"Attitude"- mHealth Apps and Users' Insights: An Empirical Approach to Understand the Antecedents of Attitudes towards mHealth Applications

Luisa Sophie Vervier, André Calero Valdez and Martina Ziefle
Human Computer Interaction Center, RWTH Aachen University, Campus Boulevard 57, Aachen, Germany

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Abstract: Mobile health apps are a solution to make people more self-sufficient with their health in relation to their lifestyle or medical needs. The mobile health landscape is growing, but still its usage rate is rather low. Since the attitude towards mhealth apps has not been extensively studied so far, we conducted a multi-method approach study in Germany. To understand people's needs, preferences and attitudes towards mhealth applications on the one hand and the antecedents of people's attitudes towards mhealth applications on the other hand, we chose a user-centered approach. To get first insights into users' needs and attitudes, we conducted two focus groups (N=11). Topics such as privacy concerns, data sharing and app functions have emerged as key issues. Quantitatively, we operationalized the collected key topics as well as users' attributes and personal health attitudes. We collected 132 complete responses from originally 180 responses. We used partially-least squares structural equation modeling to identify the antecedents of attitudes towards mhealth applications. Results indicate that time saving and daily life facilitating functions are favored app features. Further, we found advantages (e.g. drink reminder) and disadvantages (e.g. data collection). Gender and age effects could be detected regarding health literacy, privacy concerns, and data sharing. Older participants are more cautious and reserved with the usage of health apps. Women in general show a higher health-literacy. eHealth literacy and intention to share data were identified as being the strongest influence on a positive attitude towards mhealth apps. To ensure that mhealth apps further enjoy a rising popularity, it is important to meet the users' concerns about privacy and help them to acquire eHealth literacy.

1 INTRODUCTION

Mobile applications are commonly used and affect daily lives. Especially in the health care sector, the development of health apps for lifestyle reasons is increasing. The "quantified self" movement is one actuator for people's interest in using mhealth apps (Lupton, 2013). Moreover, people in general are becoming more interested in taking an active role in their own health care. They have become eager to take health care decisions on their own. Especially, ever since the physician-patient relationship has turned into a shared decision-making relationship (Ernst et al., 2014). A further aspect which gives a special importance to the mhealth topic is the societal challenge of demographic change. People will increasingly depend on technical support in the future (Lupton, 2013). Therefore, there can be no better starting point than using and developing existing and well known techniques further, such as smartphone apps (Bhavnani et al., 2016).

Mobile health apps are an advanced form of eHealth. As smartphones enjoy a rise in popularity especially with versatile software, apps have great potential for revolutionizing the health-care services. However, the quality as well as the users' acceptance of such systems is still questionable (Powell et al., 2014). Thus, there is a growing urgency to understand peoples' needs, preferences, and attitudes towards mhealth applications. What kind of functions are important for an mhealth app from a users' perspective? And on a meta-level, what are important topics that appear when looking at peoples' attitude towards mhealth apps? As the attitude shapes the willingness to use mhealth apps, it is of special interest to identify such aspects and to consider them when defining guidelines for mhealth app development. In this study, we investigate this topic. The aim of the study is to explain the antecedents of the attitude towards mhealth apps and to derive guidelines for digital health care actors.

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2 STATE OF THE ART

In the following section, we present an overview of the different aspects that play a role in trying to understand the attitude towards mhealth applications.

2.1 mHealth

The aim of mHealth is to contribute to the health care of users through the use of mobile devices (Conway et al., 2016). Mobile devices such as a smart phone or tablet provide a platform for maintaining motivation, defining goals, and receiving feedback (Appelboom et al., 2014). They have a number of characteristics that are considered to have *"(...)great potential for the healthcare sector"* (Matusiewicz et al., 2017).

The most important characteristic of smartphones is that they are part of everyday life (Gehring et al., 2014). Since smartphones are highly valued by users (Dennison et al., 2013) and have a size that makes them transportable, users usually carry them along all day long when switched on. That way users are reachable regardless of time and place. Moreover, it enables to address all kind of user groups. It offers an optimal opportunity to disseminate information and applications on the subject of health in a target-group-oriented, effective and independent manner, regardless of time and place.

This is not least due to two other important features of smartphones: built-in sensors and networking (Dennison et al., 2013). The built-in sensors make it possible to automatically measure health-related data such as a user's physical activity. Thus, individual needs can be met. The interconnection of smartphones also allows users to share their health data with friends, acquaintances or even their physicians and health insurers.

These numerous advantages of mHealth result in a great potential for improving and promoting health care, which could possibly fundamentally change the health market and the health system. Although many advantages are present, the attitude towards health apps is very different. Individual needs are often not covered to the satisfaction of users. So, there are many immature health app versions on the market that are questionable regarding security and privacy. These aspects, as well as the individual ability to use health apps, present great challenges for developers. With our study we want to shed light on the users' need and preferences as well as on the main aspects people deal with when considering health app usage.

2.2 Online Privacy in the Context of mHealth Apps

Data protection and user privacy are central aspects in the health care context. The explanation for this lies in the way health apps work. They can constantly collect information about the user's health in real time (Gao et al., 2015). Since this information is usually perceived by users as sensitive, data protection is a topic of great importance. Users' worries include above all the concern for the protection of privacy and the protection against unauthorized use of the data (Bansal et al., 2010). As soon as users disclose information about their health online, there is a risk that it may be misused or illegally used by third parties. Thus, when using an app, the user runs a risk that is directly related to the concern for the security of personal data (Miltgen et al., 2013). Nevertheless, users are often willing to take the risk and disclose their personal data in an app in order to gain a personal advantage. In such cases the perceived advantage must be greater than the perceived risk for the user to be willing to pass on his data (Li et al., 2014).

2.3 eHealth Literacy

The consideration of users' prior knowledge is often neglected in the development of mHealth offerings. It is assumed that the user has the necessary knowledge to deal with it (Norman and Skinner, 2006). However, studies indicate that this assumption is not necessarily true. In order to be able to use mHealth services for their own benefit, however, users must have certain skills which are summarized under the term "eHealth Literacy". These include: *"the ability to seek out, find, evaluate and appraise, integrate, and apply what is gained in electronic environments toward solving a health problem"* (Norman and Skinner, 2006). Users must therefore be able to independently search, find, evaluate, and apply health information. The prerequisite for the success of this process is that users can deal with the corresponding technology and the countless sources of information. They must be able to critically question the information and the media they provide in order to form trust (Vervier et al., 2018). Only in this way users can make so-called informed decisions for their own health. In order to be able to develop mHealth services that are tailored to the needs and abilities of users, these abilities must first be surveyed. For this purpose, Norman and Skinner have developed the so-called eHealth Literacy Scale (eHEALS). The scale is based on elements of socio-cognitive learning theory and self-efficacy expectations. It combines six subject areas or basic skills: "traditional literacy, health lit-

eracy, information literacy, scientific literacy, media literacy, [...] computer literacy" (Norman and Skinner, 2006). To understand in what extend health literacy has an impact on the positive attitude on mhealth apps, we considered this phenomenon as an important aspect in our study.

3 RESEARCH METHODOLOGY

This study aims at exploring two perspectives regarding the attitude towards mhealth applications. In a first step insights of people's experience and ideas about functional aspects as well as barriers and motives of mhealth apps are collected qualitatively. In a second step, based on the results of the focus group, all key factors were included in an online survey and operationalized quantitatively. Moreover, dimensions such as personal health attitude implying eHealth literacy and health orientation, online privacy perception, including privacy concerns, as well as the intention to share data and last but not least user attributes (i.e., age, gender) were taken into account in order to understand the attitude towards mhealth applications. This two-way multi-method approach seemed to be the best method to identify, evaluate, and quantify these factors. Two focus groups were run with two different age groups. Based on the results an online survey was designed (see figure 1). The most important research questions leading the investigation were:

1. *Does gender or age have an impact on user's preferences (features, disadvantages, advantages)?*
2. *How strong do personal health attitudes (health orientation and eHealth literacy) and online privacy perception (privacy concerns) as well as the intention to share data explain the positive attitude towards mhealth applications?*
3. *Do further user factors such as age and gender have an additional impact on the positive attitude on mhealth apps?*

3.1 Focus Group Study

The aim of the focus group approach was to identify and discuss young and old adults' ideas of mobile health applications, its usage options, functions, advantages and disadvantages. For this purpose, two successive focus groups were carried out with 11 (8 female and 3 male) participants with an age range from 19-57 ($M = 35.6$ years, $SD = 16.6$) years. The younger group was aged between 19 and 25 years and the older group between 48 and 57 years. In the beginning participants were encouraged to brainstorm about mobile health apps they know or even use. In a free discussion, participants shared their experiences and previous knowledge of mhealth applications. In a further step topics such as functions of health apps as well as motives for use and non-use were discussed and ranked. As main topics privacy concerns, data sharing, and app functions have emerged as key issues in both groups. Older participants stated a stronger privacy concern about their personal data than younger participants.

3.2 Online Survey

To understand which factors influence the attitude toward mhealth applications, we conducted a questionnaire study with 132 participants. The survey data was collected in Germany in summer 2017 via an online questionnaire. Participants took part in the study voluntarily without any compensation. At the beginning of the survey, detailed information was given on the purpose and objective of the study. We also stressed that participants were welcome to express their views on the subject and exchange their opinions openly. Additionally, in accordance with data protection standards in empirical studies, we informed the participants that none of their responses could be traced back to them personally. The survey consisted of four parts starting with user attributes in part one.

User Attributes. We assessed age, gender, and self-rated app experience (*"I consider myself a very experienced user of apps"* to be answered on a 6-point-Likert scale). Moreover, we assessed general usage frequency of health apps (i.e. nutrition app, lifestyle app, fitness app, disease control app, app for medical service) on a 6-point-Likert scale from *never* to *several times a day*. Variables regarding the personal health attitude were assessed in a second part.

Personal Health Attitude. We used the health consciousness scale by Dutta Bergmann (Dutta-Bergman, 2004). The respective items (five of a kind; e.g. *I do everything I can to stay healthy.* or *Living life in best possible health is very important to me.*) were added after having checked the scale reliability (Cronbach's $\alpha = .773$). The data amounted to an AVE of .528. Additionally, we measured eHealth literacy with the eHeals literacy scale by Norman and Skinner (Norman and Skinner, 2006) consisting of 7 items such as *I know how to find helpful health resources on the Internet* among others. Cronbach's alpha for the scale was .93 and the average variance extracted (AVE) was .632.

Privacy Attitude. We used three items adapted by Li (Li et al., 2014) as the online privacy concern scale as e.g., *I am concerned about threats to my personal*

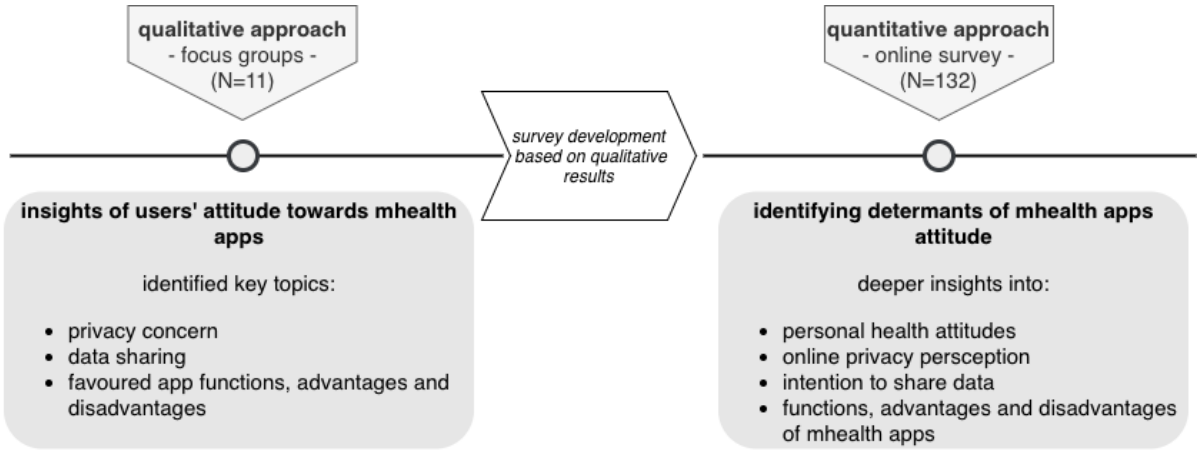

Figure 1: Overview of research process showing both qualitative and quantitative measures to address our research questions.

privacy today. The scale showed a good reliability of Cronbach's $\alpha = .817$ and an AVE of .719.

In the privacy attitude section we additionally added a scale called *intention to share* with 3 items created by the authors. *I am willing to provide my health data to a doctor of my choice.*, *I personally see an advantage in sharing my health data with my physician.* and *By sharing my health data with my physician, a better health care is guaranteed for me.* with Cronbach's α=.843 and AVE=.762.

Attitude Towards Health Apps. Last but not least, the attitude towards mhealth (3 items, developed by authors: *The usage of health apps is fun.*, *The usage of health apps is a good idea.* and *I like the idea of using a health app.*) were measured ($\alpha = .871$; $AVE = .795$). All items in the scales had to be answered on a 6-point-Likert scale from *I do not agree at all* to *I totally agree*. Finally, as generated result from the previous focus group, advantages and disadvantages were also considered in the last part. Participants had to rank the aspects in order of individual importance.

3.3 Statistical Method and Procedures

To understand our data, we used descriptive statistics and report 95%-confidence intervals on all point estimates. When using null-hypothesis-significance testing, we set our level of significance to $\alpha = .05$. In this study we used partial least square structural equation modeling (PLS-SEM) in Smart-PLS 3.0 (Hair Jr et al., 2016) to understand the causal relationship of the antecedents mhealth attitude. The benefit of PLS-SEM lies in the possibility of causal inference in modeling. We report the path-coefficients, the r^2 was adjusted for the predicted variables in the inner model. We designated the significant relationships from the bootstrapping procedure. Cronbach's alpha and the average explained variance as quality measures of our model are reported (see section 3.2 Online Survey). As PLS-SEM is used for exploratory approaches, the following assumption were made: We assume that with increasing age, privacy concerns increase. The opposite we assume with health orientation. It will decrease with increasing age. Female participants will have a higher health orientation and a higher eHealth literacy. We assume the stronger the privacy concerns the lower will be the intention to share data. Moreover, we assume that a higher health orientation and eHealth literacy enhances the positive attitude towards mhealth apps. However, the online privacy perception might influence the positive attitude negatively. Figure 2 portrays the research model and the underlying theoretical framework where the latent constructs are assigned to two thematic topics: personal health attitude and privacy attitude. Personal health attitude includes health consciousness and eHealth literacy. Privacy attitude covers privacy concern and intention to share data. The arrows symbolize the assumed influences among the constructs on the positive attitude towards mHealth apps. Age and gender are depicted underneath the diagram as two factors which might affect the particular constructs in general.

3.4 Sample Description

Our sample consisted of 132 participants who completely answered the online survey from originally 180. 62% were female and 38% were male. The age range was between 18 and 63 years with $M = 35.9$ ($SD = 23.5$, see also Table 1 and Table 2). The sample was divided into age groups (youngest group 18 to 25 years (39%); middle-aged group 26 to 40 years (28%) and older group 41 to 63 years (33%)). The education level was rather high. 39% had completed a high

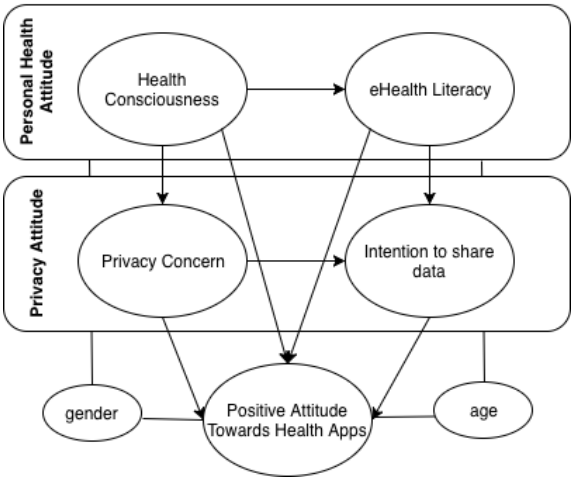

Figure 2: Overview of theoretical framework of our research model.

school degree and 38% held a university certificate, indicating the heterogeneity of the sample's educational level. Most of the participants (30%) allocated their current activity in the commercial area, 29% in a technical area, 14% allocated it to the social field, 8% to a medical field, 8% to an artistically field and 8% to other areas.

Table 1: Demographic characteristics of aggregated sample (N=132).

Demographic characteristics		Percentage
Age	mean (SD)	35.9 (23.5)
	18-25 years	39%
	26-40 years	28%
	41-63 years	33%
Gender	women	62%
	men	38%
Education level	university	38%
	high school degree	39%
	other	23%

Participants rated themselves as rather experienced app users with $M = 4.25$ ($SD = 1.3$; scale from 1 to 6). The experience decreases significantly ($F(2,129) = 17.529, p < .001$) between the youngest and middle age groups ($M_{younger} = 4.86$; $SD_{younger} = 1.05$ / $M_{middle} = 4.38$; $SD_{middle} = 1.29$), but increases significantly with the older participants ($M_{older} = 3.44$; $SD_{older} = 1.16$). When asked about general usage frequency, the participants generally seemed to use few health apps down to none. Fitness-apps ($M = 2.45$; $SD = 1.58$) are still used the most, followed by nutrition ($M = 1.80$; $SD = 1.58$), lifestyle ($M = 1.69$; $SD = 1.18$), medical service ($M = 1.38$; $SD = .69$) and disease control apps ($M = 1.28$; $SD = .91$). In general, the sample constituted a rather healthy group with a health consciousness value of $M = 4.09$ ($SD = 0.9$; 6 points max.). The eHealth literacy level was averagely high with $M = 3.94$ ($SD = 0.93$). In this context, a significant gender ($F(1,112) = 6.37; p = .013$) effect could be detected. Female participants ($M = 4.08$, $SD = 0.80$) rated their competence to evaluate digital health information higher than male participants ($M = 3.68$, $SD = 0.97$) participants.

Table 2: Mean (M) and standard deviation (SD) values of our measured variables.

Variable	M	SD
age	35.90	23.50
app experience	4.25	1.30
usage fitness app	2.45	1.58
nutrition app	1.80	1.58
lifestyle app	1.69	1.18
medical service app	1.38	0.69
disease control app	1.28	0.91
health consciousness	4.09	0.90
eHealth literacy	3.94	0.93
privacy concerns	4.07	1.13
attitude towards mhealth app	3.52	1.13

Participants reported a rather high privacy concern measured at $M = 4.07$ ($SD = 1.13$; 6 points max.). Again, a significant difference in age was observed ($F(1,115) = 13.108; p < .001$). The concern for online privacy in general was significantly stronger among older participants ($M = 4.67$, $SD = 0.93$; 6 points max.) than among younger participants with a mean of $M = 3.56$/6 points ($SD = 0.92$). A similar picture emerged in the personal attitude to share data ($M = 3.84$, $SD = 0.12$; $F(2,107) = 7.439, p < .001$). Young participants ($M = 4.17$, $SD = 0.91$) perceived a significantly higher advantage in this and show a greater willingness to transmit their health data digitally to their physician than older participants ($M = 3.84$, $SD = 1.27$).The attitude towards health apps was averagely high with a mean of $M = 3.52$/6 points ($SD = 1.13$).

4 RESULTS

The presentation of the results is guided by our research questions. We first look at the impact of user diversity towards mHealth before looking for causal explanations. Lastly we include age and gender into our models.

4.1 Impact of User Diversity on Users' Preferences Towards mHealth Apps

In order to identify the importance of specific functions and features of health apps, participants were asked to rank six options which were characterized as central aspects in the focus groups for each preference. As a most important function user-friendly operation was mentioned, followed by support for the development of health awareness, reminder for e.g., eating, information about health topics as well as tracking e.g., steps. On the last place of the ranking, agreement of consultation hours with physicians were mentioned. No age or gender effects could be detected.

Table 3 shows the results of the ranked advantages and disadvantages of health apps. Also in the formation of these rankings, no statistically significant user diversity influences could be detected. So far a very a homogeneous picture emerged when taking user diversity such as age and gender into account when looking at different aspects of preferences.

4.2 Explanation of Attitude Towards mHealth Apps with Personal Health Attitudes and Online Privacy Perception

To find out what determinants influence the attitude towards mhealth apps we used the structural equation modeling using partially-least-squares algorithm. In figure 3 the inner model of positive attitude towards health apps is depicted which we introduced earlier as the theoretical framework of our study (see figure 2) . Due to readability we decided not to present the outer model. The majority of path coefficients for the items reached a value of 0.7, and 0.8 in most cases. Only the health orientation items included two of totally five of a kind with over 0.6 (scale reliability Cronbach's $\alpha = .773$, $AVE = .528$). Path coefficients are written on the arrows which connect the latent constructs. Negative influence is colored red. We identified significant correlations by annotating the test values with asterisks. The adjusted r^2 indicates the extend the variable is influenced by others. At a first sight, the bold arrow shows the main determinant of the latent construct of the positive attitude towards mhealth apps. In the sample eHealth literacy had the biggest positive impact as previously assumed. Participants who are familiar with their smartphones and in general with digital devices and who are able to independently search for and and find health information, evaluate and apply it according to the definition of eHealth literacy. Further, they seem to be open-minded towards mhealth.

Being health conscious also influences the attitude positively, however, by far not as strong. It seems that being interested in leading a healthy life does not include being interested in electronic services which might support the way of life. Looking at the privacy attitude area, privacy concern itself did not influence the positive attitude significantly at all. It had a negative impact on the intention to share data. The higher the personal privacy concerns were the less people were willing to disclose data in the context of mhealth apps. Still, looking at the second latent construct of privacy attitude, the intention to share data correlates positively with the positive attitude towards mhealth apps. To sum up, according to the sample, determinants of the positive attitude of mhealth apps are eHealth literacy and the willingness to pass the required data via an mhealth app.

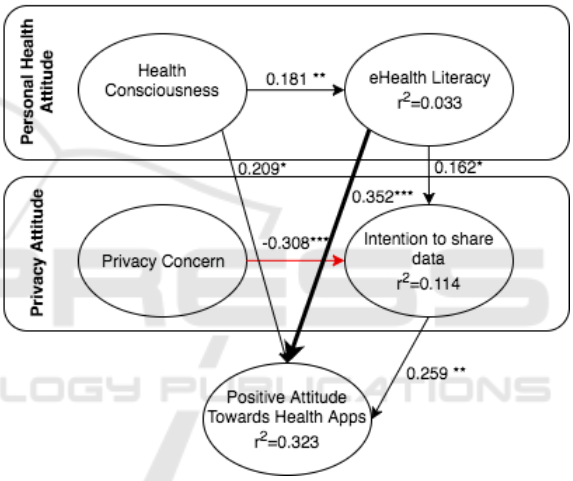

Figure 3: Results of the PLS-SEM Algorithm. Only significant paths (after bootstrapping) are shown. Red arrows indicate negative path coefficients.

4.3 Impact of User Diversity on Antecedents of Attitude Towards mHealth Apps

Taking a deeper look at our data, age and gender had different effects on the investigated model. User diversity played an important role. Starting with gender, the positive attitude is described best by highly health conscious male participants ($\beta = 0.340, p < .05$). Attitude is further significantly influenced by intention to share ($\beta = 0.334, p < .05$). A further negative significant influence was detected between privacy concern and intention to share data ($\beta = -0.328, p < .05$). Looking at the model through the "female glasses" only one significant impact could be found. However, this one was very strong between eHealth literacy and positive

Table 3: Ranking (#) of mHealth app advantages and disadvantages (N=132).

advantages	#	disadvantages	#
constant availability of own health data	1	lack of data protection	1
interesting features	2	monitoring by third party	2
check compatibility of drugs	3	lack of personal contact	3
time saving (medi order)	4	no direct questions possible	4
road-saving	5	constant data collection	5
overview of pharmacy nearby	6	dependence on smartphone	6

attitude with a path coefficient of $\beta = 0.472 (p < .001)$. Age showed effects in the middle-aged and older age group. Similar to female participants, a significant influence was found on eHealth literacy and attitude ($\beta = 0.513, p < .001$), a negative one on privacy concern and intention to share ($\beta = -0.337, p < .005$) and finally on health orientation and eHealth literacy ($\beta = 0.404, p < .001$). The one and only significant influence in the older age group was detected on intention to share and attitude with a path coefficient of $\beta = 0.546 (p < .001)$. To conclude, user diversity such as age and gender play a dominant role regarding the attitude towards mhealth apps.

5 DISCUSSION & GUIDELINES

Discussion. With our paper "Attitude" we wanted to investigate on people's ideas and position relating to the mobile health services or rather health apps. To understand people's needs, preferences and attitudes towards mhealth applications on the one hand and on the other hand to understand the antecedents of people's attitudes towards mhealth applications on a meta-level, we chose a user-centered approach. That way, we could gather more robust results and deal with the research question in detail. In a first step focus groups were run, in which we analyzed users' ideas of mobile health applications, its usage options, functions, advantages and disadvantages.

In a second step, an online questionnaire was sent out in which the results of the focus groups were quantified as well as the attitude of health apps and its antecedents were explored. To do so, we formulated a model with two thematic topics: personal health attitude consisting of two latent constructs, namely health orientation and eHealth literacy. The second topic dealt with privacy attitude, operationalized by online privacy concern and willingness to share data. Last but not least user attributes (age, gender) were taken into account in order to understand the attitude towards mhealth applications.

Users' insights won from the focus group study showed that users favored app features were aspects which improve and facilitate daily health life routines and save time. Thus, arranging appointments via app were highlighted. Also functions, which allow keeping track on and documenting health topics were mentioned. In this respect, our results are consistent with those of Mendiola (Mendiola et al., 2015). The ideas about functions were in line with the current trend of the "quantified self" movement. Moreover, privacy concerns have emerged as important topics. Participants considered good data encryption and the protection of their personal data as very important as well as the desire for a serious provider (Wilkowska and Ziefle, 2012). Besides privacy aspects, simple and user-friendly operations were essential features. In general, participants could see many advantages in using a mhealth apps which could offer an overview of pharmacies and physicians close by. Reminders of different kinds such as a drink reminder were also considered as an important advantage, especially by older participants. Not surprisingly, communication with physicians were mentioned among others. Participants seemed to be very reflected. Among all great features an app could offer, they also were aware of possible negative aspects such as smartphone addiction and the feeling of uncontrolled and unclear data collection. Finally, lack of personal contact as the fear of feeling socially alone were mentioned.

When looking at the outcomes in the questionnaire study, again, it was corroborated that users independent of age or gender attached high importance to the same features, advantages and disadvantages as discussed above and also portrayed in table 3. Interestingly, that the advantage of having a constant overview about own health data goes hand in hand with the disadvantage of perceived lack of data protection. As assumed the topic of the so called *privacy calculus* (Li et al., 2014) appears in the context of mhealth app usage. It seems that the appreciated features of mhealth apps might outweigh the perceived risk (data protection and privacy) as long as the advantages of facilitating daily life and saving time are predominant as well as user can trust the provider.

In our study we also tried to shed light on the antecedents of a positive attitude towards mhealth apps.

In advance, we prepared assumptions based on literature but also on the results of the focus groups. We could make note that with increasing age, privacy concerns increase as well. The results of the focus group already gave a hint, that older people are more concerned about their online privacy. The results are consistent with other studies on the subject as e.g., Zeissig et al. (Zeissig et al., 2017). No significant results could be found according to the assumption that health orientation rises up with decreasing age. That might be due to the fact that the sample in general represented a rather healthy one. Another reason might be attributable to the lower validity of items as described in the research methodology. The assumption that female participants will have a higher health orientation and a higher eHealth literacy could empirically be proven at least for eHealth literacy. The model showed that females eHealth literacy had the biggest influence on the positive attitude towards mhealth apps. In other words, in our study, women in general were more familiar with the usage of digital devices and the health topic. We also learned from this study, that the extent of privacy concerns represented the biggest motive or barrier in the same way for the willingness to share data.

Guidelines. Our findings show needs and preferences of participants who are rather healthy and could imagine a mhealth app for lifestyle reasons. Therefore, our ideas will give guidance to developers of lifestyle health apps. In general, mhealth apps should offer a user-friendly operation. As people are becoming more interested in taking an active role in their own health care, features which improve and facilitate daily health life routines, save time are appreciated most. The challenge however occurs right here, where appreciated functions by users collide with individual privacy concerns and data protection worries. At this point, mhealth app providers must assure and be able to let the user use the app with all security and encryption possibilities of the users sensitive data which are on the highest standard. As we learned from the study, privacy concern influences the willingness to share data negatively. In other words, as long as the privacy concern can be taken by offering highly secured mhealth apps, the intention to share data will rise. Thus, people will benefit from a better personalized service according to their needs. Moreover, being eHealth literate increased the positive attitude and thus possible usage of a mhealth app enormously. Implementing learning opportunities in a mhealth app for improving and keeping one owns health behaviour skills up-to-date would be an interesting further feature.

6 LIMITATION & FUTURE RESEARCH

As studies always need to fit time and content framework conditions, there are limitations that occur naturally. Since the study was conducted in the authors and students surrounding at a university, a rather technically affine sample was measured. Future studies have to focus on conducting more representative studies as well as bigger samples to make representative statements. Moreover, different cultural aspects of different countries might deliver interesting results. So far, this study aimed at gaining general attitudes towards mhealth applications. At this point it would be of interest to develop a possible mhealth app and evaluate it with e.g., the unified theory of acceptance and use of technology model (UTAUT) in the health care sector (Slade et al., 2013). That way the intention of using such a mhealth app could be explored more in detail. As the phenomenon of eHealth literacy occurred to be a very important result in our study it is important to pay close attention to this topic. In this study, we entered the validated item scale by Norman and Skinner (Norman and Skinner, 2006) who can be seen as the pioneers of the first eHealth literacy model. However, in course of time different theoretical approaches have been made, regarding current digital standards (Griebel et al., 2018) who also questioned Norman and Skinner's approach according to its lack of usage context and the missing fit with interactive Web 2.0 contents. The digital health literacy instrument (DHLI) by Rosalie van der Vaart for instance represents a new approach with a validated item battery which operationalizes seven different constructs such as operational skills, navigational skills, information searching, evaluation reliability, determining relevance, adding content, and protecting privacy (van der Vaart and Drossaert, 2017). Another interesting and validated model which should be considered in a further empirical investigation with the same research question is the e-HLS Instrument by Secking (Seçkin et al., 2016) who takes a three factor solution into account (behavioral, communicational and attitudinal components of health literacy). With the decision and usage for one of the current theory approaches, a gold standard could also be set as a side effect which is still missing in the research of eHealth literacy. A further future research idea would be to subject the same research question to a sample with sick people. Additionally, needs and preferences should also be explored for people who need to use such an app for medical or more severe healthy reasons in form of monitoring their health. Questions which occur especially in an individual usage context of health monitoring could

be the way of personalization of health information in the conflict situation of personalization preferences and privacy concerns (Calero Valdez and Ziefle, 2019). The research field of mhealth apps, eHealth literacy and privacy concerns in the healthcare context is still wild and huge and offers many empirical research opportunities which need to be seized.

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