Help Individuals at the University of Twente quit smoking with the strength-based approach combined with self-management techniques

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Abstract

Background

Smoking can lead to long-lasting damage to the body and might result in premature death. When smoking addicts stop smoking before the age of 35 there might be no lasting damage. Smoking cessation can be upheld by increasing the self-management of the addict. The self-management behaviour of the addict can be improved by increasing the well-being of the individual through the application of a strength-based approach in the form of an eHealth app. A specific way to make new interventions is to follow the user cantered design because it allows for a cooperation between the user and researcher.

Methods

Interviews were held with two individuals to investigate the self-management behaviour and the needs of the user when increasing their self-management. The data gathered from these interviews was analysed and was the basis for creating a lo-fi prototype. The lo-fi prototype was tested by letting the two original participants and four additional participants perform several tasks while thinking out loud. Besides a SUS questionnaire was filled in by all the participants.

Results

Five themes were found during the interviews, (1)the general smoking behaviour of the participants, (2)what motivated smokers to quit, (3)how individuals self-manage, (4)what persuasive features were wanted in an intervention, (5)several suggestion for a possible intervention. A lo-fi prototype was made in the form of an eHealth app with the possibility to contact real-life health or social workers. The usability testing led to a positive outcome and SUS score of 81 which is above average.

Conclusion

Participants seemed to start smoking around 16:00 o'clock and self-management seemed to be dependent on the motivation of the smoker to stop. Besides was the persuasive feature rewards most wanted to replace the smoking. The participants thought the lo-fi prototype was usable but, the strength-based approach was not important towards increasing the self-management of the smoker. Therefore, further research needs to be done towards the relation between using the strength-based approach and increasing the motivation to help smoking addicts quit.

Contents

Introduction

The first use of tobacco in Europe started when Christopher Columbus brought it back from his first voyage (Cross, 2006). The peak use of tobacco took place between 1960 and 1970, where tobacco was advertised as being 'cool' and good for one's health (Wipfli and Samet, 2016). After 1970, tobacco consumption decreased. Control programs revealed that it can cause diseases and death. Nowadays, tobacco gets demoted by using taxes on buying tobacco and the usage of scaring the customer with threatening pictures on cigarette packages (Wipfli and Samet, 2016). In the Netherlands, 17.3 percent of the population between the age of 20 and 24 is addicted to smoking (Trimbos.nl, 2019). In order to be characterised as smoking addicted, several criteria must be met. A tolerance must have been built against smoking; withdrawal symptoms arise when an individual does not smoke; several attempts to quit smoking; the individual continues smoking even though the individual knows it causes negative health outcomes. Lastly, 3 or more symptoms have to be present in a period of twelve months (Davey, 2015). The behaviour of smoking a single cigarette again is known as a 'lapse'. If the person would continue smoking after the single cigarette it is called a 'relapse' (West, 2017).

Being addicted to smoking can result in several health issues, causing a possible premature death (West, 2017). Most commonly, diseases can arise that affect the lungs, either lung cancer or chronic obstructive pulmonary disease is also known as COPD. Besides, cardiovascular diseases like strokes or coronary heart disease can be the consequence of smoking. Furthermore, smoking can lead to several different functional impairments like eyesight loss, deafness or back pain. (West, 2017). Therefore, it can be stated that smoking can result in several negative consequences.

Even so, smoking addicts know that smoking can have negative consequences for their health, they continue smoking (Fidler & West, 2011). The reason for this addictive behaviour represents the nicotine in tobacco. Nicotine is an addictive drug that classifies as a stimulant as well as a depressant (George, 2019). Nicotine fulfills this role by inducing a release of dopamine in the brain, resulting in the one side in reduced stress and anxiety level and on the other side a higher feeling of pleasure (Benowitz, 2010). The sensation of pleasure and relieve of stress can become a conditioned response to a stressful situation, meaning that individuals turn to smoke whenever they experience stress. Not being able to smoke would induce withdrawal symptoms for the additive individual, which make it difficult to quit smoking. When nicotine is not

absorbed by the body anymore, the mind becomes irritable, depressed and anxious. Smoking a cigarette would make the withdrawal sensations disappear (Benowitz, 2010). Therefore, the arising withdrawal symptoms represent strong reasons for addicts to keep smoking (Piasecki, Richardson and Smith, 2019).

In order to prevent a possible premature death caused by the possible mentioned health issues, quitting to smoke represents an important act for the individual (West, 2017). In fact, Individuals who stop smoking before the age of 35 have the possibility to regain all their lost years due to smoking. After 35, individuals can regain only 2 and a half months back for every year without a cigarette. (Doll, Peto, Boreham, & Sutherland, 2004). If daily smokers with the age between 20 and 24 would stop smoking, it would mean that they still get all the years returned that have been damaged by smoking. Next, to the biological health benefits, do quitters also report a higher level of life-satisfaction and reduced levels of stress compared to non-quitters (Piper et al., 2011). Therefore, the target group for the study includes individuals with an age between 20 and 24 who show daily smoking behaviour.

To help individuals with ceasing to smoke it can be beneficial to increase the self-management of the individual. Self-management has a big role in dealing with difficult situations and a low amount of self-management could be due to the fact of the conditioned response and the positive effects of nicotine. Therefore, would increasing the self-management of individuals help them to stop smoking. Self-management is built up out of several different factors; self-control, self-regulation, and self-determination (Bandura, 1991). Self-regulation is the ability to identify and decrease the sources of problems in mood, thought, and behaviour. Self-control is the ability to impede or control of problems in mood, thought and behaviour only when these problems arise (Steptoe and Poole, 2016). Self-determination is the theory that humans have inherent tendencies to grow (Deci and Ryan, 2008).

These different areas of self-management can be improved through several techniques. The first theory of self-management is the operant view. The operant view states that to control behaviour the individual must control the variables that would result in the behaviour (Skinner, 1999). For example, having a cigarette aground to smoke represents a variable that results in the behaviour smoking. Consequently, the individual would not buy a package of cigarettes anymore in order to decrease the possibility to smoke. The second theory refers to the cognitive view of self-management (Bandura, 1969). This view holds that first one’s own behaviour and the

resulting solution will be assessed, then the controlling response will be initiated. Behaviour will change if there is a discrepancy between the perceived behaviour and the wanted behaviour of the individual (Kanfer, 1971).

Besides these first two views towards self-management, it's important to make an individual aware of the contingencies that are present in one's life. According to Bandura, the best method to make an individual aware of one's contingencies is by performing self-assessment (Bandura, 1969). When assessing one's own contingencies the individual can understand whether there are contingencies that are contradicting and thus are not beneficial for the individuals' goals. There are two sorts of contingencies, intrinsic and extrinsic. Intrinsic contingencies are distinguished by activities for the individuals' own sake. Extrinsic contingencies are distinguished by activities that are related to a separate outcome. Self-management can be best supported using rather intrinsic motivations than extrinsic. However, in order to make an extrinsic motivation more powerful, it should be internalized. Internalization is the process of a behaviour that develops to be more autonomously regulated or appreciated over time, resulting in activities for the individuals' own sake (Ryan and Deci, 2000). An extrinsic motivation that is related to other life goals is internalized the easiest and therefore the most effective (Patrick and Williams, 2012).

Besides these mentioned techniques, it is possible to increase the self-management by focussing on the well-being of an individual. Individuals with lower well-being use maladaptive coping strategies like ignoring difficulties. In comparison, individuals with higher well-being engage in highly adaptive coping strategies like a positive re-evaluation of difficulties (Freire et al., 2016). Having higher well-being is important for Individuals since a recent study showed that there is a high correlation between stress in Individuals and the usage of cigarettes (Slopen et al., 2013) A large percentage of the target group is still studying, which might bring a lot of stressful situations like exams.

An individual's well-being can be increased by utilizing one's strengths (Linley and Harrington., 2006). Utilizing strengths can be achieved using the strength-based approach. The strength-based approach is a positive psychology approach that consists of 3 steps. Firstly, the strengths of an individual are explored. These strengths will be formulated into goals, in order to help the individual to deal with negative emotions. The last step is to exercise the use of positive emotions in relation to the meaning of life of the individual (Rashid, 2014). Next, to the strength,

the incorporation of the goals formulations is important because goal management can diminish the discrepancies between the present situation and the goal of the individual (Arends et al., 2013). The usage of this approach has already been proven by an earlier positive psychology intervention on smokers that made a third of all the participants stop smoking (Rashid, 2014).

There are several ways to apply the strength-based approach in practice in order to increase an individual's well-being. EHealth represents one of these ways. EHealth has three main goals. First, it represents a tool to make the life of human behaviour easier. Secondly, eHealth can be used as a medium, for example motivating the user. Lastly, an eHealth intervention can function as a social actor, for example giving feedback (Fogg, 2011). Using eHealth has several benefits. The first benefit of using eHealth Interventions is its high accessibility (Van Gemert-Pijnen et al., 2011). The usage of mobile phone apps by young adults has drastically increased over the years (Pew Research Center's Global Attitudes Project, 2019). Besides, empowerment represents an advantage of using eHealth **(**Van Gemert-Pijnen et al., 2011). Empowerment refers to an individual's ability to take control of their own health. Therefore, it is possible to take care of the individuals' process and the current state that they are in. If this is combined with expert opinions, which are data-driven, it is possible to give patients tailored advice about their current situation. Thirdly, it is possible to use a range of new techniques with the field of eHealth. For example, the domain of social support or dialogue support from the app itself. The users can get in contact with other users, to either compare their progress with them or provide support to each other. This could increase the motivation of users. The last benefit is the quality of care. This is a benefit because the efficiency and the effectiveness of treatment can be improved. Instead of going to the general practitioner, a video call meeting could be set up and could spare time **(**Van Gemert-Pijnen et al., 2011).

EHealth Interventions can be set up and supported by using persuasive features. Persuasive features represent specific features in a program like eHealth that motivate the user to perform the desired behaviour. Resulting from previous research can be stated that the use of a variety of features is the most effective. (Chang, Kaasinen and Kaipainen, 2013). Reduction, simulation, self-monitoring, and personalization are the most used features (Lehto and Oinas-Kukkonen, 2011). The reason for that is, that they specifically support the performance of primary tasks, like not buying any packages of cigarettes anymore. Reduction reduces the behaviour of the user into smaller and simpler tasks to increase the benefit of cost ratio.

Simulation demonstrates the cause and effect relationship. Self-monitoring tracks the progress of the individual, which motivates the user to not give up. Personalization persuades the user with specific content to make the user understand that the current behaviour is not positive for the user itself. (Lehto and Oinas-Kukkonen, 2011).

Besides the persuasive features are there four behavioural change techniques (BCT) that can be used to influence the behaviour of the user and increase the wellbeing and self-management. the first theory is behaviouristic learning (Skinner, 1953). This theory could be used to complement some persuasive features like feedback. The second theory is the social cognitive theory (Bandura, 1986). This theory can be used to take the environment of the target group into account when trying to motivate them to change their behaviour. Thirdly can the goal-setting theory be used (Locke & lathum 1991) This is important because one of the parts of self-management is highly linked to the ability to create goals.

There is a need for a good connection between the individuals that will make use of the eHealth and the individuals designing it, since the intervention should cover all the needs of the user to be efficient. This can be done by implementing a user-centered design (UCD) (Van Gemert-Pijnen et al., 2011). The needs of the user will be investigated by the individuals that design the intervention. This process is guaranteed by making the whole process an iterative process. An iterative process is a process of continuous feedback loops, based on the needs of the user during the design process (Gulliksen et al., 2003). A specific method to ensure these feedback loops are interviews and usability tests (Van Gemert-Pijnen et al., 2011.). Interviews can be used to understand the needs of users. Usability testing is a technique to evaluate a product and to measure its usability. During the test, the user will be asked to think-aloud, which means that they will straight away explain what they are thinking while performing the usability test (Güss, 2018).

Currently, there are several mobile apps that try to decrease the number of smoking lapses by increasing an individual's self-management. Most of the apps use several or a combination of persuasion techniques like; rewards, self-monitoring, tailoring, social learning, and cooperation (Do et al., 2018). The current apps do this, by giving badges for times that someone sustained from smoking. Next, to that, tailored information for the users is present that indicates the amount of money that has been saved by not smoking. Lastly, the goal of not smoking is achieved by interacting with other users during difficult times and the comparison of

non-smoking times between specific smokers. However, none of the current apps is incorporating a positive psychology approach in combination with user-centered design (Do et al., 2018).

The aim of the research will be to support individual, between 20 and 24, to increase their self-management so that they will not lapse anymore when quitting to smoke. This will be achieved by designing a lo-fi prototype using an eHealth intervention. The importance of the research lies in the fact that there are several negative factors bound to smoking and these can be cured when an individual quits before the age of 35. The Intervention will be based on the strength-based approach in combination with the use of persuasive features and the BCT's. The user-centered design will be applied to answer the following five research questions.

Research questions

1. What is the general smoking behaviour of the target group?

2. How do Individuals self-manage with their daily smoking behaviour?

3. What are the needs of the user from a technical point of view towards the support of their own self-management when lapsing?

4. How can the needs of Individuals that are smoking be realised into an eHealth prototype?

5. What is the usability of the lo-fi prototype based on the think-aloud method?

Methods

Participants

The study was conducted in 2019 and included individuals with an age between 21 and 24. The inclusion criteria were to be a daily smoker. The number of participants was six. Two of the participants took part in two interviews per participant and all the participants took part in a usability test of the lo-fi prototype. One man and one woman were interviewed. Furthermore, participated two more females and two more men in the usability tests. This means that the female-male ratio was 50/50. The age ranged between 21 and 24 years (M = 22, SD = 1.1). Lastly, there were three different nationalities; three Germans, one Italian and 2 Dutch's.

Materials

Interviews

The first interview was about the daily smoking and self-management behaviour of the participants, included 22 questions and was semi-structured (see appendix A). The topics that were included in the interview were; demographics, recognition of the addiction and the symptoms, impairment in the daily life, self-management, and technology. For example: "Is there anything that makes it easier for you to cope with your daily smoking behaviour in relation to your self-management?" or "Could you maybe explain the negative and positive consequences of smoking?" The second interview had 14 questions and was about the needs of the user to quit smoking (see appendix B). An example question is "Can you imagine technical devices would be more helpful than normal therapy or would you like to combine the intervention with help from a social or healthcare worker?" A mobile phone was used to record the interview and a laptop to read the questions from. Besides the questions, worksheets were used from a previous intervention and a list of persuasive features was given to the participants.

Prototype

The materials needed for creating the lo-fi prototype were gained from the interviews, literature and a computer with the program Balsamiq Mockups 3, in which the lo-fi prototype was made.

Usability testing

The usability testing was done in two different steps. The first one was a usability test with the lo-fi prototype itself (see appendix D). The lo-fi prototype was shown on a laptop in the

Balsamiq Mockups 3 cloud environment. The participants had to complete 16 tasks (see Appendix D). The participants did so while exercising the thinking aloud method and were recorded on a phone. Next, to that, a system usability scale (SUS) was used (see Appendix E). The SUS is a scale which assesses if a participant thinks the technology is appropriate and useable. The scale consists of ten questions with a 5-point-Likert scale, ranging from 1 to 5, in which 1 meant strongly disagree and five meant strongly agree. An example question was, "The scale has been used frequently in different research projects and it is deemed to be especially flexible and follows the ability to adapt to different technological contexts (Jordan, Thomas, McClelland & Weerdmeester, 1996).

Procedure

Interviews

Both the patient partners and the four additional respondents were found through convenience sampling and none of them rejected to participate in the study. The study was approved by the ethical committee of the University of Twente after it had been reviewed by a supervisor. To ensure that the participant knows their rights, for example "I understand that my participation is voluntary and that I am free to withdraw at any time and without giving a reason." and that they know the intention of the study an informed consent on paper was given to the participant at the beginning of the interviews. The interview structure went from more broad questions to specific. The questions were all open questions and where needed was asked for further clarification. If questions were not understood or help was needed to gain a better understanding an example was given or items from the open questions were explained. To gain more information from the participant probes where used, for example, "hmhm" or "could you tell me some more about it". The persuasive features were further explained by giving them a laptop, which had a list with all the persuasive features and the participant were able to scroll through it and explain which features they wanted to have and which they didn't. The interview itself was done in a private room inside the university library and all the interviews took around 30 minutes to finish.

Prototype design

The lo-fi prototype was created in several steps. First was a list made of persuasive features that were indicated as wanted by the patient partners. All the specific persuasive features were implemented in a specific feature of the prototype. Then a start-up screen was made where

the user could log in and give his personal details. After that were the pages made that integrated the strength-based approach. When all the pages were done was the main menu created that could be used to navigate between the separate pages. During the finalisation of the app were colours and symbols added to make it more user-friendly and besides that was a settings page added that could change certain aspects of the prototype.

Usability testing

The usability test with the thinking aloud method was performed in a booked room of the library. The participants included four new patient partners and the two previous ones. The new participants were also found using convenience sampling and signed the informed consent. The participants were shown what the lo-fi prototype can and cannot do before the start of the test. For example, the participant was explained that only the buttons that become red are clickable and that text boxes cannot really be filled in. The researcher then took place on a spot where the screen and the actions the user took were both visible. If the participant was unclear about what to do the task was mentioned once more. If the user did not talk for ten seconds the researcher would ask the user to think aloud with the probe "think aloud". After the tasks were completed the researcher still asked the overall thought about the prototype and if the participant could mention several good and bad points in retrospect towards the design and the process of the app. Lastly, the SUS questionnaire was given. The user was asked to fill in the questionnaire without giving the questions to much thought but give the first answer that comes up.

Analysis

Interviews

The interviews were transcribed verbatim. One of the interviews was held in Dutch and was also transcribed in Dutch. However, the quotes were translated into English. The other interviews were held and transcribed in English. To ensure the anonymity of the participants were names, dates, and places replaced with X's. The transcribed interviews were then copied into ATLAS.ti 8.4 and coded. The codes for ATLAS.ti 8.4 were formed by using an inductive process. Inductive is a bottom-up approach to recognise important recurring components out of the held interviews. The codes were formed into categories and smaller subcategories. from the process, four main categories emerged. The categories are according to the research questions.

The first research question: "*What is the general smoking behaviour of the target group"* was answered with the category: *General smoking behaviour*. The codes in this category are;

time of smoking, cigarettes smoked on a daily basis, negative impact of smoking behaviour, positive impact of smoking behaviour.

The second research question: *"How do Individuals self-manage with their daily smoking behaviour?"* was answered with the use of two categories. The first category is *motivation,* which includes the codes; *motivation to stop smoking* and *motivation to smoke.* The second category is *self-management,* which includes the codes; *self-management problems* and *self-management techniques already used.*

The third research question: *"What are the needs of the user from a technical point of view towards the support of their own self-management when lapsing?"* was answered by using the categories; *persuasive features* and *intervention suggestions.* The subcodes of the persuasive feature category are; *Competition, praise, real-world feel, reduction, rewards, self-monitoring, simulation, social comparison, reminders,* and *tailoring.* The subcodes of the intervention suggestion category are; *app, combined with healthcare*, *strength-based* and *other*.

Usability testing

As has been done with the interviews, the usability tests were also coded verbatim and inserted into ATLAS.ti 8.4. To ensure the anonymity of the participants were any details personal details like names replaced by other X's. The codes were made using an inductive manner. Three main categories were found when reading the tests; *design, process* and *technical improvements.* The category *design* and *process* both include the codes positive and negative feedback. The category *technical improvements* include the codes *design improvements* and *process improvements.*

The SUS has two different measurements, negative statements and positive statements (Jordan, Thomas, McClelland & Weerdmeester, 1996). The scores on items 1,3,5,7, and 9 are subtracted by 1. The scores on items 2,4,6,8, and 10 are calculated by subtracting the score from 5. This leaves a score between 0 and 4 on all the items. The scores are then summed up and multiplied by 2.5. The score is then placed on the scale found below. Scores below 50 are deemed as not acceptable and scores above 50 are deemed acceptable (Jordan, Thomas,

McClelland & Weerdmeester, 1996).

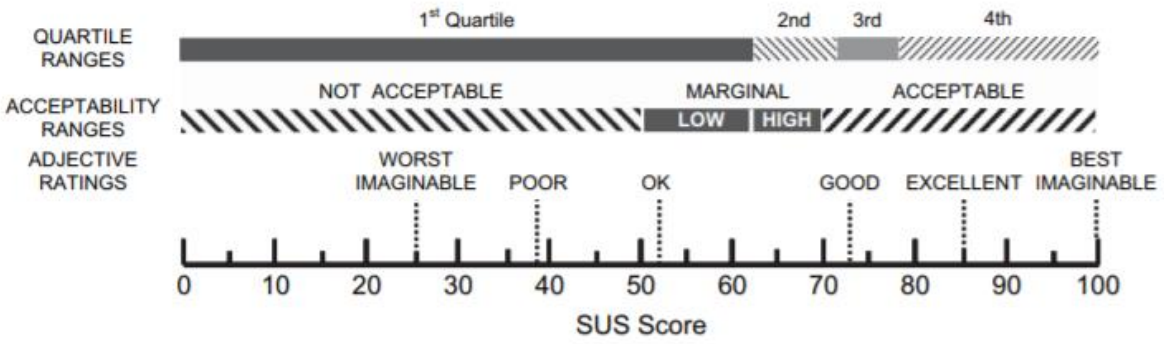


Figure 1. The interpretation of the SUS

Results

The result section will be divided into sections according to the separate research question. Each section will explain the results per research question.

"What is the general smoking behaviour of the target group?"

The first participant smokes 20 cigarettes a day and the second participant's smokes around six or seven cigarettes per day (see Appendix F). However, both participants state that they have an onset of smoking during the start of the afternoon and that there is a peak of smoking in the evening. The reason for this onset is that both the participants see the smoking behaviour in the evening as a reward for the work they did during the day. Both participants also state that they go through physical difficulties, like difficulty breathing, while smoking and especially while trying to perform sports. A second negative consequence is that it creates a bad aroma and a bad taste. The positive thing about smoking is according to the participants that it relaxes them and reduces stress.

"How do Individuals self-manage with their daily smoking behaviour?"

Self-management and lack of motivation

Both participants explain that there was a time that they tried to stop smoking (see Appendix G). During this period both participants engaged in self-management enhanced behaviour to avoid relapse. Participant one explains that she didn't buy any packages of cigarettes anymore. Besides not buying any packages anymore both the participants engaged in behaviour that distracted them from the actual smoking, like reading, listening to music/podcasts and performing more

sport activities. Lastly, both participants also keep track of their non-smoking behaviour trough a schedule on the phone or on a whiteboard with the amount of not smoked days on it. Even though both participants engaged in self-management enhancing behaviour they started to smoke again. Both participants explained they started smoking again after a romantic relationship was ended. Participant one started specifically again when a stressful situation occurred. Participant two started again because he missed the sensation of smoking and at work there was a colleague that gave him external motivation by offering him cigarettes. Both the participants acknowledge that smoking is bad for their health but continue anyway. Thus, it can be concluded that both participants understand smoking is bad for them and are able to self-manage their behaviour when having enough motivation, but after the external motivation was gone there has been a lack of motivation to self-manage their behaviour.

"What are the needs of the user from a technical point of view towards the support of their own self-management when lapsing?"

Intervention suggestions

Both the participants unanimously stated they wanted to have an app that was connected to a social or healthcare worker (see Appendix H). The reason for this was that participant stated that he would like to be able to even make an appointment with a general practitioner to gain additional motivation to stop smoking. Next to that did participant 1 explain that she would like to discuss her progress or goals with a social or healthcare worker. The opinion on the strength-based approach and the usage of the worksheets were mixed. Participant 1 thought the usage of strengths while formulating her goals would give her an advantage and more motivation. However, participant two could see the connection but couldn't imagine how it would work and therefore did not see the added benefit of it. Participant 1 explained that worksheets two, which asks for the five strengths, and five, which asks about the goals of the participant, would be easy to combine and helpful. The reason for this was that seeing her own goals and strengths would convince her that she could reach them. Participant two stated that worksheet nine, which asks the participant to evaluate the personal goals, would be helpful. Participant 2 thought so because it would remind him of the reasons he is trying to quit.

The code other was created as part of the intervention suggestions because both participants stated things that were outliers or items that couldn't be created with the lo-fi prototype but might still be interesting. Participant 2, for example, would like to have a heart rate

monitor that would alarm him straight away if he would start smoking. The alarm would then create an annoying sound which would force the smoker to quit.

Persuasive features

The persuasive feature most mentioned was rewards (see Appendix H). Both the participant explained they wanted to have a lot of different rewards during a lot of different moments. The reason for this was that both participants saw smoking as a reward itself and therefore wanted to have a replacement for that. A suggestion given by participant one is that a colour set that could change the colour of the app. The colour set could be earned by achieving her goals or reach a daily non-smoking streak. Besides rewards was the code self-monitoring also mentioned quite often. Both the participants explained that when they tried to quit smoking, they used a calendar on which it was highlighted every time a day had passed that they hadn't smoked. Therefore, both participants would like to see a calendar of some sorts or a tracking system that shows them their progress. Besides the self-monitoring feature, both participants want personalized information about their smoking behaviour and its impact on their health. Lastly was the persuasive feature reduction mentioned to help them understand their progress better and stay more motivated.

The two persuasive codes, reminders and real-world feel, were both mentioned five times. Both the participants stated they would like to get two different kinds of reminders. First, would they like to get reminders starting between 15:00 o'clock and 17:00 o'clock instead of 09:00 o'clock. The reason for this was that both participants only start smoking around that time. Furthermore, reminders were wanted later in the process to remind them of how difficult for example, sporting, was when they were still smoking. The real-world feel was mentioned five times because both the participants wanted to be able to reach a social or healthcare worker. A social or healthcare worker was wanted to ask questions if needed or have a short conversation about their progress. Participant wanted to have this because she would like to be able to ask questions about how to deal with stressful situation or even get in contact during a stressful situation to prevent smoking.

Codes that were not mentioned often were competition, praise, and simulation. Competition was mentioned because both participants would feel good if they stopped longer then someone else. Praise was only mentioned by participant 1 because she would like to get feedback that motivated her to quit again instead of negative feedback when she lapsed.

Simulation was only mentioned by participant 2 because he had the feeling that his lungs were still properly working compared to other lungs and seeing the real state of his lungs would scare him into quitting.

"How can the needs of Individuals that are smoking be realised into an eHealth prototype?"

An eHealth intervention was created in the form of an app which included several persuasive features and the possibility to get in contact with a social or healthcare worker. The persuasive features and the main function of the app will be explained below with the help of pictures from the app itself.

The first feature of the app is the explanation of the positive consequences of quitting and the negative consequences of smoking. The persuasive feature that has been used here is *personalization*, since the user gets information that is tailored to the general smoking behaviour. In figure 1 and 3 are the negative and positive consequences explained with visual images if the user likes to receive more information this is then given on a second slide (Figure 2 and 4). The second slide can be scrolled through.

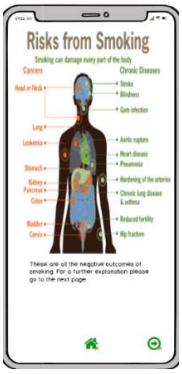


Figure 1. negative consequences of smoking

Figure 2. Negative outcomes of smoking 2.

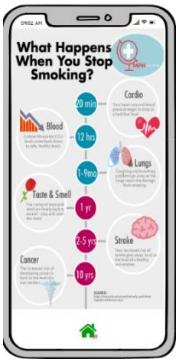


Figure 3. Positive outcomes of quitting

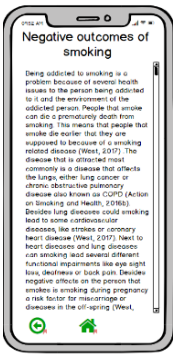


Figure 4. Positive outcomes of quitting 2.

If the user is making progress with quitting it is possible to fill the calendar app (Figure 5). The user can click on the plus symbol for adding a day and on the minus symbol if the user smoked. The user will then be forwarded to a well-done page or a don't give up page. In both, the cases are the persuasive features *feedback* used. Besides the persuasive feature *feedback*, is the behavioural change technique *reinforcement* used by giving negative or positive reinforcement statements. Lastly is the user able to unlock new colour sets, that can change to colour of the app when goals are achieved. These features are installed to motivate the user to either keep going or not to give up.

Figure 5. progress calendar

Figure 6. Don't give up

Figure 7. Well done!

The calendar is linked to another feature of the app. The social competition (Figure 8). The social competition page lets the user compete with fellow friends that also try to quit smoking. The persuasive feature *competition* has been used in this figure. The reason for this feature is used, is that during the interview has been noted that having a competition with people that are known to the user increases the motivation. The slide shows a list of names of friends with the user that has the biggest progression on top with a crown. This function can be turned off or on as well.

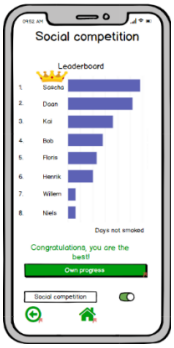


Figure 8. Social competition.

The next feature that is incorporated stems from an already existing intervention. The worksheets that came as most wanted during the interview were 2, 5 and 9 as explained on page 16. These incorporations of these worksheets can be found in (Figure 9, Figure 10 and Figure 11). The strengths slide is the first slide that is shown in the app after the user logs in. The user is asked to fill in his or her five strengths and the reason for this is further explained if the user

clicks on the question mark. After filling in the user is asked to make goals where the user incorporates the previously filled in strengths. The user is also asked to think about separate live goals that are already present. The reason for this is that according to the self-determination theory are goals then more internalized. After making the goals the user can evaluate them and if needed also create new goals by clicking on the right arrow (Figure 11).

Figure 9. strengths

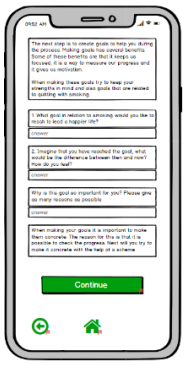


Figure 10. goals

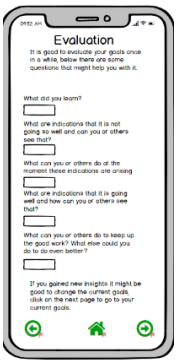


Figure 11. evaluation

During the interview was mentioned that the users want several ways to reward themselves and to see progress. Progress can be seen by evaluating goals and the calendar but also by two other functions of the app. The first one is the money meter (Figure 12 and Figure 13). In the first figure is the user asked to fill in the number of cigarettes smoked a day, the brand and how long the user is already quitting. Then the app calculates how much money the user already saved by quitting on a weekly, monthly and total basis.

Figure 12. money meter 1

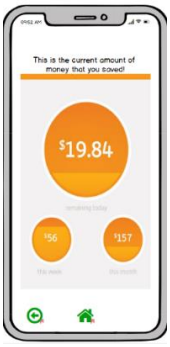


Figure 13. money meter 2

The second self-monitor function is the lung meter. The first page of the lung meter asks for personal details, like the time that has been smoked, the number of cigarettes and the age (Figure 14). The app will then calculate the quality of the lungs and compares it to the lungs of a healthy person (Figure 15). The persuasive feature that is used here is next to *self-monitoring* is *simulation.* The user is then able to see what happens to his lungs if he stops smoking by clicking below the picture, which sends the user to the positive consequences page.

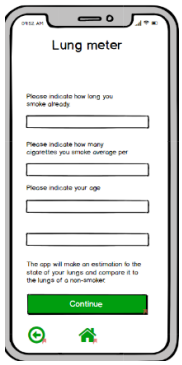


Figure 14. Lung meter 1

Figure 15. Lung meter 2

The participant can turn on and of reminders at the reminder section (Figure 16). During the interview the users stated that reminders in the morning would not be useful. Therefore, a function is added where the users can change the time the reminders start. Besides that it's possible for the user to turn the reminder on and off.

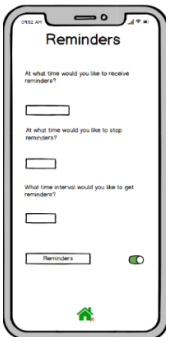


Figure 16. Reminders.

A setting page has also been made for the user where a language can be chosen or where colours can be changed (Figure 17). The current colour setting is green, but when the user achieves more goals it's possible for the user to change the colour settings (Figure 18). The persuasive feature that has been used here is the *rewards* feature.

Figure 17. settings page

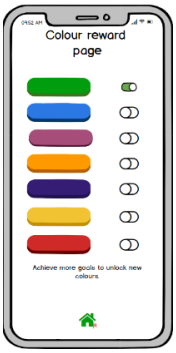
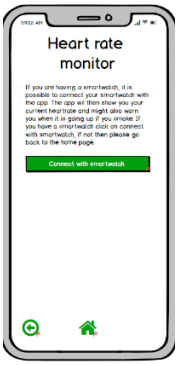


Figure 18. colour changing

During one of the interviews a participant mentioned that it would be nice to get an alarm whenever a cigarette was lit. Therefore, a feature was installed where the user could connect a

smartwatch to the app (Figure 19 and 20). The app would then always be aware of the heart rate of the user and whenever it would spike because of a cigarette the user would get an alarm or a vibration. The user always has the possibility to turn of the alarm.



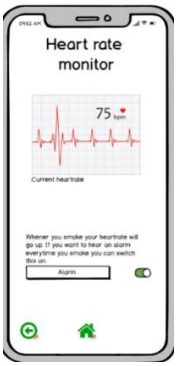


Figure 19. smartwatch connecting *Figure 20. heart rate monitor.*

Lastly was a menu page added (Figure 21). In the menu page the user can switch back and forth between all the different functions of the app. Besides that, is the user able to sign out of the app with the icon in the top right.

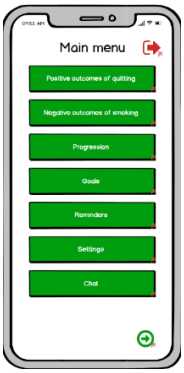


Figure 21. Main menu.

"What is the usability of the lo-fi prototype based on the think aloud method?"

The results of the usability tests on the lo-fi prototype are described in the section below.

Design

A lot of positive feedback was given on the design part of the intervention. All participants liked several aspects of the intervention. First, they liked the visuals that were given and especially the visuals given in the consequences of smoking and stopping feature. They stated that the given information was clear and relevant. Besides that, the participants were pleased about the number of features that were presented. Especially the lung meter and the shocking effect of the comparison between "healthy" and "smoker" lungs stood out. Participant also explained that the

shocking effect of their own bad lungs was interesting.

Besides positive feedback was also negative feedback received. Participant one explained that the type setting was too low, and some words were difficult to read. It was also unclear what separate parts of the app were about and in specific the goal setting page. Participants stated that they would like to see a banner where was explained that it was about goals. Next to that was there a difficulty with reaching the second page of the main menu because the arrow button at the bottom was not seen straight away by five out of six participants.

Process

All the tasks that were given were performed by the participants without too much trouble. The only task that was not performed was the evaluation task. When the participants were asked to evaluate and change the goals all the participants went to the goal page right away and made new goals instead of first evaluating them. The process of the app gained a lot of positive feedback on the aspect that certain pages were related to each other. For example, the don't give up page is connected to the goals page. participants stated that it was very neat and very motivating that the linkage of some features were there because this was motivating them. Besides the connection between the pages was there also satisfaction when items were further explained with the help of the question mark.

Negative feedback on the process part of the app was received when participants had to complete the task of a day not smoking. Three out of six participants wanted to click on the agenda instead of the plus button. Besides did all the functions properly according to the participants.

Lastly were participants asked to give suggestions on the app. On the process part was one participant annoyed that it was a must to go back to the main menu after every feature and then switch between the menus. A suggestion was given to add a scroll function to the menu. On the design side of the app some suggestions were given to be able to change the font and the size of the letter type next to the language and colours in the setting. Besides an addition in the settings page participant 4 stated that next to a filled in calendar a graph was wanted to visualize the progression even better. Lastly some suggestions were given towards making it more clear what certain pages were about by placing headings or a general statement when opening the app for the first time.

Concluding were all the participants excited about the app and were very satisfied with

the large number of features that it supported. Besides that, the participants stated that it was good that a lot of the features were integrated with each other and the goals came back in multiple features. However, some participants noted that the strengths part of the app was missing besides in the making of the goal, but a solution for this problem was not presented.

The SUS

The SUS that was used next to the thinking aloud method resulted into a mean score of 81.67 which indicates that the lo-fi prototype has a good usability.

Discussion

"What is the general smoking behaviour of the target group?"

During the first interview, it became clear that the participants had both a different smoking style. Participant 2 smoked less then participant 1 however, they both start smoking around 16:00 o'clock. On part of the smoking behaviour do they both fall into the daily smoking behaviour population and are classified as a smoking addict. Literature does not differentiate between heavy daily smokers or normal daily smokers; therefore, no conclusion can be taken.

"How do Individuals self-manage with their daily smoking behaviour?"

When looking back at the interviews and the literature research at the start are several things standing out. The main goal was to use the strength-based approach to increase the general wellbeing and with that the self-management of the target group. Besides that, was the usage of goals used to improve the self-determination (Deci and Ryan, 2008). The participants explained that the use of strengths had potential, but that the connection was not clear to them. Even though the goal approach was predicted to enhance self-determination were there no questions asked about goals during the interview. By asking questions about this the need of the user for making goals could have been better understood. If the needs towards the goal would have been better understood it could have improved the prototype.

During the introduction was highlighted that smokers continue smoking because of the nicotine addiction. During the interviews came out that the feeling of relaxedness and rewards was the greatest motivator for Individuals to continue smoking. As mentioned before does the

nicotine in the tabaco induce a relaxed feeling. According to previous research are there three main motives for nicotine addicts to continue smoking (Buczkowski et al., 2014). The first one is lessening stress by smoking. The second one is the need for pleasure that relates to smoking. The third one is the environment the individual is in like a friend or colleague that smokes. The cravings that are starting when withdrawal symptoms from nicotine make the user feel impaired in mood and performance. When the user feels impaired in mood and performance is the usage of a cigarette calming and will the cycle start again. When reflecting on the interview was there no question about the withdrawal symptoms that were felt by the users and this might have been a good addition to the interview. This would lead to a greater insight into the behaviour the smokers perform during that period. The pleasure that was felt by the usage of the cigarettes was however mentioned multiple times in the form of rewards. The influence was also mentioned by one of the participants, since he started smoking again together with a colleague at work.

Besides the withdrawal symptoms and the difficulty of the strengths-based approach were the questions asked during the interview to less and to shallow. While coding the interviews became clear that the answers of the participants were too ungrounded. For example, did participant 1 state “sometimes I tell myself to do it and then I just do it” However, was there no further explanation given of how and why this was done. Probes of asking to explain more could help. Besides that, it could be a possibility to create a step by step approach where the user is asked to explain his self-management behaviour and the reasoning behind it on paper.

Lastly, would it be a possibility to separate self-management into the 3 different topics self-control, self-determination, and self-regulation (Bandura, 1991). As mentioned before is self-management made up out of these segments and by splitting them would it be possible to focus independently on any of these factors. This could lead to different insights into the behaviour of the participants.

“What are the needs of the user from a technical point of view towards the support of their own self-management when lapsing?”

The most needs of the user were found out when asked about what persuasive features would be wanted and how the persuasive features had to be incorporated into the prototype. Showing the list of features was a good method to make the user indicate what features were wanted. The codes that were most mentioned were rewards, reminders and real world feel. According to literature are there several persuasive features more important than others (Lentferink et al.,

2017). The first one is personalisation, secondly reduction, thirdly praise messages and lastly reminders. These persuasive features seemed to highly increase the healthy behaviour performed because they motivated the user. When compared with the features that were found during the interviews can be stated that rewards and real-world feel were mentioned a lot but might not be the most influential ones when trying to change behaviour. However, according to another review of persuasive features might real-world feel and in specific the possibility to get in contact with a social worker be extremely effective (Asbjørnsen et al., 2019).

Next time it might be useful to combine the persuasive feature to the self-management behaviour of the user and ask them to combine a feature that would help the user with specific parts of the self-management. This might lead to very specific features that increase self-management.

The questions asked on the aspect of the needs of the user to indicate if a combination with a healthcare or social worker was wanted were easily answered. Participants were unanimous with answering that a combination was wanted with the healthcare for support. So, no changes should be made to that part of the interview.

The way the interviews were held was satisfying. The semi-open structure helped with getting specific answers but at the same time left space open to elaborate more on the input from the user.

"How can the needs of Individuals that are smoking be realised into an eHealth prototype?"

The production of the prototype went easily because the participants explained in a clear way which persuasive features were wanted and in what form. The reason for this was the usage of the user cantered design (UCD) (van Gemert-Pijnen et al., 2011). The UCD allowed for a tailored intervention to the needs of the user since there was cooperation with the participant. According to the UCD the design could be improved even more by evaluating the prototype with the user and design a second version of the intervention. Besides is the goal of the UCD to make a relationship between all the functions that are present in the intervention (van Gemert-Pijnen et al., 2011). As the participants stated before was the connection between the strengths not that clear in the intervention. Perhaps could the strengths part of the intervention gain a better relationship to the rest of the intervention by including the users again and redesign this part of

the intervention.

While creating the prototype there were however some difficulties. The lo-fi prototype could only be made clickable in a sense that it was not possible to work with the prototype. This decreased the number of functions that could be presented and made the prototype of less quality than an actual app. One of these difficulties was the creation of the main menu. During the usability test was stated by some participants would like the main menu to be scrollable. It is possible to make a scrollbar in the main menu but since it is not usable would half of the menu not be available and therefore the option of making a second main menu was chosen.

The number of functions that can be thought of could be used to create multiple apps. However, during the usability test was stated by several participants that the number of functions the app intervention provided was good. Therefore, only one app should be created to decrease the amount of costs and giving the users the choice of using several features or not.

"What is the usability of the lo-fi prototype based on the think-aloud method?"

The reliability and validity of thinking aloud protocols are low (Güss, 2018). The reason for this is that there is great ambiguity for the researcher but also for the participants. There can be a variety in the ability of the participant in describing his or her own actions and thoughts while performing the method. Besides that, is there a lot of ambiguity for the researcher while coding the data. One way to solve this problem is to only use premade codes with a deductive approach and not deviate from them, but this could harm the richness of qualitative research. A reason to apply the thinking aloud method is however that it is easy and cheap. Besides does it not limit the user in explaining his or her own thoughts (Wenger and Spyridakis, 1989). During the research was felt that there was quite some ambiguity. The reason for this was the difference in participants. Some participants only stated what they clicked on and others explained what they thought of the design and process.

For the current research was the usability test useful to do. Insights and suggestions were gained to improve the intervention drastically. One of the biggest improvements was that the main menu could be structured in a different way by for example placing multiple features under one heading. Next to that was one task not completed at all and did all the participants not even see the evaluation page. This gave the insight that the evaluation page should be integrated into the goals department. Another insight that was given was that some features were more appreciated than others. All in all, was the usability test useful and would be recommended to not

do one round of usability testing, but to do more rounds of usability testing and redesigning the intervention. By using more usability tests could more bugs be taken out and could the prototype be even more sophisticated. Besides was it useful to combine the quantitative approach of the SUS and the qualitative approach of the think out loud method because this led to insights from two different points of view.

Limitations

In general, can be stated that the way the UCD is set up it is quite vulnerable to socially desired answers. The semi-structured interview at the beginning allows the users to give a great variety of answers and insights but also leaves a lot of room for socially desired answers (Louise Barriball and While, 1994). Next, the same can be concluded from the usability tests that were done using the thinking out loud method. Furthermore, was no second researcher used to make interrater reliability of the codes and is, therefore, the validity lower than could have been. Lastly was the usage of two participants in this area not enough to make a generalizable statement about the needs of the whole population. A more generalizable statement could be made if the number of participants would have been higher and the diversity increased. The diversity could have been increased by not only taking students from the University of Twente. Individuals from different parts of the society could have given different insights and perhaps given different motivations to start or stop smoking. An idea might be as well to also include non-daily smokers to understand the differences and similarities between the two groups.

Strengths

The strength of the research lies in the qualitative component. The qualitative component led to a high richness factor of insights into the participants' needs. Secondly was the usability tested in two different ways and can be stated that the usability is according to a large amount of positive feedback from the think-aloud method as well as the SUS. Lastly is the fact that the participant is involved in every step of the process a strength of this study because it gets tailored exclusively to the wants of the targeted group.

Further research

For further research it would be advisable to expand the first interview and have an additional questionnaire were the participant can fill in the exact behaviour regarding self-control, self-regulation and self-determination. Besides that, the participant should be given a text were all the three concepts are explained as to get a higher quality answer from the participant.

Conclusion

All in all, can be stated that a large number of needs from the participants were gathered. The persuasive features wanted by the user were highlighted in extreme. The implementation of this data led to a successful lo-fi prototype according to usability testing. The strength-based approach was the component that was least influential according to the participants. The use of this approach in combination with trying to help smokers quit should be further researched since according to the literature the combination should be viable. When more information could, however, be found out on the aspect of self-management could the app be even further incorporated into a real prototype to help Individuals quit smoking and extend their life years.

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Appendix

Appendix A

interview 1

General participant information

What age are you?

What do you study?

What is your gender?

Recognition of the disease and symptoms

What does having an addiction mean to you? How would you define it?

At what times during the day do you smoke?

How long do you already have a smoking addiction?

How did others react to your smoking addiction?

When did you smoke your first cigarette?

If you already started smoking as a child, did you behaviour as a smoker change when you became an adult?

Could you describe your own smoking behaviour, in for example cigarettes smoked a day?

Did you already try to stop smoking once? If yes how did that go/ what did you do?

Impairments in daily life

Did/Do you experience any impairments in your social life because of smoking?

If yes what kind of impairments do/did you have experienced in your social life?

Did you experience any impairments in your educational life/ job/ career?

If yes what kind of impairments do/did you have experienced in your educational life/ job/ career?

Self-management

What problems do you experience with your self-management?

Is there anything which makes it easier for you to cope with the addiction?

Did you already try certain things to not smoke anymore? Like a technological intervention?

Technology

Which technical devices do you use?

How much time do you spend with technical devices per day?

Are you active on social media?

Are there technical devices which helped you to deal with smoking? If yes, which ones? If no, could you think of one which could help you in your daily life?

Appendix B

Interview 2

If you look at your mobile / laptop for a certain reason, do you get easily interrupted by other things that come on your phone?

Are there websites you have visited, to get advice and help? If yes, which ones? If no, why?

What are the most problematic behaviours that you have when lapsing? How could technology solve those problems?

Is there anything that would help you to handle your addiction in your daily life?

Do you think that an eHealth intervention would facilitate your management with your addiction?

(Explained persuasive features)

What should be included in such the intervention, what should be avoided?

Do you think there should be more technical devices/ interventions which support coping with a smoking addiction?

If there would be a technical aid for quitting smoking would you prefer to have it on you mobile as an app? If not, which other technical device would you prefer?

Can you imagine that technical devices would be more helpful than a normal therapy?

Would you like to combine the intervention with help from a social worker or healthcare worker?

So here we have the intervention, show sheets.

How do you think we could combine this with an intervention?

A**ppendix C**

Usability test for the thinking out loud method

Task 1. Create an account and login.

Task 2. Fill in all your strengths and continue to the goals page.

Task 3. Create your goals.

Task 4. Add 1 day to your progression.

Task 5. Change the language and colour of the app.

Task 6. Evaluate and change your goals.

Task 7. Compare your progression with your social environment.

Task 8. Turn on reminders and set them at five o'clock.

Task 9. Understand the negative consequences of smoking and the positive consequences of quitting.

Task 10. See how much money you saved by quitting smoking.

Task 11. Understand the current state of your lungs.

Task 12. Connect your smartwatch to the app.

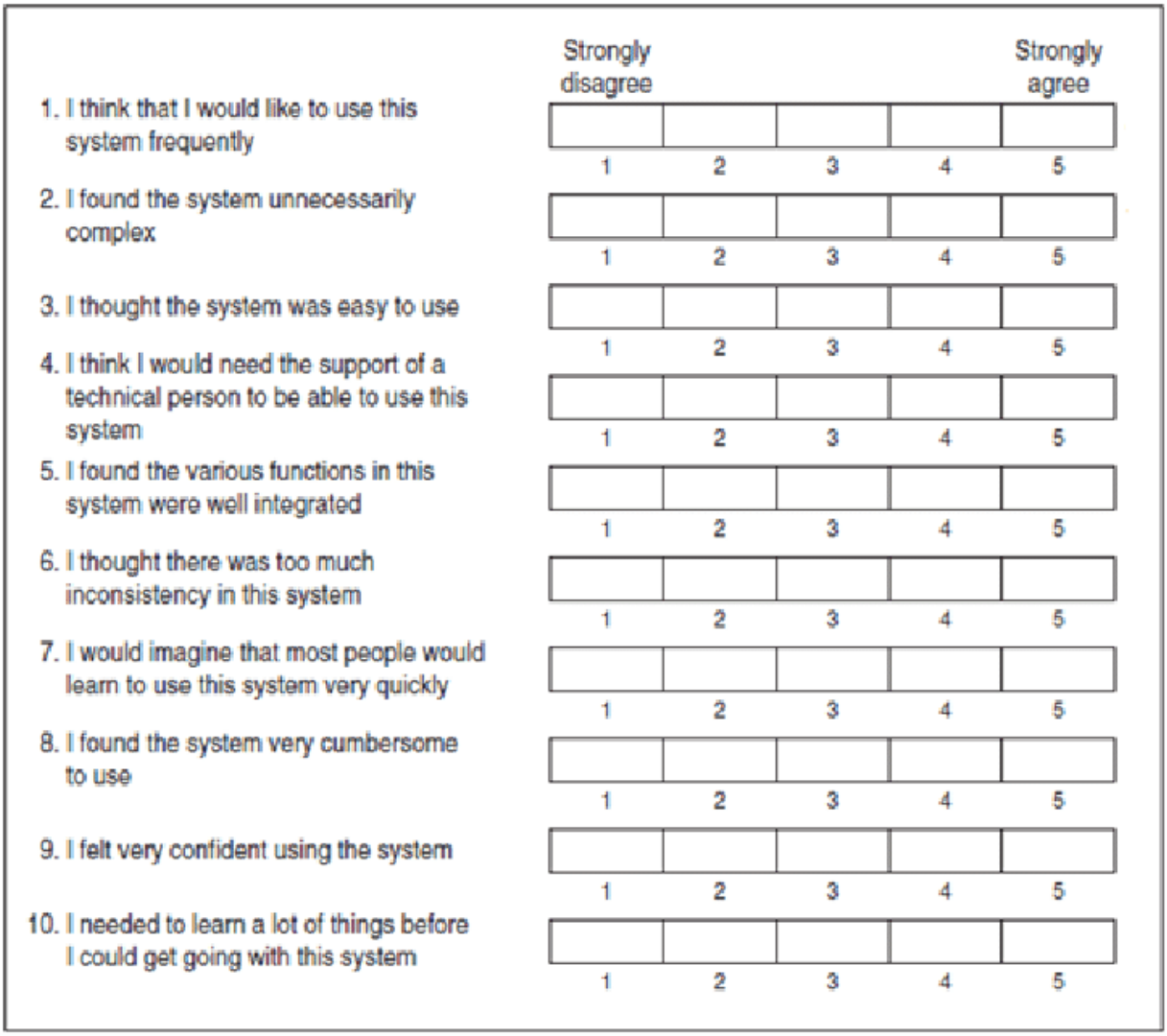
Task 13. Contact a social/ healthcare worker

Task 14 Fill in a that you smoked.

Task 15. Sign out.

Appendix D

System Usability Scale questionnaire



	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	1	2	3	4	5

Appendix E

Codes general smoking behaviour

Categorie	Code	Definition	Frequency	Quote
General smoking behaviour	Time of smoking	Indicates the time the participants in general start smoking or have a peak of smoking more.	5	*"I usually have a peak time during the evening"* participant 1 *"I never smoke in the morning"* participant 2
	Cigarettes smoked per day	An indication for the amount of cigarettes smoked per day	2	*"Around seven or six per day I think"* participant 2
	Negative impact	The negative impact that smoking has on several domains of the participants lives.	8	*"Since I smoke I do feel that my performance went down quite a lot"* participant 1 *"I also knew how that tasted and*

Category	Code	Definition	Frequency	Quote
				smelled” participant 2
				“*Health wise I sometimes get shaky and get mentally weak sometimes because I get a headache”* participant 1
	Positive impact	The positive impact that smoking has on several domains of the participants lives.	1	“*positive I would say that it is my stress release”* participant 1

Appendix F

Codes Motivation and self-management

Category	Code	Definition	Frequency	Quote
Motivation	Motivation to smoke	Reasons of the participants to smoke	7	*"I just started again because it was a really stressful period and I just broke up with X and my parents went out of the country for work and I just bought a package"* participant 1 *"For me it's really a kind of rewards for in the evening"* participant 2 *"For me it's also that I have habits that are accompanied with smoking"* participant 2
	Motivation to stop smoking	Previous or present reasons of	10	*"So I once stopped smoking when I*

		participants to stop smoking.		*dated X"* participant 1
Category	**Code**	**Definition**	**Frequency**	**Qoute**
				"I just didn't want to disappoint me in a sense that I wanted to quit" participant 1
				"If I went to the fitness I had the feeling that I had way more strength" participant 2
Self-management	Self-management problems	An indication if there are any problems with self-management.	4	*"In general, I don't have any problems with self-management"* participant 2
				"When I try to start then it sometimes happens that I just lay in my bed watching Netflix and I know that I need to do my stuff." Participant 1

Category	Code	Definition	Frequency	Quote
	Self-management techniques already used	Techniques the participants already use that improves their self-management.	15	*"When I stopped I just didn't buy any packages"* participant 1
				"I would also say that finding ways to distract myself is a really good way" participant 1
				"I tried to make notes on my phone that you can fill in. I just made a page for non-smoking and every day I didn't smoke I would just fill in another bullet." participant 1
				"podcasts and books" participant 2

Appendix G Codes intervention suggestion and persuasive features

Category	Code		Frequency	Quote
Intervention suggestion	App	An indication that the participants want to have an app.	4	*"I definitely would like to have something on my phone. I think an app would be best"* participant 1
	Combined with healthcare	An indication that participants want external healthcare appointments outside of the app.	1	*"Besides that maybe also an appointment with the doctor every 3 weeks to put a bit of pressure behind it"* participant 2
	Strength based	An indication if the participants are interested in working with the strength based approach	3	*"I can see the connection between strengths and quitting with smoking, but I can't imagine it that well"* participant 2 *"If it would be visible for me to put my strengths into action plan I think that would*

				help me." Participant 1
	Other	Items that were not congruent with other codes but still relevant.	3	*"Actually I would need something like an alarm straight away when I start with smoking but I think that is a bit too difficult"* participant 2 *"So I would like to see my heartrate, amount of money I have saved and a difference in mood."* Participant 2
Persuasive features	Rewards	An indication that the participants want to have rewards after certain actions are done.	8	*"I think a reward if I then passed like the fifth day would make me happy"* participant 1 *"I really need rewards and especially if I am having a bad day"* participant 2

Persuasive features	Self-monitoring	The ability to see the progress that has been made.	5	*"Also if I would make a calendar where I can see how far I am already would help me"* participant 1 *"A app that shows my progress and then I would also like to get a long-term motivation for example: if you continue to stop for two more weeks your progress is this."* participant 2
	Personalization	A feature that gives specific content to persuade the user.	5	*"But something more on the positive side of knowing what you gain when you would stop"* participant 1 *"I think it is good to get information from a lot of different views about the difference when I*

				stop smoking." Participant 2
Persuasive features	Reduction	A feature that would persuades the user that there is a benefit to the costs.	1	*"Like the positive things that happen when I stop smoking for a certain amount of time"* participant 1
	Reminders	A system that would send notifications to the user.	5	*"For example once in a while even if I am doing good and after 15 days that I didn't smoke give me some appreciation or still help me with things that I could do to not lapse.* Participant 1 *"That I would get a reminder after a longer period that reminds me of how difficult it was when I was still smoking"* participant 2

				"I would like to get reminders at four o'clock in the afternoon and not in the morning since I don't smoke then anyway." Participant 2
Persuasive features	Real world feel	An indication that an external service is wanted	5	*"So I would say it would be better to combine it with maybe a healthcare worker that could help me."* Participant 1
				"I would like to have it as maybe a chat box where I can text someone and they would answer in a decent amount of time" participant 1
	Competition	A feature that lets users compete with each other.	2	*"Social comparison would really work for me though, you know I would feel good if I am doing*

				better than someone else” participant 1
Persuasive features	Praise	A feature that makes the user more open for persuasion	2	*“I think making me feel guilty because I started again would make me feel even more bad then before and that would absolutely not be helping me, I would just like to have something positive then”* participant 1
	Simulation	A feature that would show a relation between a certain cause	1	*“Simulation because with smoking it’s always the idea that someone else’s lungs are*

	and effect by visual images.	*damaged but mine are still all right"* participant 2

Appendix H

Codes design and process

Category	Code	Definition	Frequency	Quotes
Design	Negative feedback	Negative feedback stands for all the negative points that were given about the design.	14	"*Some of the words were in way too small typesetting*" participant 1 "*I think if I read this now I would like to see that I am able to create goals and strengths about this app maybe somewhere in the beginning*" participant 5 "*The 1. 2. 3. Are a bit confusing because they are not stated in the goal page*" participant 6 "*Ah there is an arrow button on the bottom I didn't know that"* participant 6

	Positive feedback	Positive feedback indicates all the positive points that were given during the usability test.	42	"*Oh that looks like a nice little chart. Taste and smell and this is all about my health so that is nice to see and to visualize*" participant 4 "*When I would work with it I there are a lot of options, I didn't miss something*" participant 5 "*I go to the lung meter and fill in my questions and then it tells me in what state my current lungs are, oh that looks beautiful."* Participant 6 "*I think design wise it is really neat in the sense that you have everything you need and there is*

				no useless information. "*It is also quite organized as soon as you realise that there is a second page in the main menu*"
Design	Negative feedback	Negative feedback stands for all the negative points that were given about the process	7	"*I don't know where I can compare my progression*" participant 1 "*Aah I can't click on the calender but on the plus sign, that was not logical for me*" participant 6 "*Aah I see there is also an arrow button which leads me to the next page, but I thought that would close the whole window*" participant 4
	Positive feedback	Positive feedback indicates all the positive points		"*Aah there is more information with the question*

		that were given during the usability test.		*mark"* participant 2 "*Ooh and then I can also continue to the positive outcomes again, I like this*" participant 5 "*I like it that you connected differenct pages with each other it makes it logical and it motivates me to stop smoking*" participant 6
		Intervention suggestions		
	Process	This code indicates that there are intervention suggestions on the process aspect of the app.	1	"*You have to get to the next page a lot of times maybe a scroll function could help with this*" participant 2
	Design	This code indicates that there are intervention suggestions on	20	"*In the main menu I would make clusters instead of the ten different topics you have*

	the design aspect of the app.	*now."* Participant 4 "*I would like to see a graph in the progression feature, the agenda itself is not really rewarding. A graph where I can see my overall progression is really rewarding for me."* Participant 6 "*When you go from the strength page to the goal page I would put in a heading that explains that*" participant 6 "*Make some larger type setting*" participant 1