored to their own timeframes (Solbrig &Jones, 2017). This fits in with the desired user-control of the participants of this study. They want to be able to choose their own moments for receiving reminders. This is an important criticism that can lead to the support of the user in order to strengthen the autonomy, which is a goal of ACT. Furthermore, current research and studies support the assumption that reminders should be under user´s control. According to Prestwich et al. (2009), users find the property of reminders annoying and pushy, if they cannot adjust them. In addition they compared personalized reminders to general reminder. They found out that only the personalized reminders increased the exercise usage directly (Prestwich et al., 2009).

Nevertheless, some questions remain open. There are different explanations why participants lost their motivation. Reminders are not working properly and need to be improved. It is desired to personalize the app. The treatment is intense, so the participants have no desire or strength to do the tasks in the app. Usage during the holiday season is not desired. Despite being able to contact the researchers and ask for help, they stopped using the app without informing anyone. These reasons are understandable but do not match the initial motivation. After using the app, they seem to be frustrated although they did not use the app as it was designed. In order to reduce frustration, it would be helpful to offer support to the older ones before they start to use the app. Czaja & Lee (2007) did research about the impact of aging on access to technology. They found out that it would be helpful to train older participants with technical devices. Participants do not request help, for unknown reasons, so it would be helpful to offer them a voluntary training in which they can improve their technical skills.

The app *"Geluk en zo"* hold the promise in terms of increasing the happiness of chronic pain patients. Achieving happiness and satisfaction is related to the successful use of the app. Research shows that the goals can be achieved if the system is designed to accommodate the needs and preferences of the users (Czaja & Lee, 2007). The target group is often female and old-aged but if the app is adapt to this group, the experienced users will be frustrated with the app. To counteract this, it can be helpful to consider introducing levels to the app. The levels should be personalized in including the age, their personal timetable and how experienced participants are in dealing with smartphones. The participants have the opportunity to increase their skills and to rise in the levels. Whether distribution of participants has a positive effect on the usage of the app has to be studied.

4.3. Strengths

A strong point of this study is that the app has been used and tested for the first time during the treatment of patients. Another strong point is that all chronic pain participants from different treatment groups were highly engaged to take part in this study and to try out the app. The numerous participation of the patients was due to the presentation that had taken place before. During the presentation, the participant's curiosity was awakened. Therefore, the presentation is also counted to the strong points of the study. This can indicate that future patients would agree to use the app during their treatment and that presentation about the app is worthwhile. Another strong point of this study is that testing the app is completed individually. Interviews are also taken individually, face-to-face whereby the participants expressed their opinion freely and without being influenced through the treatment group.

Also important and a strong point of this study is that different levels of Smartphone skills have been taken into account. The participants differ in experience and level in dealing with mobile phones and apps. The study includes participants on expert level and participants who were beginners and unfamiliar with phones and apps.

There are some strong points regarding to the app. Striking is that participants' positive feedback regarding to visual appeal of the app and the information given in an understandable way. The contents of the app and also the video's quality are highly rated. The results of the target group confirm that the app can be a supportive system for patients during their treatment. The exercises do not expire and can be edited whenever possible for the user. That's an important point that determines whether the app is responsive to the needs of the user.

4.4. Limitations and suggestions

Based on the experiences made in this study, limitations and suggestions are described. Additionally, all results should be considered with caution because of the aspect that the users did not used the app for two weeks and did not complete all exercises in the app, so that it cannot be generalized. First of all it must be stated that participants were selected by purposive sampling, which can have advantages and disadvantages. Advantages from purposive sampling are that it is a commonly used sampling method in clinical research and it is less expensive. Disadvantages of this method are that purposive sampling can be too subjective and bias cannot be measured (Malterud, 2001).

In this study only patients, who are currently undergoing treatment have been invited to use the app. It would be interesting what other patients report about the usability of the app,

when they are in a different state, i.e., a group that uses the app before treatment starts, in the beginning of the treatment, in the middle, and one after the treatment is completed. Comparing the information provided by the different groups could give insight about which treatment moment is the best for using an app. The re-test should not only be conducted with other groups but also not during the holiday season, with improved reminders and the opportunity to personalize the app to the user's needs. The holiday season is mentioned because participants reported it as a reason for not using the app continuously for two weeks. They also state that using the app during the treatment is too intense. They want the app as aftercare opportunity. This contradicts the statement before because the treatment was stopped during the holiday season. Thus, they had no double burden regarding to treatment but the possibility to test the app, as desired as an aftercare tool, at home in their usual environment. Unfortunately, the reason cannot be discussed exactly because it is based on a presumption. The researchers had the assumption that participants lost their motivation and that they have fallen back into old behavior patterns at home. This assumption is confirmed by other studies. In the study of Thase et al. (1992) 32% of the participants relapsed in old habits after they were released to home. The Participants suffered from depression where relapses are reported frequently. That fits in this study because chronic pain patients often suffer from depression. As a consequence of the presence of chronic pain, depression is more common in chronic pain patients (Fishbain et al., 1997). To get the patients out of this condition or to prevent relapse, another positive psychology strategy should be added to the app. In addition to the ACT-based app, there should be short positive messages. That could also raise the motivation of the participants and this is the most important point. Chronic pain patients do not achieve big results because their status of their disease does not change. It is hard to stay motivated with having slow or no results. Providing rewards and encouraging messages can support them to stay focused and motivated. Even though the systematic review of Ryan and Deci (2000) shows that rewards can be counterproductive and undermine intrinsic motivation.

Additionally, because none of the participants completed all exercises and to keep user's interest to run the program, another option can be added to the app. An idea can be to receive compliments for exercises the users have filled in. Small push notifications just like short messages; you have done 50%. Congratulations. One more week, then you did it! Presenting virtual trophies when participants achieve something, for example to fill in two exercises a day, the majority of the participants reported that it had influenced their initial motivation (Munson & Consolvo, 2012).

Furthermore, there were many suggestions with regard to the functionality of the app. Some of them are important to increase the usability of the app with regard to Nielsen´s Heuristics (1994). The app does not fit in all heuristics, especially not the *error prevention* heuristic. Due to error prevention, the app must be revised because the loss of participation was also related to errors in reminders.

Another limitation in this study was that the program of the app was running even if the user was not working with it. As a result many exercises have been lost and could not be taken into account. Therefore the app should only continue to run to a certain point and then send another reminder with the status of the user including the information about his open tasks.

If the study should be repeated, it would be useful to install a button with frequently asked questions, where users can check if their problem is listed with solutions, options or with the opportunity to contact one researcher.

Some of the participants claimed that the treatment is too intense to use an app in addition. On closer inspection, it becomes clear that this is stated by the inpatient group. This statement is not confirmed by the outpatient group. They find time to work on the app, maybe because they participate in different treatments, with different intensity. Another explanation can be that the inpatient group has more depressive symptoms and is therefore less motivated. It would also be interesting to do a depression questionnaire before the participant's use the app. It can be helpful to check if there is a correlation between depression and duration or the frequency of the use of the app.

In conclusion; the current study provides a first insight into the user experiences usability of the eHealth intervention app "Geluk en zo" for chronic pain patients. The participants of this study have confirmed that the usability of the app is in generally improvable and that a supportive system is desired. Nevertheless, the desired time of use depends on the patient group and intensity of treatment. Usage also depends on the functionality of the app and seems to be age-related.

Another testing is recommended because the app is not fully used by the participants of this study. There should be more variation in demographics between the participants. An additional depression survey should be added before using the app and after usage, to get deeper insight in patient's feelings and to see if the app support well-being and reduce depressive symptoms. This is important because the majority of chronic pain patients suffer from depression and this can affect the use of an app.

To increase the reliability of the results, a mixed-method is recommended.

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Appendix

Appendix 1.

Interviewschema (n.a.v. de verdeling van Nielsen, 2012 & Van Gemert-Pijnen, 2011)

Voor ons onderzoek is het belangrijk dat dit interview wordt opgenomen, gaat u hiermee akkoord?

Demografische gegevens
a. Geslacht:
b. Leeftijd:
c. Behandelvorm: poliklinisch/klinisch

A. Algemeen, motivatie, verwachtingen en voortgang
Wat in de aanmeldingsprocedure (informatie/presentatie) heeft je enthousiast gemaakt?
Wat miste je in de aanmeldingsprocedure?
Waarom ben je de app gaan gebruiken?
Wat waren je verwachtingen van de app?
In hoeverre zijn deze verwachtingen uitgekomen?
Zou je dit kunnen toelichten?
Is het gelukt om de app twee weken te gebruiken of ben je op een bepaald moment gestopt?
Ja: waar ben je gestopt?

B. Systeem
In hoeverre vond je de app gebruiksvriendelijk?
Wat vond je van de knoppen in de app? (goed te vinden/duidelijk wat het was)
In hoeverre vond je de app overzichtelijk?
Wat maakte de app overzichtelijk?
Was de informatie goed leesbaar/zichtbaar? (lettertype, lettergrootte, mogelijkheid in te zoomen)
Wat vond je van de filmpjes?
Wat vond je van de kwaliteit van de filmpjes? (beeld/geluid)

C.Usability: subjective satisfaction (tevredenheid gebruikers)
Wat was aantrekkelijk voor jou, en wat niet?
Wat vond je van de lay-out?
Hoe heb je het gebruik van de interventie in de afgelopen twee weken ervaren?

D.Usability: learnability (omgaan met de app/bruikbaarheid/kun je de app leren gebruiken)
Wat vond je van het gebruiksgemak van de app?

In hoeverre kon je (snel) met de app leren omgaan?
Wat zou kunnen helpen om de app sneller leren te gebruiken?

E. Inhoud
In hoeverre vond je de instructies/oefeningen duidelijk? (dus wat je moest doen)
Welke wel en welke niet?
Wat maakte dat het duidelijk was?
In hoeverre kon de je gegeven informatie begrijpen?
Wat maakte het begrijpelijk?
Wat had je nodig om de informatie beter te begrijpen?
Hoe ging het uitvoeren van de oefeningen?
Wat zou je eventueel nog nodig hebben om de oefeningen goed uit te kunnen voeren?
Welk onderdeel vond je het belangrijkst/ of best geschikt? Waarom?
Heb je het gevoel dat de app een goede manier is om voor je eigen geluk te zorgen?

F. Usability: memorability (gebruiken van het geleerde wanneer de app niet wordt gebruikt)
In hoeverre lukte het je om de app in je dagelijks leven te integreren?
Wat maakte dat je het wel/niet makkelijk integreerde in je leven?
Heeft de app je in het dagelijks leven geholpen?
Op welke manier wel/niet?
Welk onderdeel vond je het belangrijkst/ of best geschikt? Waarom?

G. Service (proces van aangeboden zorg, registratie, functies die aanwezig zijn)
Heb je reminders gekregen?
Wel: Wat vind je van de reminders?
Wel: Hebben reminders geholpen om de app te gebruiken?
Niet: Denk je dat ze nuttig zouden zijn?
Niet: Heb je de app zonder reminders kunnen gebruiken?
Welke reminders zouden behulpzaam zijn?
Welke functie(s) vond je het prettigst/meest bruikbaar?
Welke ondersteuning had je prettig gevonden tijdens het gebruik van de app?Wat zou je graag toegevoegd zien?

H. Usability: efficiency (hoeveel tijd besteden gebruikers aan de app)
In hoeverre heb je aandacht besteed aan de app?
Wat had je nodig om voldoende aandacht te kunnen besteden aan de app?
Heb je tijd genomen toen je de oefeningen ging doen?
Hoeveel tijd kostte het werken aan de app?
Komt de tijd die je erin steekt overeen met wat je nuttig/bruikbaar/voordelig vond?

I. Usability: errors (fouten in het systeem)
Welke problemen ben je tegengekomen in het systeem?
Hoe heb je deze geprobeerd op te lossen?

J. Usability: errors (van gebruikers)
Welke fouten heb jij gemaakt tijdens het gebruik van de app?
Waardoor maakte je de fouten?
Wat zou hier kunnen helpen, volgens jou?

K. Blended care (inhoud behandeling)
Sloot de app aan op de behandeling bij het Roessingh?
Wat sloot goed aan bij de behandeling?
Wat sloot niet goed aan op de behandeling?
Wat miste je in de app? / Welk onderdeel van de behandeling zou je graag terug zien in de app?
Welke onderdelen van de behandeling zag je terug in de app?
Wat vind je van een app in een behandeling (zoals bij het Roessingh)?

Wat is er wel/niet prettig aan een app in een behandeling?
Heeft het geholpen om hetgeen wat je geleerd hebt in de behandeling vol te houden/toe te passen?
Welke oefeningen in de app zouden meer aandacht kunnen krijgen in de behandeling?

L. Aanbevelingen/overige opmerkingen
Is er iets in jouw situatie veranderd na het gebruik van de interventie?
Kun je de voor jou belangrijkste voordelen van de app noemen?
Kun je de voor jou belangrijkste nadelen van de app benoemen?
Heb je aanbevelingen om de app te verbeteren?
Zou je de app aanbevelen aan anderen? Waarom wel of niet?
Zijn er opmerkingen die je wil delen? / Heb je nog aanvullingen?

Wij willen je bedanken voor je deelname en bijdrage aan ons onderzoek.

Appendix 2.

Toestemmingsverklaringformulier (informed consent)

Titel onderzoek: De applicatie Geluk en zo bij chronische pijnpatiënten. Co-creatie en onderzoek naar gebruikerservaringen.

Verantwoordelijke onderzoekers: Jawaneh Sanaie, Nienke Smidt en Gert-Jan Prosman, Universiteit Twente, Enschede

In te vullen door de deelnemer

Ik verklaar op een voor mij duidelijke wijze te zijn ingelicht over de aard, methode, doel en belasting van het onderzoek. Ik weet dat de gegevens en resultaten van het onderzoek alleen anoniem aan derden bekend gemaakt zullen worden. Mijn vragen zijn naar tevredenheid beantwoord.

Ik begrijp dat het materiaal of bewerking daarvan uitsluitend voor het verbeteren van de app wordt gebruikt en voor presentaties daarover.

Ik stem geheel vrijwillig in met deelname aan dit onderzoek. Ik behoud me daarbij het recht voor om op elk moment zonder opgaaf van redenen mijn deelname aan dit onderzoek te beëindigen.

Naam deelnemer: ……..

Datum: …… Handtekening deelnemer: …..…….

In te vullen door de uitvoerende onderzoeker

Ik heb een mondelinge toelichting gegeven op het onderzoek. Ik zal resterende vragen over het onderzoek naar vermogen beantwoorden. De deelnemer zal van een eventuele voortijdige beëindiging van deelname aan dit onderzoek geen nadelige gevolgen ondervinden.

Naam onderzoeker:

Nienke Smidt / Jawaneh Sanaie

Datum: …… Handtekening onderzoeker: ...…….

Appendix 3.

Theme	Codes	Definition	Comments
4. Design	- Layout - Aesthetics	- Participants comments to visual design of the app, font type - Layout is clear and appealing to participants	*Goed! Ja, ik dacht al ahh wat ziet het goed uit! Ja, als je eerste keer ernaar kijkt. (m, 54)* *App was duidelijk. Ja, in ieder geval. (f, 27)* *Ja heel erg overzichtelijk. Ja dat zag daar neetjes uit. (f, 57)*
5. System/ perceived ease of use	- Installation app - Learnability - Efficiency - Memorability	- Participants are able to understand and operate the app - Participants trust	*Het gebruik is gemakkelijk voor me.* *Ja de app geeft ook aan hoe de app is en*

		- Motivation	the app as a source of help - Participants are able to remember perform task after not using the app - Participants positive feelings towards the app (they are motivated to use the app, excited, interested)	*die is makkelijk te gebruiken. (m, 54)* *Op zich de vragen waren duidelijk. Het beantwoorden, het knopp verzenden daaronder. Ja, dat was alles allemaal netjes te doen. (f, 57)*
6.	User-control	- Errors - Prevention - Mobile devices - Overwhelmed	- App offers error Management - Feedback messages - Correction in function - User-interaction in personalizing settings / reminder timing	*Het heeft te maken met tijdstip van de herinneringen. Als ik zit te eten, dan zal ik mijn eten niet ontbreken om het in te vullen. (f, 57)* *Ik heb ook bij instellingen gekeken dat stond wel voor mij aan maar ja, heb ik niet gekregen. (f, 27)* *Misschien was dat met de app ook makkelijker geweest, als dat in mijn dag rytme was. (m, 54)*

Appendix 4.

Quotations translated from Dutch into English

1. *Goed! Ja, ik dacht al ahh wat ziet het goed uit! Ja, als je eerste keer ernaar kijkt*

- *Good! Yes, I thought ahh how good it looks! Yes, when you look at it for the first time*

2. "*Ja dat was wel vrij duidelijk zeg maar, gewoon de algemene knoppen zijn ook wel zoals je er ook bekend mee ben van andere apps. Dus dat was al goed." (m, 24 yr.)*
- *"Yes, that was pretty clear, just the general buttons are also the same as you are familiar with from other apps. So that was good. "(m, 24 yr.)*

3. *"Dat was wel duidelijk. Daar heb ik geen problemen mee gehad." (f, 43 yr.)*
- *"That was clear. I have had no problems with that. "(f, 43 yr.)*

4. *"Ja, dat was perfect volgens mij." (f, 57 yr.)*
- *"Yes, I thought that was perfect." (f, 57 yr.)*

5. *"Ik zat te denken misschien een ander font type of zo nog. Dat het wat hipper lijkt, waardoor het je meer aanspreekt ofzo."(f, 29 yr.).*
- *"I was thinking maybe a different font type or something. That it seems a bit hipper, which makes it more appealing to you or something. "(f, 29 yr.).*

6. *"Ja, wat ik wel mooi vond was het kleurgebruik." (f, 36 yr.)*
- *"Yes, what I liked was the use of color." (f, 36 yr.)*

7. *"Geluid was goed, ja! Je kunt goed volgen, kwaliteit was goed, ja was goed." (m,54 yr.)*
- *"Sound was good, yes! You can follow well, quality was good, yes was good."(m, 54 yr.)*

8. *"Oh wel leuk. Ook wel begrijpelijk ook en ook wel toepasselijk." (f, 59 yr.)*
- *"Oh nice. Also understandable and also applicable. "(f, 59 yr.)*

9. *"Informatie was voor mij voldoende." (m, 54 yr.)*
- *"Information was sufficient for me." (m, 54 yr.)*

10. "*Ja heel erg overzichtelijk. Ja dat zag daar netjes uit." (f, 57 yr.)*
- *"Yes, very well-arranged. Yes, that looked nice."(f, 57 yr.)*

11. "*Ja, goede uitleg en vraagstelling was ook duidelijk." (f, 43 yr.)*

- *"Yes, good explanation and questions were also clear." (f, 43 yr.)*

12. *“Ja, ik vond die wel makkelijk gedaan.” (f, 36 yr.)*
- *"Yes, I thought it was done easily." (f, 36 yr.)*

13. *“Ik vond die wel overzichtelijk van de rechte kant van eh ja wat je nog open had staan en nog moest doen en de afgeronde. Dat was overzichtelijk.” (f, 57a yr.)*
- *“I thought it was clear eh yes what you still had open and what you still had to do and the completed one. That was well-arranged.”(f, 57a yr.)*

14. *“Oh ja, op zich de vragen waren duidelijk. Het beantwoorden het knopp verzenden daaronder. Ja, dat was alles allemaal neetjes te doen.” (f, 57 yr.).*
- *“Oh yes, the questions were clear. Answering, the send button. Yes, that could all be done. "(F, 57 yr.).*

15. *“Ja, dat dus niet zo. Dat komt omdat ik geen meldingen kreeg .“(v, 27 yr.).*
- *“Yes, that is not the case. That's because I didn't get any notifications."(v, 27 yr.).*

16. *“Maar uiteindelijk, de vragen waren wel duidelijk en ik kon het ook wel intikkenen en dan was het ook wel. De snelheid aan zich was prima zeg maar.“(f, 36 yr.)*
- *“But in the end, the questions were clear and I could type it in, and then it was done. The speed to itself was just fine."(f, 36 yr.)*

17. *“Ik heb dingen gemisst omdat ik geen reminders heb gekregen en ja daar heb ik dan dingen gemisst.” (v, 57a yr.)*
- *"I missed things because I didn't get any reminders and yes there I missed things." (v, 57a yr.)*

18. *“ Ja, bijna allemaal heb ik s’nachts gekregen. Dat was heel irritant.”(v, 57 yr.)*
- *“Yes, I got almost all of them at night. That was very annoying."(v, 57 yr.)*

19. *“Misschien was dat met de app ook makkelijker geweest als dat in mijn dag rytme was.” (v, 57 yr.)*

- *"Perhaps that would have been easier with the app, if it was in my day rhythm." (v, 57 yr.)*

20. "*Ik ben aangemeld en het systeem begint al en gaat door. Eigelijk moet het eerst wachten totdat je verder doet en die gaat zo door." (m, 54 yr.).*
- *"I am logged in and the system is already starting and continuing. In fact, it must first wait until you continue and then it will continue."(m, 54 yr.).*

21. *"Kijk van mijn visie is het beter dat je op een dag een bericht krijgt van wat je moet doen en dat je op de volgende dag ee bericht krijgt van wat er nog open staat, dus zo een reminder dat je nog moet iets invullen voordat je verder kan." (m, 54 yr.).*
- *"Look from my point of view it is better that at one day you get a message about what you have to do and that you get a message the next day about what still is open, so a reminder that you still have to enter something in before you can move on. "(m, 54 yr.).*

22. *"Tijdens de behandeling is het te veel. Blijf je niet bij, was beter geweest na de behandeling."(v, 57 yr.).*
- *"It is too much during treatment. Don't stick with it, it would have been better after the treatment."(v, 57 yr.).*

23. *"Kijk soms heb je visite en het systeem gaat door maar zonder dat ik het ingevuld heb." (m, 54 yr.).*
- *"Look sometimes you have a treatment and the system continues but without having entered it" (m, 54 yr.).*

24. "*Juist in die tijd die we nu hebben met keerst en oude nieuw, daar heb je dan geen zin." (v, 57 yr.)*
- *"It is precisely at the Christmas holidays and New Year, which makes no sense" (v, 57 yr.)*

25. *"Ik vond het allen jammer dat ik die in de app niet kon terugkijken."(v, 57a yr.)*
- *"It was a shame that I couldn't look back in the app." (V, 57a yr.)*

26. *“...iets met een filmpje en die kon je dan wel weer opnieuw kijken maar daar had je alleen een link voor, dat vond ik wel gek dat het niet in de app zelf kon” (m, 24 yr.)*
- *"... something with a video and you could watch it again but you only had a link for that. I thought it was strange that it was not possible in the app itself" (m, 24 yr.)*

27. “*Want je krijgt da zo veel informatie dat kan je niet alles eh ja het blijft niet alles hangen. En daarom was het makkelijker geweest als je daar nog kon eh ja terug kijken.” (v, 57 yr.)*
- *“Because you get so much information. Yes, it doesn't stay in your head. And that is why it would have been easier if you still look back, yes. " (v, 57 yr.)*

28. *“Omdat het ja voor mij heeft het niet gewerkt en ook uit de ervaringen van anderen bij mij in de groep dat het daar ook niet werkte, ja dan zou ik het nog niet aanbevelen. Maar op moment dat het wel zo is dan zie ik het echt wel als meerwaarde.” (m, 24 yr.)*
- *“Because yes it didn't work for me and also from the experiences of others in my group that it didn't work there either, yes I wouldn't recommend it yet. But the moment it is improved, I really see it as an added value.”(m, 24 yr.)*