University of Twente

26.04.2019

Understanding engagement with eHealth-apps

A qualitative interview study

Tizian Eckhardt

s1557378

MASTERTHESIS 10 EC

SUPERVISORS

DR. SASKIA M. KELDERS

H. KIP

FACULTY OF BEHAVIORAL MANAGEMENT AND SOCIAL
SCIENCE, POSITIVE PSYCHOLOGY AND TECHNOLOGY
UNIVERSITY OF TWENTE P.O. BOX 217 7500 AE
ENSCHEDE THE NETHERLANDS

Abstract

Background

Ehealth-applications for smartphones or tablets or so called "Digital Behaviour Change Interventions" (DBCIs) promote a healthy lifestyle and support their users to change their behaviour in a healthy way. To be the most effective, the users have to be engaged with the app. However, engagement is, up until this point, not clearly defined and different studies find different factors that might promote engagement. The aim of the current study is to find out what engagement with health-related apps means to people, and which factors influence engagement.

Methods

To answer these questions five semi-structured interviews on the topic of engagement were conducted. The first inclusion criteria for participation was to use an eHealth-app, and the second inclusion criteria was that the interviewees felt engaged with the app. Engagement was explained to them as finding the app important. Furthermore, the participants were asked for the usage behaviour and therefore their adherence with the eHealth-app. After conducting and recording the interviews, the interviews were analysed with the help of the created code schemes. With the code schemes it was tried to define engagement and to find some engaging functions according to the answers of the participants in the current study.

Results

The current study found that the feeling of engagement differs between different users. According to the participants, self-monitoring, tailoring and an easy handling of the app positively influence adherence and therefore engagement the most.

Discussion

The findings of the current study were mostly in line with findings of previous research. Further research might possibly aim at finding a definition of engagement that takes care of the individual character of engagement, and also at finding out which factors are more important to which user group. For example, if elderly people have other needs in apps than younger people.

Conclusion

The current study revealed that defining engagement is not that easy because of the different views and the belonging foci on it. The results show also that different users have different needs and therefore it is not possible to name universal factors that guarantee an increase in engagement.

Keywords: Interview-study, engagement, aspects of eHealth-apps, individual needs and experiences

Introduction

The dangers of an unhealthy lifestyle

Nowadays, lifestyle-related diseases like obesity, coronary heart disease and lung cancer, present a serious problem when it comes to public health (Lopez & Murray, 1998). Additionally, the phenomenon of the demographic change takes place in most Western countries challenges the health care systems and places a financial burden on them. Demographic change describes the phenomenon that there are fewer young people who pay health insurance contribution, resulting in less available money, while at the same time the number of elderly people in need of health care due to age-related health problems and chronic diseases has increased (Schmidt, Hendricks, Griebenow, & Riedel, 2013). Changes in lifestyle like starting a regular physical exercise routine can work against obesity and cancer. Due to this, it is necessary to promote healthy behaviour patterns (Warburton, Nicol, & Bredin, 2006). Leading and adopting a healthy lifestyle can be supported through the use of so called "eHealth-apps". This sort apps are mostly digital behavior change interventions (DBCIs), because they deliver support for a change in lifestyle with the help of mobile phones or tablets. Nevertheless, research has found that more than a third of eHealth-app users abandons them within six months and does not use them any longer (Karapanos, 2015). Thus, there is a need for making people feel more engaged with the apps to prevent that they lose interest in apps on mobile devices. Especially since research also shows that the chances for success of an intervention rise if people use the intervention on a regular basis and if they complete the intervention or in other words: if they are engaged with the app (Perski, Blandford, West, & Michie, 2016).

The potential of new technology

Before talking about engagement related to these DBCIs it should be discussed why they are a possible solution to the problems resulting of the lifestyle today. There is the fact that physical activity can reduce the risk for certain types of cancer, coronary heart disease and of course for obesity (Warburton, Nicol, & Bredin, 2006). eHealth-applications promote a healthy lifestyle via mobile phones or tablets and thereby provide the opportunity to support people in their daily life, to adopt a healthy lifestyle. A strength of eHealth-apps is their range: every fifth person in the world owns a smartphone and can therefore make use of eHealth-apps. In 2015, approximately 500 million people already have used eHealth-apps (Zapata, Fernández-Alemán, Idri, & Toval, 2015). eHealth applications can be used nearly everywhere which is why they can be easily integrated into the everyday life of their users. Hence, eHealth apps can reach many people and furthermore they can facilitate certain activities, like tracking exercise or calorie intake. Calorie counting for example is a lot easier with the support of an app than when it's done manually (Husain & Spence, 2015). They can also monitor the progress of their users and present it to them in form of a clear graph or they

can provide information to users of how to behave in emergency cases (van Gemert-Pijnen, Peters, & Ossebaard, 2013). Furthermore, research has shown that increased engagement with an app is positively correlated with weight loss or smoking cessation (Perski et al., 2016). An example of an eHealth-app that tries to increase the physical activity level of its' users is the app "Runtastic". This app motivates people to go running through tracking their activities. That means that this app keeps track of the distance covered by the users and provides information, about how long it took the users to do so or how many calories that activity burned. Furthermore, the app provides plans for training sessions if users want to achieve a specific goal like running a marathon. (runtastic GmbH, 2019).

Engagement

In order to answer the question which factors promote engagement with eHealth apps it is useful to define engagement. Perski et al. (2016) found that there exists a definition of engagement, stemming from computer related scientific literature and one definition that derives from behavioural science literature. The computer-related definition sees engagement as a mental state of "flow" wherein people focus on the given app. A definition of engagement that goes with the computer-related definition comes from Chapman (as cited in O´Brien & Toms, 2008): "something that 'engages' us is something that draws us in, that attracts and holds our attention". On the other hand, the behavioural science literature focuses more on behavioural patterns like the usage frequency of an app or the duration of the usage when it comes to defining engagement. Support for this view of engagement comes from Fan, Liu, Wang, & Wang, 2016 who state that an active role, thus frequent usage of an app, promotes engagement. Another definition of engagement defines it as: "a dynamic process, that is expected to vary both within and across individuals over time" (Perski et al., 2016). This view is supported by O´Brien and Toms (2008) who also found engagement to be a very individual experience that is composed of physical, cognitive and affective parts. Singh et al. (2016) define engagement as: "the ability for apps to enable collaboration, activation and participation, information-sharing, and decision-making in one's own health" (p. 2). So up until this point, there is no consistent definition of engagement. However, all these definitions have something in common: they all emphasize the individual experience of the users. Thus, it is not easy to clearly define engagement. That means in turn that finding or exploring engaging factors is very difficult and because of that it is difficult to engage the users.

Influencing factors

Nevertheless, there are some studies that try to find factors that influence engagement. According to Singh et al. (2016) engagement can be increased through self-monitoring or just by providing health-related facts in general. Perski et al. (2016) found that engagement can be influenced positively through reminders or self-monitoring. Another study also states

that self-monitoring and furthermore goal-setting are one of the factors that influence the usage-behaviour, and therefore also engagement the most (Garnett, Crane West, Brown, & Michie, 2015). Because there was found out that also goal-setting is connected to engagement the motivation of people to start using the eHealth-app should be studied.

A theory by O`Brien and Toms (2008) should also be discussed here. They claim that users constantly switch between four stages of engagement namely "point of engagement", "period of engagement", "disengagement" and the fourth stage of "reengagement". According to O`Brien and Toms (2008) the user does not necessarily reach the last of the four stages, "reengagement". This is because disengagement can be created before it comes to the stage of "reengagement" and therefore it can prevent the stage of "reengagement". Disengagement can be created through different factors. Examples are internal factors like not thinking about the app or external factors like a high level of stress. Positive experiences with an app or a "nice interface" in turn could rise the chance of "reengagement" (O`Brien & Toms, 2008).

However, it is important to mention here that factors like "a nice interface" are individual ratings that can differ between users. So, it seems that there are no functions that necessarily rises engagement in all users. The term engagement is furthermore related to the term "adherence". Adherence describes the usage behaviour, thus if the app is used actively and in the right way, and is therefore a part of engagement (Cavanagh, 2015). A study (Sieverink, Kelders, & van Gemert-Pijnen, 2017) state that the term adherence is operationalized in many studies with the frequent usage of the app, but it describes the frequency of usage and if the app is used in the intended way. Thus, adherence is a part of engagement and is more than just the frequent usage. It should also be mentioned that there are some functions that can influence engagement or rather the adherence in a negative way. Negative examples are apps that overwhelm the user, disturb their privacy or apps with severe security gaps. Applications should also not deliver too much, or outdated information, and should therefore be "up to date" (Musselwhite, Freeman, & Marston, 2017). In conclusion it is therefore not that easy to design an app and finding the right balance between engaging and disengaging factors especially because of the fact that many different functions influence, according to many different studies, influence engagement

The current study

Due to the fact, that engagement is not interdisciplinary defined until now, because it seems to depend on individual factors like the experienced connectedness of the users with the app, it is necessary to gain more information about this topic directly from the users of eHealth-apps. In this way it should be possible to define engagement so that the different disciplines like the computer- and behaviour related sciences could agree on the new definition. The question of "how to increase engagement effectively" is also not easy to answer. Different

studies name different factors that influences engagement in a positive way. To find the factors that influence engagement one should ask users for their own experiences. By doing so it might be possible to find factors or patterns that are responsible for fluctuations in engagement. The first research question of the current study therefore is: "What does engagement for people in health-related apps mean?" and the second question that arises is: "Which functions of an app influence people to use this app for a long-time period?" With answers to these questions it could be possible to find out more about the topic of engagement. This in turn, could help to give a definition of engagement that combines the views on engagement of the different disciplines like the behavioural science literature or the computer related science literature. A list of factors that influences engagement, based on interviews with people who uses eHealth-apps, might help developers to design online interventions that use mobile devices as platforms in an efficient way, and in this way saving also costs for the health care systems.

Method

Design

The current study is an interview study with a qualitative explorative design and has been approved by the ethics committee of the University of Twente. The number of request for this study was 18223.

Participants

Convenience sampling via the network of the researcher, was used to recruit the five participants for this study. The researcher approached them via phone or E-Mail. Inclusion criteria were to make use of a health-related app and to be engaged with it. Engaged with the app was explained to the participants as finding the app important. It did not matter for how long the participants had been using the app as long as they considered the eHealth-app as important for their lives. Furthermore, the participants had to be older than 18.

Materials

The interview used in the current study was semi-structured (see Appendix A / English version and Appendix B / German version). First the participants had to give "informed consent" and answer some demographic questions. After this, the interview went on with general questions about the health-related app that was being used by the participants. The first question for example was: "Which app do you use?". After this part about the app in general, questions about the experiences the users make with the app, were asked. An example for a question is: "Do you have fun while using the app?". Other questions in this part of the interview are about the general usage behaviour. An example here is the question: "How often do you use the app in your daily life?" The last question in the interview

was the question for possible improvements or wishes of the participants." Do you have any suggestions for improving the app?" All questions were based on a pilot-study to ensure a fluent progress without any misunderstandings. If the participants nevertheless struggled with one of the questions during the interview, they had the possibility to ask the interviewer for the meaning of this question. The interviewer tried to reformulate the original question to make it more understandable, or he explained the intention of the question. If necessary, the researcher asked for more precise information about a specific topic if it was relevant for the results of this study.

Study procedure

The time and the place of the interview were chosen by the participants. This way they had time to concentrate on the questions and to tell freely about what came to their mind concerning the interview. Important was that the room was quiet. To ensure a safe feeling for the participants, they were told in the informed consent that their participation in this study is voluntary, that their data will be made anonymous and that they had the right to stop the interview whenever they wanted without any consequences. The informed consent also informed the participants that the interviews were being recorded and explained to the participants why they were recorded. Furthermore, they were informed that these recordings would not be published. At the end of the interview the participants were thanked for their participation and they had the possibility to ask questions about the intended use of their data, about possible results or the results so far.

Analysis

The interviews were transcribed verbatim and then translated from German into English. The next step was to anonymise the interviews to ensure the privacy of the participants. Then, for analysing, the interviews were imported to the computer software ATLAS.ti, a software for analysing qualitative data. A code scheme was created via an inductive approach for each of the two research questions. Inductive means that the codes thus, also the code schemes, were created by reading the interviews and finding appropriate labels for text parts in the interviews, as opposed to deductively labelling the text parts, using an already created code scheme. (David, R. Thomas, 2006). The first interview was read multiple times and the parts that helped answering one of the two research questions were highlighted and labelled. Two coding schemes were made. The first coding scheme belongs to the first research question, and the second coding scheme codes functions that the participants perceived as influencing for their engagement. During the analysis new labels were created if it was necessary. The labels and the belonging quotes were sorted to the belonging research question. The "total number of quotes" differs from the number in "Frequencies and percentages of the codes", because the researcher decided to only count two quotes if there is talked in-between the

two quotes about another topic. If a quote was only interrupted by a question of the interviewer two quotes were counted as one quote. The code scheme was adjusted during the whole process of analysing. Adjusting means for example that codes that seemed not to be relevant for the current study were excluded because of the inductive approach.

Results

The age of the participants in this study varied between 20 and 28 (M age=24,2). The respondents spoke German and the interviews were held in German.

Table 1 shows which health-related application the participants used and for how long they had been using them.

Table 1.

Characteristics of the participants

Participants	Gender	Age	Job	App	App in usage (in months)
1	Male	20	Student (Communication science)	Headspace	2
2	Female	26	Student (Psychology)	FitBit-app (belonging to the FitBit-watch)	4
3	Male	23	Student (Psychology)	My Fitness Pal and Freeletics	14/18
4	Female	23	Student (Psychology)	Samsung Health App (belonging to the Samsung Gear Fit 2 Pro)	18
5	Male	28	Metal worker	FatSecret	15

Research question 1

Engagement in health-related apps

The following two tables (Table 2 and 3) show the absolute number and the frequencies of how often the codes were mentioned by the interviewees.

Table 2.

"What means engagement for people in health-related apps?"

Codes	Frequencies and percentages of the codes belonging to the first research question	Total number of quotes	Number of interviews, the codes were named in (n=5)
Usage behaviour	17	20	5
Feeling of connectedness	13 (37.1%)	18	5
Positive experiences with e-Health-apps in general	8 (22.9%)	9	5
Start to improve the personal level of fitness	9 (25.7%)	9	4
Start because of an expected benefit on the long-term	5 (14.3%)	7	3

The first code in the current study is named "Usage behaviour". This code is about the context in which the app is used. Meant is the time when the app is used, the place where it is used or for how long the app has been already used. As stated in the introduction, the usage behaviour is connected to engagement and therefore this code is integrated into this study. One interviewee used his app only for two months, but he stated that he had been using similar apps for a long time. The other interviewees used their apps for at least half a year up to one and a half year. The participants spoke 17 times about their usage behaviour.

The second code is named "Personal connectedness". This code labels statements of the interviewees, wherein they tell if the app had become a part of their lives, like in this quote: "*Yes, in every case [it has become a part of my life]*" (Interviewee 5, male), or if the app is important to the participants: *"They really had a big importance. "Freeletics" itself, as the app had a big importance*" (Interviewee 3, male). This label is intended to look if the participants mentions an emotional bonding related to their app. This code accounts for 37.1% of the given codes. In the case of this study all interviewees said that they feel connected to the app and that the app is a part of their lives. Even the interviewee, who had used the app just for two months, felt connected to it. *"It is already somewhere integrated,*

but still not in a way that I would say, it is a necessary part. I will integrate it more, but I already reached a big piece" (Interviewee 1, male).

The code "Positive experiences with eHealth-apps in general" accounted for 22.9% of the codes belonging to the first research question. This code was given, if interviewees talked about positive experiences with other eHealth-apps, if they had used one before. Because of their positive experiences with other comparable eHealth-apps they switched to the actual used eHealth-app. An example is: *"Ähm, yes I tested „7Mind". That is the German version, but only a test version. I did not buy it but used it for a long time"* (Interviewee 1, male). So, the interviewee had used the app for a long time and because of the positive experiences with this "free" version he decided to spend money on this topic and to buy the English version of it. This code was also given if the users for example used other eHealth-apps, but the eHealth-app they use currently has more functions than the eHealth app they used before. "*Then I also tried "Runtastic", but this one is only focussed on sport. There you cannot type in a calorie number. But meanwhile I only use this "Samsung "health app because this includes all things in one"* (Interviewee 4, female).

Motivation for starting

One of the last two codes, related to the question of what means engagement for people in health-related apps, is named: "Start to improve the personal level of fitness". In this code, the interviewees described that they had the urge to try out something new or to change their health behaviour. They have set a clear personal goal and are motivated to improve their personal level of fitness. This code was mentioned 9 times in different interviews what accounted for 25.7% of the given codes belonging to research question one. An example is: *"I sat when I did not have to go to university, I really sat the whole day at home. I went shopping once, but that was it. Then sitting the whole day at my desk and I thought: "This could not go on like this. You have to look, that you do a little bit sport again"* (Interviewee 4, female). Here the participant set the clear goal of improving her level of fitness.

The following code belonging to the motivation is about the expectations of the interviewees. So, if they told that they had positive expectations related to their app these statements were labelled with the code: "Start because of an expected benefit on the long-term." Meant is if they had read for example that the usage of this app brings special benefits with it. Here, the participants did not have a clear goal. An example is: *"In some ways it is scientifically proven, that you can significant prevent yourself from sicknesses. Thus, you are able to work preventive with this device"*, (Interviewee 1, male). This code accounted for 14.3 % of the codes.

Research question 2

Influencing factors

By answering the second research question: "Which aspects of an app influences people to use this app for a long-time period?" the already existing positive and negative factors of health-related apps should be discussed. Following, the possible improvements should also be discussed. In general, the interviewees talked more about positive functions within their apps than over negative functions or improvements. The codes belonging to the second research questions are up to 71.3% about positive functions, up to 24.6% about negative functions and up to 4.1% about possible improvements.

Table 3.

"Which aspects of an app influences people to use this app over a long-time period?"

Codes	Frequencies and percentages of the codes belonging to the second research question	Total number of quotes	Number of interviews the codes were named in (n=5)
Positive functions			
Overview/Statistics	32 (36.8%)	35	5
Possibility to personalize	20 (23.0%)	22	5
Simplicity in everyday life	15 (17.2%)	17	4
Feedback	11 (12.6%)	11	5
Social support	9 (10.3%)	10	5
Negative functions			
Time-consuming functions	8 (26.7%)	10	4
Too few choices	7 (23.3%)	8	5
Not personally relevant functions	5 (16.7%)	5	2
Do not think about the app because of the circumstances	4 (13.3%)	5	3
Worries about privacy	4 (13.3%)	5	3

Never used functions	2 (6.7%)	3	2
Possible improvements			
The developers should increase the opportunities	5	5	4

Positive functions

The first code here is: "Overview/Statistics". Statistics mean in this case the presentation of the progress or in general the presentation of the activities of the users. The participants found it really helpful and motivating that their activities are presented clearly in a structured manner. This code was mentioned 32 times what accounts for 36.8% of the codes belonging to the second research question. This makes it to the most frequently mentioned code in the interviews. One participant explains that the presentations of the activities are comparable to a high-score in a video-game: *"That is pretty good, you can see on how many days in a row you meditated and that has the same effect like a high-score in a video-game. You frequently want to add one more day because otherwise it would start at the beginning"* (Interviewee 1, male). Other participants also find these statistics very motivating *"Explicitly motivating… I think explicitly motivating are the graphics. So, for example, you see also of course on one hand the bracelet count steps. Then you also see, okay today you made only 300 steps. Then you made 1000 steps and then you made 8000"* steps *[…]*. (Interviewee 4, female).

To the positive functions belongs also the code "Possibility to personalize". Possibilities to personalize things in the used app are for example the possibility of creating an individual home screen in an app or setting a personal goal. A fitting statement from the interviews is: *"You can set yourself a goal, you see exactly how much of your goal you reached"* (Interviewee 3, male). This code was mentioned 20 times by the interviewees which accounts for 23.0% of the codes.

For 17.2% with 15 mentions accounts the code "Simplicity in everyday-life". In parts with these labels the interviewees talk about how usable the app is in their everyday life. The interviewees describe if the app is easy to handle, if it is clear structured or if they can use it anytime. One example for this is: *"You do not have to install things, but you can start directly with it. That is very easy and so I think that is something that fits to me as a person"* (Interviewee 1, male).

One more code belonging to the field of positive functions is the code "Feedback". This code is about if the different apps give the users in one way or another feedback. For example, if the app tells the user if a goal is realistic or achievable. *"And then it tells you also:*

"That is realistic for this time, that is maybe too high, that is a good aim" and it gives you a little bit feedback" (Interviewee 4 female). The code "Feedback" was mentioned 11 times in the interviews. This accounts for 12.6% of the given codes belonging to research question 2.

The last code in the field of positive functions is the ability to connect with friends to get support from a community behind an app, or to compete with other users in tournaments within the app. All statements connected to these things got the label "Social Support". Nearly all of the interviewees said that there is the possibility to connect the app with social media and that it is positive to have this opportunity, but they also said that they do not use this function. *"You can comment something and upload pictures of yourself and you can somehow connect yourself with Facebook, but I do not need that"* (Interviewee 5, male).

Negative functions

To answer the question for factors influencing the long-time usage of apps it is also important to talk about the negative functions or about the things that were negative in the eyes of the interviewees. The first code is: "Time-consuming functions" which was mentioned 14 times. That is a percentage of 26.7% of the codes related to the second research question. This code labels statements about functions that prevent the usage because they are experienced as too time-consuming by the interviewees. The participants connect time-consuming functions mostly with counting calories: *"Ähm, I do the thing with tracking food irregular because it is too much effort in my opinion to weigh all the things before and I have no sense in it. I do this only if I eat constantly"* (Interviewee 4, female). The participants also talk about time-consuming functions in general and state that these functions might prevent usage: "*So, that it is relatively time consuming what is nice on the one hand, but on the other hand it could prevent you from using it"* (Interviewee 1, male).

Another reason for not using an app is because there are not enough choices for the users that fit their needs. Statements belonging to this label were given the code: "Too few choices". The participants say for example, that the offer of the app is reduced and so the app is not able to provide all functions that the user might need. An example is: *"I cannot type in the sport so it is all about eating"* (Interviewee 5, male) Here the interviewee says that he just uses the app for counting calories. He has no option to type in his activities or something like that. Another participant complains that she could not type in all the kinds of sport she does: "*And if I want to do yoga and track the calories of that I had to install it via the laptop. That is a bit inflexible"* (Interviewee 2, female). The belonging code to such statements was given seven times (23.3%).

The next code is the code "Not personally relevant functions". This code labels parts of the interviews wherein the interviewees talked about functions that they do not use because they only fit in a specific situation, or because they are not personally relevant for them. The interviewees talked about such functions five times (16.7%). A statement from the

interviews shows that this code labels mostly parts wherein the participants mention a specific function that they do not use because they do not need it in their life: *"No, because as already mentioned I will not use the "kid-thing". And there are some things, for example, some meditations that I personally will not do. For example, there is a pregnancy-meditation.* (Interviewee 1, male).

The code "Do not think about the app because of the circumstances" was given four times what means that this code accounts for 13.3% of the codes, labelling statements in relation to the second research question. This label was given if the interviewees talked about times wherein, they did not use the app because of special circumstances in their lives. An example is that one interviewee said that he was on vacation and did not used the app because of that. He just did not think about the app because of the new environment. Another user answers the questions for phases wherein he did not use the app with the words: *"If I am ill [I stop the usage] otherwise not.* (Interviewee 5, male).

The code "Worries about privacy" was given four times. If people have these worries about their privacy, they tend to not use the function or the app, that disturbs their privacy. They said for example that because of the potential risk arising from other apps, they decided themselves for the apps they use currently. An example of the interviews is: *"I never dealt with it. I do not like it, if you have to log on to everything and then someone frequently has your data and you do not have control over it any longer"* (Interviewee 4, female).

The interviewees talked two times about functions that they do not use because of too less interest. So, the code "Never used functions" makes up 6.7% of the codes. An example is: *"There you can do for example such a breathing exercise because it connects with the mindfulness-concept. And personally, I am not very interested in mindfulness-exercises"* (Interviewee 2, female).

Possible improvements
The one and only code in the category of possible improvements is the code: "The developers should increase the opportunities". This code describes if the interviewees could imagine that the app could be developed further in the original direction. So, for example, a mindfulness-app could build in more mindfulness-exercises than it already offers.
"Eventually, you could develop the app further with […] for example, if it is explained at the beginning how it works and then you have to do it. 10 Minutes a specific sort of music, there is so much to find in the internet. That would be interesting" (Interviewee 1, male).
Statements belonging to this label were given 5 times. It was the only thing the interviewees mentioned if they were asked for possible improvements.

Discussion

Based on the results of this study it seems like engagement is not to define through a "state of flow". The participants felt connected to the app which is according to Fan et al. (2016) an important part of engagement, but the meaning of engagement differs from user to user. The function that influences engagement according to the participants at most is self-monitoring. This code was frequently mentioned and praised by the participants.

The usage behaviour and thus the adherence of the interviewees was analysed and it became clear that the interviewees used the app quite differently. One said he uses it in the mornings, one said she uses it in the evenings, and one said he uses the app whenever it fits in his everyday-life. Thus, the usage of the app seems not to be connected to a specific time or place. Also, the interviewees state that they use the app in the intended way but tailored to their everyday life. This shows that people use the app individually and this supports the statement of Perski et al. (2016) who said that engagement is a dynamic process. It seems like it is not possible to define engagement in certain behavioural patterns like it is done in the behavioural science literature. Also, it is not possible to define engagement only in terms of adherence. It would be useful to define engagement again because this facilitates the research for engagement and engagement-related factors. A possible question related to this could be which aspects and also which functions are absolute necessary to be engaged.

Nearly all interviewees of the current study stated that supporting their hobby, with the help of the app, is more important to them than the app itself. A possible explanation for this comes from Rheinberg, Vollmeyer, & Engeser (as cited in Klauer, Stiensmeier-Pelster, & Rheinberg, 2003) who claim that people do things for two reasons. Reason one is, like in the case of the current study, to reach a specific aim. Reason two is that humans do things because it is really enjoyable to do the activity itself. Supporting an activity through another activity, like using an eHealth-app, is in contrast to a definition of engagement named in the introduction. There, Chapman (as cited in O´Brien & Toms, 2008) says about engagement: "something that 'engages' us is something that draws us in, that attracts and holds our attention" Chapman (as cited in O´Brien & Toms, 2008). None of the interviewees said that they have a feeling of enjoyment or that it draws them in while using the app. The good feeling arises because they know they can support their hobby, or because of the expected long-term effects. That means, that they are motivated because they hope to achieve an internal goal, here it would be a health benefit on the long term. Common was also that people experienced a need for a change and started because of that. This in turn, is called intrinsic motivation (Ryan & Deci, 2000). They wanted to increase their personal level of fitness without expecting a direct benefit. Therefore, it seems like users have to be already motivated beforehand to start using an eHealth-app. A possibility to raise the extrinsic motivation of people is, for example, that the government or the health insurance companies

give them a reward if they regularly use an eHealth-app. Through this the government and the health insurance companies create an external goal for many people. The intrinsic motivation could be raised for example through health education advertisements on TV. If people learn about the positive effects of sports, they might have the wish to do more sport and to live healthy.

So, in conclusion the research question: "What does engagement mean for people in health-related apps?" could not be answered easily. The usage behaviour is individual, and the interviewees used their apps in a different way. All interviewees felt connected to the app, but no one reported a feeling of flow while using the app. Thus, it seems like that engagement do not include necessarily a state of flow. Furthermore, the answers of the interviewees showed that the motivation to start using such an app also matters. Many of the participants were extrinsically motivated: they said they use the app to achieve a higher goal instead of using the eHealth app for the sake of enjoyment. Therefore, it seems like, if it is useful to motivate people to start using an eHealth-app.

Important functions

The second question in this study is: "Which aspects of an app influence people to use this app over a long-time period?" The interviews reveal that monitoring the own progress in form of statistics or graphics is important for positively influencing the usage behaviour of people. That might come through the fact that people, who use eHealth-apps, are motivated to achieve a special goal. With the function of self-monitoring they can see how much of their goal they already reached. A study by Garnett et al. (2015) also supports the finding that self-monitoring is an effective tool if people want to change their behaviour. Furthermore, Garnett et al. (2015) and the current study found that it is important for the success of a DBCI delivered via a smartphone or a tablet that the application is easy to use and offers the opportunity to personalize it. Therefore, these functions seem to influence the engagement with DBCIs, and they could also be connected to the found result that it is important to have a goal in mind. If the users have a goal, they want to achieve with the help of the app, it is important that the app is easy to handle because the users should be able to use it in the intended way. The possibility to personalize might be important because the users have their individual goal and therefore, they need to be able to modify the app in a way that supports their individual goal the most. A study found that the possibility to personalize an app leads to a better progress of their users (Yoganathan & Kajanan, 2013). Based on these findings the researcher of this study expected that personalization influence engagement in a positive way. Also, the interviewees said that it is important to save time through the usage of an app. So, Wang et al. (2016) represent the view that future apps have to be designed to meet the needs of the users to support them to reach whatever they want to reach with the help of this app. Through this it might be possible to raise the engagement of the users with future apps.

With that statement, they support in turn, the finding of the current study that it is important for users to have the possibility to personalize apps.

The conclusion and the answer to this second question is that monitoring the own progress, the option to personalize the app and an easy handling are the most influential factors when it is about app usage. Zhao et al., (2016) also found these functions to be important for increasing the effectiveness of an app. They found, like the current study, that it is important to save time of the users. Otherwise, they will not be engaged and thus they will not use the app for a long time which is problematic, since health apps are more effective if people use them for a long period of time (Perski et al., 2016).

Strengths and limitations

A strength of this study is the variety of eHealth apps of the different interviewees. Two of the interviewees used a wearable additionally to the app. A wearable looks like a wristwatch but can count steps, provides information about the sleep and about body functions like the heart-rate. Consequently, it can keep track of nearly all activities of their users. The results of this study are not only about physical health apps, but it is also included one app that focuses on mental health. This app is a so called "mindfulness-app" and helps people to relax or prepares them to keep calm in different situations. In this way, the results are gained through the analysis of a variety of people and their different eHealth-apps. So, the suggestions based on the results of this study do not only have validity for a special kind of eHealth-apps. Users of different kind of apps see the same functions as important. This could mean that relevant functions for engagement are the same for different kinds of apps.

A limitation of the current study is that there is no inter-rater-reliability that could give a study more validity and reliability (Armstrong, Gosling, Weimann, & Marteau, 1997). Nevertheless, Morse, (1997) said that researcher have to trust their own findings and should be able to defend their interpretations. All the interviews in this study were analysed the same way and followed the same interpretations. Thus, it is according to Morse (1997) possible to come to trustworthy results because all steps were accurately described. In this way other researcher can replicate this study. The code scheme of the current study was previously discussed with another researcher. In this way, needless questions were prevented, and the right questions could be asked.

Another limitation could be the lack of variety within the group of participants. All interviewees were under the age of 30. Elderly people for example, often have other technology-related abilities and therefore other needs for the usage of modern technologies like smartphones. Based on this, it would be nice if there was more variation of age within the group of participants. It is possible, that the vision of elderly people decreases, and therefore it is possible that they need another design of apps. Also, social media might give them the chance to connect with old or new friends. Therefore, the social media part might be more

important to them than to younger people, who can meet other people at school, university or at work (Van de Watering, 2005).

A strength is that all participants felt in some way connected to the app. They could tell a lot about the apps and describe why they are important to them. Nevertheless, they felt not engaged to the app in the sense engagement is defined, for example, by Chapman (as cited in O´Brien & Toms, 2008) who defines a feeling of enjoyment as engagement. This fact may show that not all people are engaged the same way and it could mean that a new definition of engagement that does not focus on the mental state of flow is needed.

Further research

The interviewees in this study felt connected to the app because it supported their hobby or their level of physical activity, but they said that other apps could possibly do the same. The results show furthermore that it is not necessary to experience a feeling of flow to be engaged and they show that engagement is more than just the frequent usage of an app. The term of engagement is defined on many different ways in the literature and is described as highly subjective. The results reflect this individual character but found general factors that influence engagement. Further studies could therefore try to find a definition of engagement that includes all the points of view, related to engagement. A possible definition based on the results of this study could be: "Engagement with eHealth-apps is about the relation of the users to the app. It describes if people have an emotional bonding to the app and if they find the app important for their lives. Engagement could be increased through internal motivation". Further research could review if this definition is complete, if some important parts are neglected or if other studies come to other results and therefore to another definition of engagement with eHealth-apps.

Future studies could also explore the function of social support. The interviewees in this study stated that social support is not important to them, but the results found by Singh et al. (2016) indicated that users can benefit from it. It might be helpful to know the circumstances in which the participants use social support. As already stated, the technology-related needs of people change with their age and therefore the function of social support might be more important to elderly people (Van der Watering, 2005). Future studies can therefore focus on social-media functions to tailor specific apps to the needs of specific user-groups.

Conclusion

This study is mostly in line with the findings of other researchers because it shows the individual character of engagement. The question: "What means engagement for people in health-related apps? is not easy to answer but the new definition of engagement could be an answer. Furthermore, it could be stated that the reason to start with an eHealth-intervention, delivered through an app, influences the engagement with this app. In particular the intrinsic

motivation in the form of having a clear goal in mind seems to raise the engagement.

The question for functions that influence the usage of people could be answered through the statements of the interviewees, but it becomes also clear that different users have different needs like for example elderly people. But the most frequently mentioned function was self-monitoring that is presented in the form of graphics. Thus, it is expected that this tool has a strong influence on engagement. This function is also described in the existing literature. With building in such a function future apps could be successful in raising engagement with eHealth-apps and in helping people to live a healthier life.

References

Armstrong, D., Gosling, A., Weinman, J., & Marteau, T. (1997). The Place of Inter-Rater Reliability in Qualitative Research: An Empirical Study. Sociology, 31(3), 597–606. doi:10.1177/0038038597031003015

ATLAS.ti (2018). What is ATLAS.ti? Retrieved from https://atlasti.com/product/what-is-atlasti/

Can healthy people benefit from health apps? (2015). BMJ, 350(may08 4), h2520–h2520. doi:10.1136/bmj.h2520

Cavanagh, K. (2015). Turn on, tune in and (don't) drop out: engagement, adherence, attrition, and alliance with internet-based interventions. Oxford Clinical Psychology. doi:10.1093/med:psych/9780199590117.003.0021

Fan, L., Liu, X., Wang, B., & Wang, L. (2016). Interactivity, engagement, and technology dependence: understanding users' technology utilisation behaviour. Behaviour & Information Technology, 36(2), 113–124. doi:10.1080/0144929x.2016.1199051

Garnett, C., Crane, D., West, R., Brown, J., & Michie, S. (2015). Identification of Behavior Change Techniques and Engagement Strategies to Design a Smartphone App to Reduce Alcohol Consumption Using a Formal Consensus Method. JMIR mHealth and uHealth, 3(2), e73. doi:10.2196/mhealth.3895

Karapanos, E. (2015). Sustaining user engagement with behavior-change tools. *Interactions, 22*(4), 48–52. doi:10.1145/2775388

Klauer, K. J. (2004). Stiensmeier-Pelster, J. und Rheinberg, F. (Hrsg.). (2003). Diagnostik von Motivation und Selbstkonzept. (besprochen von Karl Josef Klauer). Zeitschrift Für Pädagogische Psychologie, 18(1), 65–67. doi:10.1024/1010-0652.18.1.65

Lopez, A. D., & Murray, C. C. J. L. (1998). The global burden of disease, 1990-2020. *Nature Medicine, 4*(11), 1241-1243. doi: 10.1038/32

Morse, J. M. (1997). "Perfectly Healthy, but Dead": The Myth of Inter-Rater Reliability. Qualitative Health Research, 7(4), 445–447. doi:10.1177/104973239700700401

Musselwhite, C., Freeman, S., & Marston, H. R. (2017). An Introduction to the Potential for Mobile eHealth Revolution to Impact on Hard to Reach, Marginalised and Excluded Groups. Mobile e-Health, 3–13. doi:10.1007/978-3-319-60672-9_1

O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. Journal of the American Society for Information Science and Technology, 59(6), 938–955. doi:10.1002/asi.20801

Perski, O., Blandford, A., West, R., & Michie, S. (2016). Conceptualising engagement with digital behaviour change interventions: a systematic review using principles from critical interpretive synthesis. Translational Behavioral Medicine, 7(2), 254–267. doi:10.1007/s13142-016-0453-1

Runtastic GmbH. (2019) Retrieved from https://www.runtastic.com/de/

Schmidt, S., Hendricks, V., Griebenow, R., & Riedel, R. (2013). Demographic change and its impact on the health-care budget for heart failure inpatients in Germany during 1995–2025. *Herz, 38*(8), 862–867. doi:10.1007/s00059-013-3955-3

Singh, K. S., Drouin, K. D., Newmark, L. P. N., & Rozenblum, R. R. (2016). Developing a Framework for Evaluating the Patient Engagement, Quality, and Safety of Mobile Applications. doi:10.15868/socialsector.25066

Sieverink, F., Kelders, S. M., & van Gemert-Pijnen, J. E. (2017). Clarifying the Concept of Adherence to eHealth Technology: Systematic Review on When Usage Becomes Adherence. Journal of Medical Internet Research, 19(12), e402. doi:10.2196/jmir.8578

Thomas, D. R. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data.   American Journal of Evaluation, 27(2), 237–246. doi:10.1177/1098214005283748

Van De Watering, M. (2005). The impact of computer technology on the elderly. *Retrieved June*, *29*(2008), 12.

Van Gemert-Pijnen, J. E. W. C., Peters, O., & Ossebaard, H. C. (Eds.). (2013). *Improving eHealth*. Den Haag: Eleven international publishing

Wang, Q., Egelandsdal, B., Amdam, G. V., Almli, V. L., & Oostindjer, M. (2016). Diet and Physical Activity Apps: Perceived Effectiveness by App Users. JMIR mHealth and uHealth, 4(2), e33. doi:10.2196/mhealth.5114

Warburton, D. E.R., Nicol, C. W., & Bredin, S. S. (2006) Health benefits of physical activity: the evidence. *Canadian Medical Association Journal, 174*(4), 801-809. doi: 10.1503/cmaj.051351

Yoganathan, D., & Kajanan, S. (2013). Persuasive Technology for Smartphone Fitness Apps. In *PACIS* (p. 185).

Zapata, B. C., Fernández-Alemán, J. L., Idri, A., & Toval, A. (2015). Empirical Studies on Usability of mHealth Apps: A Systematic Literature Review. *Journal of Medical Systems, 39*(2). doi:10.1007/s10916-014-0182-2

Appendices

Appendix A: Interview scheme

Which app do you use?
- For how long have you been using the app?
- Why do you use this app?
- What is the goal you wish to achieve?
- Have you tried other apps and if yes, why did you stick with this one?
- What was your motivation to start using the app?
- Which functions do you find explicitly motivating for using the app for a longer period of time?

Can you explain/show how you usually use this app?
- What do you do with it?
- When?
- Are there functions of the app, that you use occasionally?
- Do you think you know all its functions?
- Are you able to use all the functions?

How often do you use the app in your daily life?
- In which context do you use the app?
- Have there been breaks during your usage?
- Why did you take a break?
- And what made you start using this app intensively again?

You mentioned that the app is important to you in a specific way. Can you explain this a bit more?
- What does the app mean to you? (optional)
- Why is it important to you?   (Ask only if it is not already answered in the answer for the first question)
- Is the app like a hobby to you?
- Would you say that he app has become a part of your daily life?

Is it something that fits to you as person?
- Do you have the feeling that you are connected to the app?
- Okay, and do you have fun while using the app?
- Is it meaningful to you?
- Do you tell others about the app?

Is there a social component in this app?
- Which functions prevent you from using the app for a long period of time?
- Do you have any suggestions for improving the app?

Appendix B: Interview scheme (German)

Welche App benutzen Sie?
- Wie lange nutzen Sie diese App schon?
- Warum nutzen Sie diese App?
- Haben Sie schon andere Apps ausprobiert? Wenn ja, warum sind Sie bei dieser geblieben?
- Aus welcher Motivation heraus haben Sie die begonnen die App zu nutzen?
- Welche Funktionen finden Sie besonders motivierend um die App über einen längeren Zeitraum zu nutzen?

Können Sie zeigen oder erklären, wie Sie die App normalerweise nutzen?
  -Was tun Sie damit?
  -Wann?
  -Gibt es andere Funktionen die Sie gelegentlich nutzen?
  -Denke Sie, Sie kennen alle Funktionen der App?
  -Können Sie alle Funktionen in vollem Umfang nutzen?

Wie oft nutzen Sie die App im täglichen Leben?
  -In welchem Kontext nutzen Sie die App?
  -Gab es innerhalb diesem Zeitraum Pausen?
  -Wenn ja, warum?
  -Was hat dazu geführt, dass Sie die App erneut intensiv gebrauchen?

Sie haben angegeben, dass die App auf eine gewisse Art wichtig für Sie ist. Können Sie das näher ausführen?
  -Was bedeutet die App für Sie?
  -Warum ist die App wichtig für Sie? (Nur fragen, wenn das nicht sowieso schon beantwortet wurde. Die Fragen 1 und 2 sind hier nämlich fast gleich)
  -Ist Sie zu einem Bestandteil Ihres täglichen Lebens geworden?
  -Ist die App wie ein Hobby für Sie?

Ist die App etwas das zu Ihnen als Person passt?
  -Fühlen Sie sich der App verbunden?
  -Haben Sie Spaß daran, die App zu nutzen?
  -Erzählen Sie anderen von der App?

Gibt es eine soziale Komponente in der App?
  -Gibt es Aspekte an der App die Sie davon abhalten die App über einen längeren Zeitraum hinweg zu nutzen?
  -Haben Sie zu dieser App Verbesserungsvorschläge?

Appendix C: Code scheme *("What means engagement for people in health-related apps?")*

Background of usage	Usage behaviour
Aspects of engagement	Personal connectedness
	Positive expectations
	Positive experiences with this app/e-Health-apps in general
Motivation for starting	Experienced need for a change

Appendix D: Code scheme *("Which aspects of an app influences people to use this app over a long-time period?")*

Positive functions	Possibility to personalize	
	Social support	
	Simplicity in everyday life	
	Overview/Statistics	
	Feedback	
Negative functions	Do not think about the app because of the circumstances	
	Worries about privacy	
	Never used functions	because of too less interest
		because they only fit in a specific situation
	Functions that prevent usage	because they are too time-consuming
		Because of too less choices
Possible improvements	They (the developers) should increase the possibilities in the chosen field	