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What Impact Do Current Health App Notifications Have on User Experience, Particularly Concerning Emotional Responses?

Vilken inverkan har hälsoapp notiser på användarupplevelsen, särskild när det gäller känslomässig respons?

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Sammanfattning

Mobila hälsoappar spelar en viktig roll i modern hälsoutveckling där påminnelser, i form av push-notiser, har varit en nyckelfunktion för att säkerställa motivation och ihållande framsteg. Ett noggrant övervägande av alla aspekter av notisdesign är dock avgörande för att säkerställa hälsosamt användarengagemang och en bra upplevelse. En av dessa aspekter är användarnas känslomässiga respons på aktuell notisdesign.

Den här studien undersöker effekten av notiser från hälsoappar på användarnas känslomässiga reaktioner, för att fungera som en vägledning för utvecklare inom detta område. Kvantitativa och kvalitativa data samlades in, genom att använda en enkätundersökning och djupintervjuer, för att förstå användarnas uppfattningar och känslor för notiser från hälsoappar.

Resultaten visade att ett stort antal användare upplever negativa känslor från notiser, där det dominerande resonemanget var bristande möjligheter att skräddarsy sådant som aviseringsfrekvens och innehåll. Dessutom, när meddelanden i notiser inte engagerar användare, provocerar de fram negativa känslomässiga reaktioner som, skuld och frustration. Ett mönster ses i intervjuresultatet, där de som får aviseringar för ofta också är de som upplever negativa känslor och inte engagerar/följer notiser.

Dessutom nämnde de att innehållet i notiser är irriterande, ibland överväldigande, påträngande, befallande och krävande. De som får färre eller anpassande notiser upplever positiva känslor och engagerar sig mer, samtidigt som de talar positivt om notisinnehåll. För vissa användare gör stressen som orsakas av aviseringar att de vidtar åtgärder direkt, vilket visar på ett ohälsosamt engagemang i vissa fall.

Rekommendationer som följer av denna studies resultat inkluderar att ändra tonen i notismeddelanden, ge fler möjligheter till detaljerad anpassning och integrera feedbacksystem i hälsoapparna. Studien bidrar inte bara till utveckling av hälsoappar utan även till hälsan hos dess användare, vilket är det första och främsta syftet med hälsoappar.

Abstract

Mobile health apps play a vital role in modern health progress, where reminders, in the form of push notifications, have been a key feature in ensuring motivation and ongoing progress. However, a careful consideration of all aspects of notification design is crucial in ensuring healthy user engagement and a good experience. One of these aspects being the users' emotional response from current notification designs. This study investigates the impact of health app notifications on users' emotional responses, to act as a guidance for developers in this field. Quantitative and qualitative data was collected to understand users' perceptions and feelings towards health app notifications, through the use of a survey and interviews.

Findings revealed that a great number of users experience negative emotions from notifications, where the predominant reasoning is lack of tailoring in areas of notification frequency and content. In addition, when notifications fail to engage users, they provoke a negative emotional response such as guilt and frustration. A pattern is seen in interview results, where those that receive notifications too often are also those that experience negative emotions and don't engage/follow notifications.

In addition, they mentioned that the content within the notifications are annoying, sometimes overwhelming, pushy, commanding and demanding. Those that receive less or customized notifications experience positive emotions and engage more, while also talking positively of notification content. For some users, the stress caused by notifications makes them take action right away, which shows an unhealthy engagement in some cases.

Recommendations following this study's results include changing the tone of notification messages, providing more opportunities for detailed tailoring, and integrating feedback systems within the apps. The study contributes not only to the development of health apps but also the health of its users, which is the first and foremost aim of health apps.

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1. Introduction

Smartphones have undoubtedly become one of the most widely used devices worldwide. Their continuous technological advancements have resulted in the adoption of different types of applications at an increasing rate. A multitude of such applications include health apps (Bravo et al., 2018).

Health apps, as their name suggests, are software applications available on mobile devices, more specifically smartphones, which provide wellness and health-based services. These include losing weight, quitting smoking, managing diabetes, and selfdiagnosis, and are available at all times. Health apps are also used for chronic diseases where patients need constant monitoring to ensure health safety (Mohammed and Hasan, 2023: IQVIA, 2021).

The developments in IoT have made it possible for a patient's status to be monitored wirelessly in real-time and over great distances, allowing doctors to not only view a patient's historical data but also view current data that indicate an emergency or alert (Mohammed and Hasan, 2023).

One of the main factors that make health apps successful is their capability to provide reminders and alerts that build certain habits toward behavioral goals and provide health monitoring (Akbar, Coiera, and Magrabi, 2019: Woodward et al., 2021).

Prompting can appear in any form, some of which include SMS (Short Message Service) messaging, phone calls, emails, and notifications, where the strategy most commonly used for smartphones is notifications, more specifically push notifications (Bidargaddi et al., 2018). Notifications are delivered through applications and inform app users about specific information which include alerts, updates, and reminders (Woodward et al., 2021). Figure 1 shows one example of what a notification can look like.

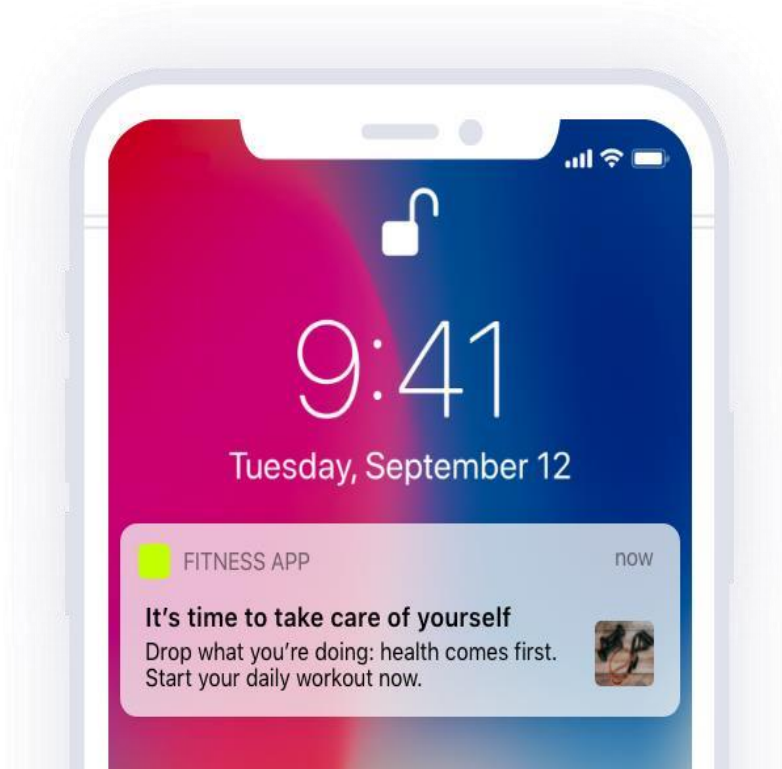


Figure 1: An example of a push notification generated from a fitness app (Barbagallo, 2021)

Push notifications not only remind the user about achieving behavioral changes but can also help save lives for patients with chronic diseases. This is done by sending an emergency alert to the patients, their doctors, and relatives (Mohammed and Hasan, 2023). Figure 2 shows how such notification is generated and displayed on mobile devices, where health parameters such as heart rate, oxygen saturation, and body temperature are displayed.

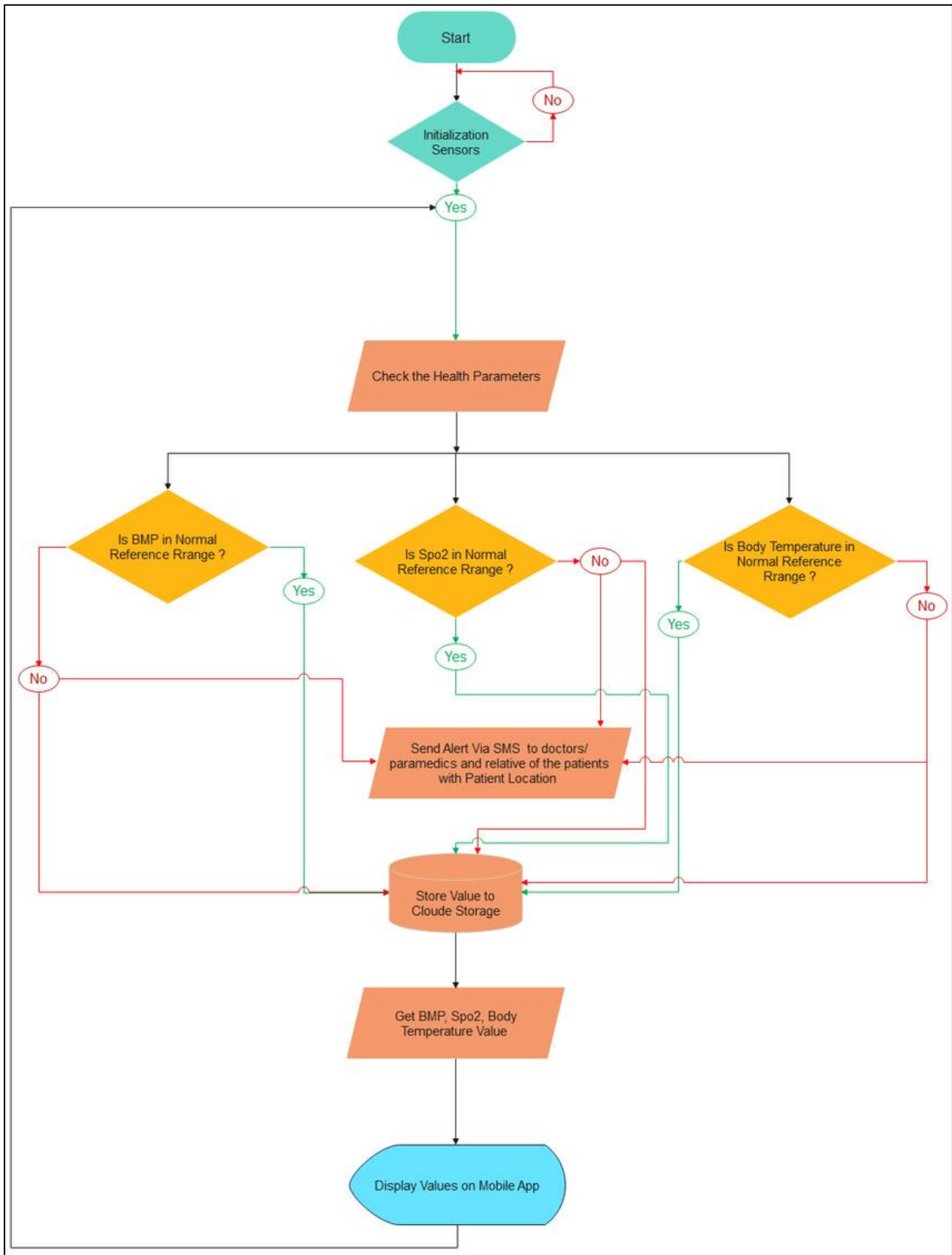


Figure 2: A flowchart showing how a patient's health status is communicated via notifications (Mohammed and Hasan, 2023).

Although health apps have increased dramatically and are seen as a promising situation for better health progress, engaging users is still a challenge that has been studied many times, however, it has not been solved yet (Bidargaddi et al., 2018). Since notifications carry important information and potentially can help in successfully engaging users, their optimal functioning is vital in ensuring the health app's effectiveness (Bidargaddi et al., 2018). When it comes to apps outside of the health category, studies mostly deal with notifications as distractors and hence investigate ways to reduce them. This is quite the opposite of how notifications are defined in the health category, due to the fact that the main objective of health apps is to ensure user commitment on achieving health goals (Woodward et al., 2021).

Health app developers face an additional burden due to the ethical aspects related to users' health information, which is deemed very sensitive for both individuals and the law. Due to its sensitivity, developers need to follow protection regulations such as the General Data Protection Regulation (GDPR) law in the EU. This applies to all health apps whose users are from the EU (Papageorgiou et al., 2018). These data protection regulations in turn affect how notifications are designed by setting certain boundaries, potentially affecting engagement factors as well.

Health apps currently lack sufficient personal information from users and thus cannot provide personalized and tailored information (Peng et al., 2016; Woodward et al., 2021). Tailoring is a vital factor in notifications as it eliminates the expectation that all users should behave in one way in order to be defined as "healthy". The lack of tailoring could result in unrealistic productivity and demotivation when it is not personalized to each user (Bidargaddi et al., 2018), where negative feelings can be generated from demotivation that further hinder the achievement of a healthy life. This is especially true for people that already suffer from a particular disease, such as Celiac disease, where demotivation has a direct relationship with anxiety, depression and physical functioning (Barberis, Quattropani and Cuzzocrea, 2019).

Investigating users' feelings and emotions associated with health app notifications will aid in a better UI design and help understand whether health apps are actually effective, since emotions play a big role in a positive health progress (Ryff and Singer, 2023, pp. 1083-1104). Hence why this study investigates the emotional responses from health-related notifications.

However, this study does not address medical apps that send notifications to doctors and nurses regarding their patients, as part of their healthcare service. The term "users" in this thesis describes people who download apps voluntarily for the purpose of their health improvement in the areas of workout, diet, and meditation.

2. Previous Research

This chapter presents previous research conducted in this field and motivates the need for this study to take place. In addition, it defines the problem that needs to be solved through a problem formulation section.

2.1 Background

As of 2024, more than 350,00 health apps exist and are substantially increasing, where an average of more than 250 apps are added to the market per day. One reason health apps increased dramatically and have still been on the rise was the widespread of COVID-19 starting in 2019, when the pandemic forced people to take care of their own health due to quarantine and increased demand on healthcare centers. Although a majority of health apps deal with overall wellness such as fitness programs and healthy diets, disease-specific apps have dramatically increased in a short period of time. These include apps for diabetes, mental health/behavioral disorders, and cardiovascular diseases. Although COVID-19 is mostly under control now, health apps still continue to increase as they've shown the potential to reduce costs for both patients and healthcare systems, save time by reducing the number of visits and reduce the use of healthcare resources (IQVIA, 2021; Bravo et al., 2018).

Health apps have also been shown to be a promising solution for the increased number of the global population. It's estimated that the number of people aged 65 and older will hit 1.5 billion by 2050, which will pose a high demand on healthcare systems and resources. Health apps will have the potential to alleviate this demand by ensuring user improvement and monitoring without in real-life visits to healthcare facilities (Bravo et al., 2018).

However, health apps need to ensure user engagement and workout habits productivity (in terms of using the app actively and not just visiting the app without doing anything about it in real life) to be successful and safe (Woodward et al., 2021). As Chiauzzi and Newell (2019) point out, people mostly use mobile apps for entertainment and social connections instead of more serious aspects such as diseases and behavioral change purposes, thus keeping them engaged to more serious and less entertaining tasks on mobile apps can be difficult and will rely heavily on user interface design and specific details.

One of these important features to be optimized is notifications, as they are considered key engagement functionalities that act as reminders in health apps (Akbar, Coiera, and Magrabi, 2019; Woodward et al., 2021; Bidargaddi et al., 2018).

Notification optimization is not only essential in helping users stay engaged and achieve their health goals but also ensures that users don't spend more time on their smartphones because of the notifications (Woodward et al., 2021).

One design area that is yet to be improved is notification tailoring (Woodward et al., 2021). Health apps currently lack sufficient personal information from users and thus cannot provide personalized communication and notifications (Peng et al., 2016; Woodward et al., 2021). Woodward et al., (2021) also show and conclude that health apps have not followed recommendations for notifications design in areas of tailoring, occurrence, and frequency. This has a great potential to lower user engagement, where Chiauzzi and Newell (2019) show that approximately 23% of users stop using health apps after one session. The reason why tailoring plays a huge role is because personalized information is seen as more personally pertinent and thus serves as a primary motivator to process information (Bidargaddi et al., 2018).

Tailoring is also a vital factor in eliminating the expectation that all users should not behave in one way in order to be defined as “healthy”. Health apps should not pressure users into following general and uniform health-related tasks as it can lead to undesirable societal impact (Dural and Kohls, 2017). This is because every user is different and has a different starting point as well as a health profile. Therefore, notifications could result in unrealistic productivity and demotivation when it is not personalized to each user (Bidargaddi et al., 2018).

Since a lack of notification tailoring can result in demotivation (Bidargaddi et al., 2018), unwanted negative feelings can be generated from demotivation that further hinders the achievement of a healthy life. This is especially true for people who already suffer from a particular disease such as Celiac disease (Barbies, Quattropani, and Cuzzocrea, 2019). Barbies, Quattropani, and Cuzzocrea (2019) investigated the relationship between motivation and specified factors which include anxiety, depression, and physical functioning. Results show that motivation has a direct relationship with anxiety, depression, and physical functioning (Barbies, Quattropani and Cuzzocrea, 2019).

Investigating users’ feelings and emotions associated with health app notifications will aid in a better UI design and help understand whether health apps are actually effective. since emotions play a big role in positive health progress (Ryff and Singer 2003, pp. 1083-1104). For instance, being anxious negatively affects exercise performance, shortness of breath, and overall quality of life for people with Emphysema (Giardino et al., 2010).

Edwards et al., (2018) also conclude that the strength of the immune response after exercise is greatly influenced by the amount of anxiety and psychological stress present before exercising. The last thing healthcare professionals and patients would want is to experience negative consequences from health apps both mentally and physically. It is vital to not only improve user engagement in terms of health app usage but also in terms of user experience acting as a measure of engagement. Hence why

this study aims to explore how users feel about current notification designs, which is crucial for positive and successful health progress via health apps.

2.2 Problem Formulation

There is a gap in the available literature on how user experience, more specifically the emotional response, is affected by current health app notifications. As Woodward et al. (2021) showed, the majority of health apps have not followed recommendations for notification design in various important areas such as tailoring. But what impacts, if any, do the current notification deficiencies have on users' emotional responses and experience?

As put forward in the background, a negative user experience can be detrimental to the users' health progress as they already either suffer from inadequate health or aim to build new habits which require extensive effort. Hence why the emotional response generated from notifications needs to be positive to increase engagement. However, to ensure whether the emotional response is positive or not, a study is required to investigate user experience regarding health app notifications. This thesis conducts this study to fill the gap available in the literature and help developers take more detailed guidelines into consideration.

Studies mostly focus on improving health apps in terms of engagement. More specifically, they focus on how notifications can increase app usage through increased engagement. Some of these studies include; Woodward et al. (2021), which examined whether notifications from health apps follow design recommendations from previous work through a quantitative approach, Muench and Baumel (2017) examine the tailoring components of digital triggers such as text messages and notifications when it comes to behavior change. Their aim was to provide developers with a guideline on how to tailor these components. Nahum-Shani et al. (2017) describe Just-in-Time Adaptive Interventions (JITAs) as key components and vital design principles for health behavior support. Schulze and Groh (2016) explore different types of conversations that help manage notifications on smartphones and increase engagement. Morrison et al. (2017) examined the impact timing and frequency have on notification response via the app Healthy Mind, a stress management health app, through a mixed-method approach.

Very few studies have investigated push notification designs that motivate users, hence specifically dealing with the improvement of users' emotional responses. One such study is conducted by Bidargaddi et al. (2018) which analyses which type of pushnotifications, in terms of content, will motivate users for a self-monitoring app. However, Bidargaddi et al. (2018) only focused on one self-monitoring health app called JOOL. In addition, the study was quantitative, where engagement was defined by metrics such as number of times monitoring was done, the time lapsed since recent app use and number of times app was used (which in this case was the number of

times the app was opened). Hence motivation was defined by users' measured interactions with the app.

However, to best understand what motivates users, one must first analyse what users experience emotionally when seeing a push-notification, and then analyse what type of notification design motivates them in regards to these emotional responses. This is because different emotional responses from different kinds of health apps require different designs to motivate users (Eislander and Tanaka, 2013). In other words, to optimize notification tailoring and increase engagement, users' unique emotional responses need to be known. This is especially important to be done for various health apps and not just one specific health app to get a clearer understanding of the bigger picture and condition of current health app notifications.

Studies have mostly examined notification design optimization based on the user's activity but have disregarded its optimization based on the user's emotional response, and this study investigates and aims to contribute knowledge in the field of app notifications based on the emotional response, which is crucial in ensuring a successful health progress and not just a successful app.

Hence, the specific research question asked in this study is the following: *what impact do current health app notifications have on user experience, particularly concerning emotional responses?*

This study answers the aforementioned researched question by examining the most commonly used apps, namely workout, dieting and meditation apps. Push-notifications that act as reminders are focused on with regards to users' emotional response. In addition, those that download health apps voluntarily for the purpose of improving their health are defined in this thesis as "users".

Answering the formulated research question will provide valuable insights on user experience, engagement and the effectiveness of health apps in meeting their purpose. Understanding how current health app notifications impact users emotionally will allow developers to prioritize user well-being and minimize potential negative effects such as stress or anxiety, leading to an improved health as emotions play a big role in a positive health progress.

3. Research Design

This chapter presents the research design implemented to investigate the study's research question. It explains the methodology, ethical considerations, study's boundaries as well as a detailed survey and interview design description.

3.1 Methods

This study follows the mixed method approach in both quantitative and qualitative forms. This means that three data collection methods are used, which are surveys and interviews. The survey will provide both qualitative and quantitative data whereas interviews will provide qualitative data. The reason why a mixed method approach; i.e. qualitative and quantitative, is adapted to this study is to provide comprehensive and thorough results to better aid in optimizing notification design.

Quantitative methodologies deal with specific variables and parameters rather than the situation as a whole, they focus on quantifying results to help in detailed policy formulation and effective decision-making that do not appear vague. Qualitative methodologies on the other hand mainly deal with describing a situation, which in this case is done by gathering users' opinions and feelings about push notifications from health apps. Hence why it is important to include both quantitative and qualitative approaches (Kumar, 2011).

As mentioned earlier, primary data is gathered through both surveys and interviews. Surveys are implemented in the form of closed-ended questions to help quantify results and analyse certain parameters in detail. While interviews are implemented in the form of open-ended questions to understand users' perceptions and give them the space to answer freely. Figure 3 shows a flowchart clarifying the steps taken in collecting data.

This study also follows an applied exploratory approach when it comes to the applications and objectives perspectives. *Exploratory* means that the study has an investigative nature, and *applied* means that the study will apply known research methods (such as surveys) to answer the research questions (Kumar, 2011).

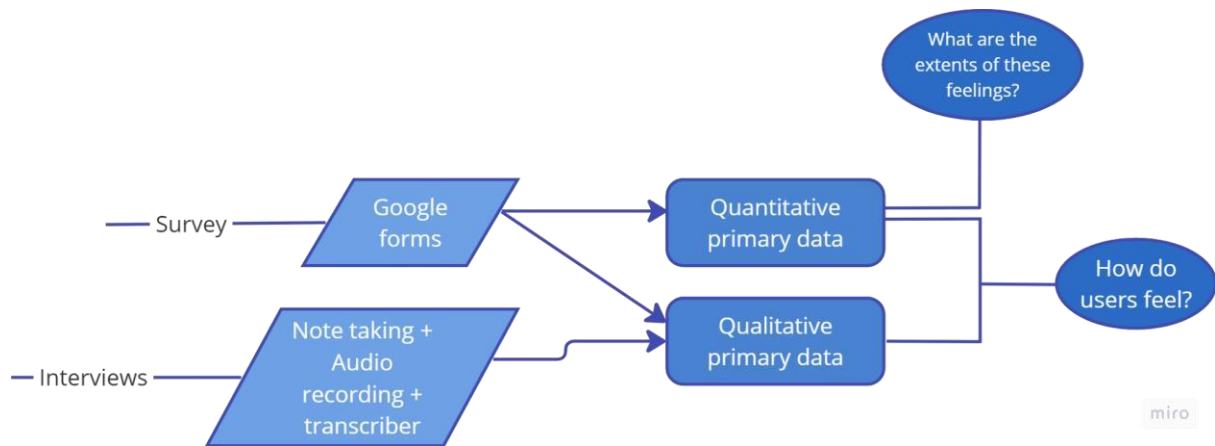


Figure 3: A flow chart summarizing the study's methodology.

As shown in Figure 3, the initial lines represent the methods chosen for this study which are interviews and a survey. The parallelograms represent the tools used to obtain data. Google Forms was chosen as the platform to collect survey results while audio recording, note-taking, and a transcriber were used to collect interview results. As previously mentioned, a survey was used in the form of both close-ended questions (95%) to obtain quantitative data and one open-ended question (5%), while interviews were used in the form of open-ended, semi-structured questions to obtain qualitative data, hence the round edged rectangles represent the types of data achieved.

Both quantitative and qualitative primary data will help us understand how users feel about push-notifications acting as reminders. In addition, quantitative data provide numerical values representing the strength of these feelings, to better understand the extent of this situation. Hence the oval shapes represent the results obtained.

3.1.1 Study Boundaries

The system boundaries and/or criteria for the apps that have been examined are health apps that help users reach their goals with the help of an app, which can be workout apps, meditation apps, or dieting apps. The types of notifications examined are pushnotifications, more specifically, push-notifications that act as reminders for the purpose of initiating an activity or task completion. The system boundary also serves as a criteria for the section of interviewees in this study.

It is important to note that there are also apps that function only as reminders, which are apps that remind users to for instance take their medicine in time, check fever, ... etc. There are also apps which are not health based but include certain features that can help form positive health-based habits, such as Spotify. For instance, meditation channels help exist on Spotify where you can listen to calming music as a way of relaxing and practicing meditation. These apps do not fill the boundaries of this study and are hence not part of the criteria used to collect data.

More specifically, when it comes to data collection, the most commonly used and most studied health apps are focused on. This is to ensure high-quality data and understanding from the literature review. Furthermore, it is to provide in-depth results as well as not get lost in too general results, while also ensuring the majority of users are covered. After doing a preliminary literature research on health apps, workout, dieting and meditation apps were the most commonly studied and used, hence why these three health apps are examined (VonHoltz et al., 2015).

In addition to that, interviewees were mostly using these three health apps, thus confirming that workouts, dieting, and meditation are the most commonly used.

In this thesis, the term “users” refers to patients or common people that download health apps voluntarily. It does not refer to healthcare professionals such as doctors or nurses that need to use certain health apps for their work.

3.1.2 Research Ethics

When it comes to research ethics, a consent form was created for interviewees before going through the interview process. This is to make clear to participants how their data will be handled and what to expect from the interview. The consent form made clear the following points:

- The interview will focus on interviewees thoughts and opinions about health app notifications.
- The interview is not based on general thoughts and opinions on every health app but rather on the health app the interviewee uses and their personal experience.
- The gathered data will be shown in this study. In addition, it will be presented for classmates, supervisors, professors, and others on the thesis defence day at Malmö University. Furthermore, it will be used for the course called Data and Information Technology within User Experience Design, Spring 2024, 15 credits.
- From the data provided by the interviewees, only the parts relevant to the study and deemed crucial for the author will be used.
- The interview will be audio recorded and transcribed. Only the author will listen to and transcribe the audio.
- The personal information recorded will be handled confidentially.
- The interviewee will be anonymous both in the thesis report and presentation on the thesis defence day.
- The interviewee has the freedom to ask questions and end the interview at any time they please.

As for the survey, it was made clear that the answers are anonymous. In addition, questions that deal with personal information did not have an asterisk and were hence not obligatory to be answered. This is to give participants the freedom to choose whether they are comfortable with sharing personal information or not, such as their age.

According to the Association for Computing Machinery (ACM) (2018) general ethical principles, it is an obligation for computing professionals to first and foremost serve society in terms of social and environmental sustainability. That principle has been the core mindset included in all parts of this study, from researching this topic and formalizing the problem available, to the actual handling of data and the interactions with participants.

With health app usage being on the rise and with more advanced health apps entering the market as discussed in Section 2.1, this study contributes to society by investigating some of the still potentially available negative implications associated with notifications from health apps, which can hinder both mental and physical progress. Thus, this study directly contributes to human health and the general ethical principles of 1.1 and 1.2 (Association for Computing Machinery (ACM), 2018).

Filling in a part of the gap available in the current literature regarding health apps, documenting the results in an honest and transparent manner, studying the society as a whole no matter what the race, gender, age, ethnicity, nationality, religion...etc, treating sensitive data confidentially, discussing possible limitations, and elaborating on the ethical code all leads to the consideration and implementation of the four codes discussed in ethical codes from Association for Computing Machinery (ACM) (2018).

3.2 Survey Design

A questionnaire was constructed from 19 questions, 18 of which were close-ended and one open-ended question to provide participants with some degree of freedom when it comes to stating their opinions on notification improvement. This means that the survey provided both quantitative data from the 18 questions (95%) and qualitative data from the last question (5%).

Out of the 19 questions, 3 were related to the participants' background and personal information, which included age, occupation and type of health app used. The rest were related to how participants feel about notifications in the aspects of interface, feelings generated, potential impact (both positive and negative), frequency, tailoring, and overall suggestions. The detailed questions within the survey form can be found in Section 8. A.

The chosen language for the survey design was English to cover a wider audience due to most health apps in the App Store and Google Play being in English (GrauCorral et

al., 2020). In addition, Google Forms was used as the tool to collect respondents' insights, which was published on Malmö's university Facebook page, the author's Facebook page and a Facebook page called "Träning, kost och hälsa" which translates to "exercise, diet and health". Direct contact was also made with people who engage in health apps.

The base of the survey questions was inspired by Biduski et al. (2020) but were made more specific and tailored to this study. These questions have been tested before and used by many authors in the field as they're proven to work in terms of giving credible responses. In addition, the author is well known and an expert in the field.

Furthermore, the different emotions selected as part of the analysis were inspired by previous studies as well as Biduski et al. (2020) questions.

The study aimed to survey and interview as many people as possible, but when data saturation was reached (the point where the same answers were given over and over again and nothing new was added) that's when the data collection phase ended, the number of participants and interviewees was determined.

3.2.1 Interview Design

The selection of interviewees was done as per the criteria set for this study regarding health apps, which as explained in the literature review, need to be apps that help users reach their health goals such as workout apps, meditation apps, or dieting apps. The type of notifications examined need to be push-notifications, more specifically, push-notifications that act as reminders for the purpose of initiating an activity or task completion.

Apps that solely function as reminders and are not health apps have not been selected. To summarize, the people interviewed were those who used a health app voluntarily for the purpose of improving their health, which was done for all ages, genders, backgrounds... etc. to reach a wider audience and cover different parts of the society. The interviews were prepared in a semi-structured design as the aim for the interview is to understand user behavior rather than measure it in certain boundaries. Understanding user behavior in a clear, open manner requires follow up questions from interviewees' responses, hence why the interviews were designed in a semi-structured approach.

As for the structured part of the interviews, a total of 16 questions were prepared which covered areas of opinion on the health app used, notification frequency, tailoring, engagement, progress made, notification content and feelings associated with notifications. In addition, the last question provided more freedom by asking if the

interviewee has something to add or elaborate on in terms of app improvement. A total of 10 participants were interviewed which fit the criteria set for the study.

The core of the interview questions has been derived from Patton (2015), to again, increase the credibility of the responses and make it useful for future studies. In addition, the author is well-known and established in the field and his questions have been tested before and are used by other authors. Hence his questions were used to ensure quality in the data collection.

4. Results and Analysis

This chapter presents the results of the study which are presented in two distinct sections. The first dedicated to survey results and the second dedicated to interview results. The survey results provide quantitative analysis while interview results provide qualitative analysis and overall patterns.

4.1 Survey Results

The questionnaire attracted 32 respondents, of which 78% are employees, 12,5% are students and 9% are both studying and working. Out of the 32 total respondents, 19,5% were aged between 17-25, 45,2% were aged between 26-45 and 35% were aged between 46-65. The survey results proved that workout, meditation and diet apps are the most widely used. Results showed that 56% of participants use workout apps, 19% use diet apps, and more than 6% use meditation apps. The remaining 19% participants use other health apps which include steps taken, menstruation tracker and heart rate measurement.

Overall, participants showed that health apps are mostly easy to use and that their notifications help maintain consistency. 59,5% answered that health app interfaces are easy to use, 34,5% said they are somewhat easy, and 6% answered not so easy. When it comes to consistency with health-related activities, 65% of the participants find notifications from health apps helpful in maintaining consistency. However, 34,5% never or rarely find them helpful. In addition, almost half of the participants think that notifications help them reach their health goals whereas 39% don't think so and 12% are not sure.

Although the overall general perception on health apps and their notifications seem positive, a great number of participants undergo a negative emotional response and disengagement. To be more specific, 28,5% of participants said they feel stressed when receiving notifications from health apps, 3% feel anxious 3% feel irritated, and 3% feel annoyed, whereas 28% feel motivated, 9,5% feel energized and 25% are neutral (neutral also includes those that answered we ignore it, don't feel anything, and neutral). See Figure 4. When categorizing these emotions into positive, which include the feelings motivated and energized, and negative which include stressed, anxious, irritated and annoyed, it is seen that 37,5% of participants have a positive emotional response, 37,5% have a negative emotional response and 25% are not affected. This is also shown to be approximately in line with the answers given regarding whether notifications influence mood and emotions positively, negatively or not at all. 37,5% of participants answered that notifications influence mood and emotions positively, 31,5% answered it as negatively and 31,5% answered it as no influence.

Feelings Associated with Health App Notifications

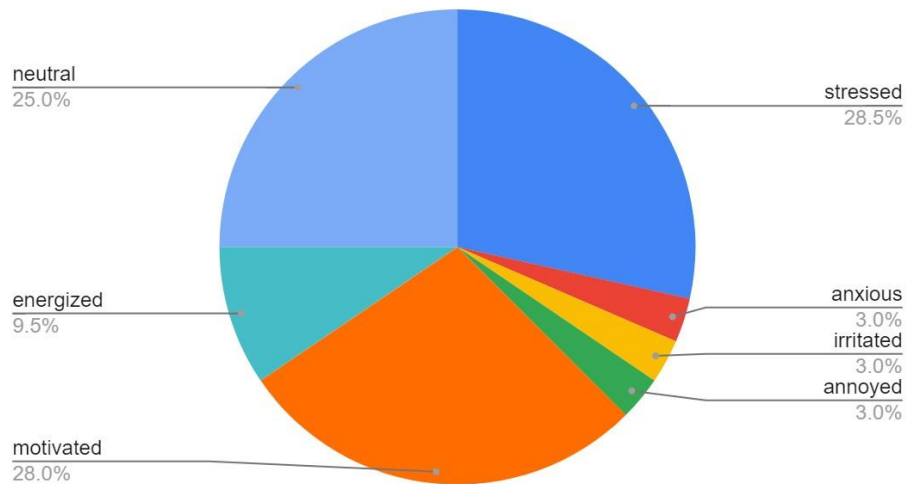


Figure 4: Pie chart showing the strength of emotions felt when receiving notifications from health apps

When focusing on stress, the percentage of a negative emotional response increases, where 50% have experienced stress or negative emotions, 47% of participants have never experienced stress or negative emotions and 3% said they shut them down.

When it comes to translating these emotions into actions, the negative effect becomes bigger, where results show that notifications are not effective in engaging users and motivating them to take action. 53% of participants never or rarely take action, 37,5% of participants do it later and only 9,5% take action right away. However, it is not apparent whether the 9,5% that take action right away are the same users that feel positive or negative emotions from notifications. If it's mostly users that feel positive emotions, then it shows a sustainable engagement, if it's mostly users that feel negative emotions, then it shows that a mentally unhealthy engagement exists.

Another possible reason why more than 50% of participants never or rarely take action can be due to the overwhelmingness caused by notification frequency, which is a feeling of overburden from tasks or emotions and becomes too much to handle for the user. About 47% of participants said they feel overwhelmed by the number of notifications, whereas 53% never or rarely feel overwhelmed. This overwhelming response may not only come from the number of notifications but also the notification frequency, because according to participant answers, only 22% receive notifications multiple times a day whereas the rest, 78%, receive notifications once a day, several times a week, once a week or less than once a week. See Figure 5 for detailed results.

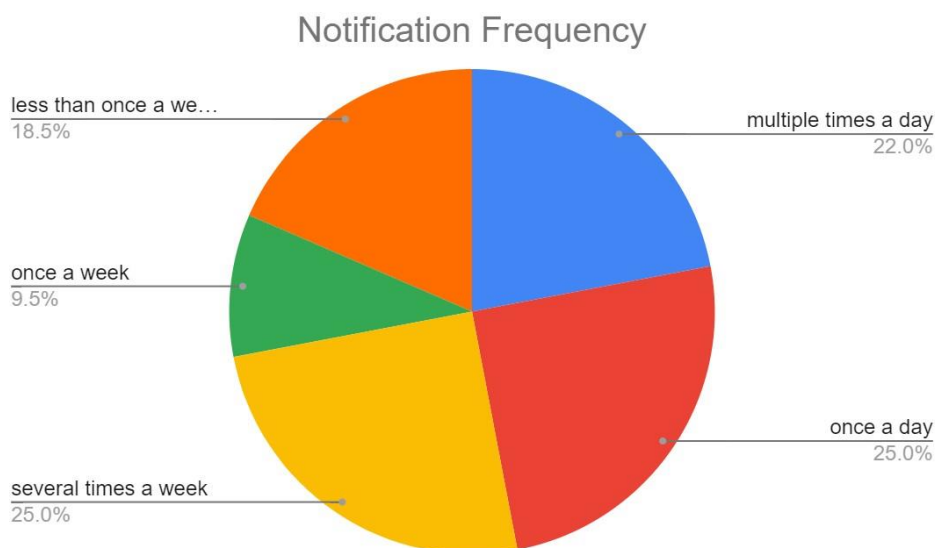


Figure 5: Pie chart showing the notification frequency from health apps.

In addition, most of the suggestions made on improving the effectiveness and impact of notifications were related to notification content and tailoring. Of the 17 suggestions made, about 65% specifically mentioned the speech content and personalization. Some of the comments made were the following:

“The tone of the notification speech could be improved by maybe making it more thoughtful and personalized”

“Creative notifications, like including humor etc can improve a person's approach towards it...must reduce being like an alarm”

“It would be good to add why I should start a workout or meditate. “Catchy words” to get me going immediately”.

“It's a difficult subject, but if there is a way to remove the guilt and pressure of the apps, keeping them motivational...”

The content may also be a big reason why most users don't take health app notifications seriously. The survey showed that 72% of participants never or rarely prioritize notifications from health apps among other notifications, 25% sometimes prioritize, and only 3% always prioritize first.

Many health apps provide the freedom to customize notification frequency, which might be a reason why 53% of participants never or rarely feel overwhelmed by the number of notifications. This is because 47% of participants said they customize notifications to suit their preferences, whereas the rest don't customize, rarely customize, or don't know how to customize notifications, see Figure 6.

Percentage Participants that Customize Notifications

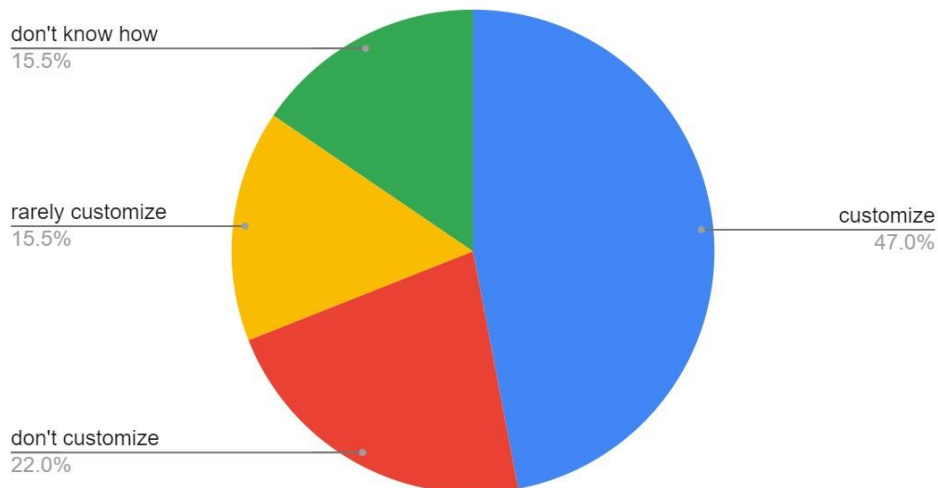


Figure 6: Pie chart showing the amount of participants that customize notifications from health apps.

It might also be that the health apps used by participants do not provide customization as 6 out of the 17 suggestions given by participants regarding notification improvement and effectiveness mention customization. The following are some of their comments:

“More customization”

“The user should be able to choose the frequency and type of notification from the app”

“Be able to customize notifications according to the goal of why I use the app”

“Customize them on your preferences”

When it comes to the indirect negative consequences of health app notifications, 23% of participants spend more time on the phone because of the health app notifications they receive, whereas a great amount, 61% don't spend more time, and 16% are not sure if they do. Another indirect consequence is when notifications fail to engage users, it in addition provokes a negative emotional response, thus not only leading to inactivity but also in a worse mental state than what was first present. 47% of participants feel guilt, frustration and annoyance when ignoring notifications, 34,5% don't know how they feel, 12,5% feel relief and gladness, and 6% don't feel a particular way. See Figure 7 for more detailed results.

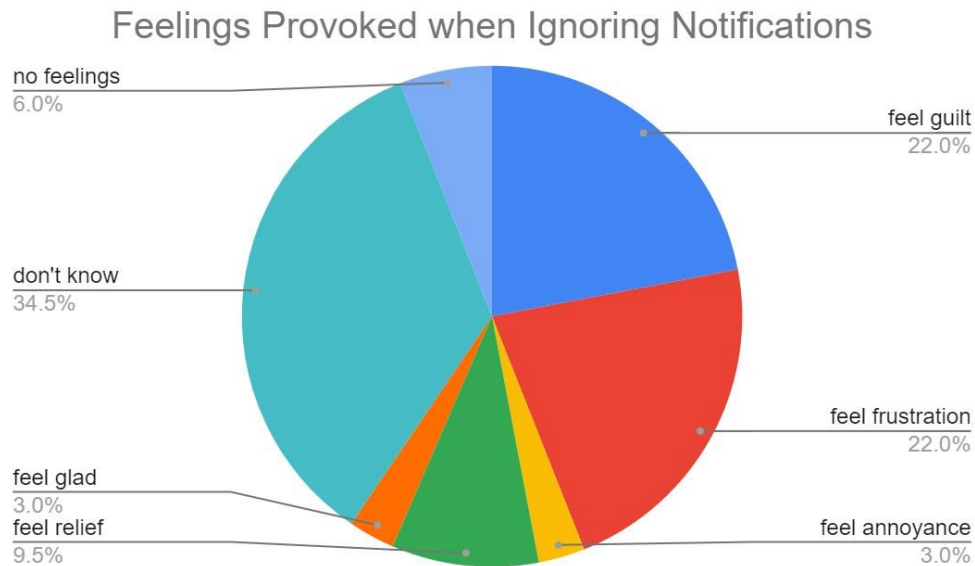


Figure 7: Pie chart showing the strength of feelings present when ignoring notifications from health apps.

As for managing the stress caused by notifications, 53% of participants manage stress by adjusting notifications, 19% take a break from the app, 12,5% delete the app, 3% avoid notifications, 12,5% say they don't need to manage it, have no stress, don't know, or gave no answers.

42% of participants turn off notifications when they want to take a break from the health app or get sick, 29% pause the health app, 6,5% don't know how to manage notifications, 6,5% delete the app, 6,5% delete the app and 16% ignore notifications.

4.2 Interview Results

All of the 10 interviewees are employed and were aged between 26-45. Their jobs include researcher, project manager, flight attendant, consultant, teacher and more. Most of the health apps used by the interviewees fall under the workout category, where 7 answered that they only use workout apps, 2 answered that they use both workout and meditation apps, and one answered using a diet app.

The interviewees use health apps for various reasons, which include the following:

- diet management
- to be able to workout from home
- get in a better shape, to track workouts and see progress
- because it's cheaper than a gym
- to keep track of steps taken
- to relax and calm down
- to do breathing exercises

- to build up continuity and be consistent with workout
- to get a workout plan
- to get motivation and be more active

The qualitative data was first gathered in a document after it was transcribed, which was then categorized. The categorization was based on the theme of the question, where answers to each question from all participants were categorized together to understand the overall extent of each phenomenon presented in the question. Similar responses could already be observed for each question. However, to go in depth into the analysis, diagrams were used to see if any patterns are present between the various phenomena/questions, mostly in the form of mind maps. After analysing the diagrams, certain patterns could be seen which were presented visually in the form of diagrams as well as text. The extent of each phenomenon and patterns were presented in the form of text, diagrams and pie charts, with their quotes as supporting evidence.

Overall, most interviewees showed a positive response regarding whether or not they think the app helps them reach their goals. They mentioned that the app is easy to access, is helpful in reaching goals, provides motivation, acts as a reminder and shows personal progress. Only two interviewees showed hesitation as one claimed that the app is difficult to use and another one mentioned that they need to find motivation. These were their comments:

“I think so, the app is difficult to use and also takes a long time to put everything” - ID02

“Might help sometimes! But need to find motivation for myself” - ID06

In addition, interviewees could mostly see a positive health progress being made because of the app. They mentioned that their strength and powerlifting has gotten better, it has gotten easier to calm down now, their running has improved, they have the knowledge on how to workout now, getting the shape they were hoping for, and are feeling healthier now. Another interviewee mentioned that they see positive progress after changing to a more tailored app. The following are some of the positive comments given regarding their progress:

“I consequently did different split stretch and mobility videos for about a year several times a week and in the end I was able to get into a split, so my mobility increased a lot by following these videos” - ID05
“Before using the app, I didn’t meditate that often, but now with the help of the app, it is easier for me to calm down after a stressful day. I find it easier to calm down and not stress over unnecessary things in life.” - ID07

“I am healthier now and feel better in my day-to-day life” - ID10

“Before, it was with a group and it wasn't tailored for me. But with the new one, I put my stats and it gives me where how to work out” - ID01

One interviewee mentioned that they don't see a difference because of the app, but that it is more of a lifestyle change and the app has been a plus. Another one mentioned that their goal hasn't really improved as they've had a stressful time at work and haven't had time for workingout.

Regarding notification frequency, 7 out of the 10 interviewees expressed that they receive at least one notification per day. 5 out of the 7 said that they currently receive notifications too often (more than a few a day), whereas the other two mentioned that they only receive twice a day or have customized notifications and receive only one a day at a preferred time. As for the remaining 3 out of 10 interviewees, it was mentioned that they either turned off notifications or only get notifications once a week. The reason why 2 interviewees have turned off notifications is because they used to receive too many notifications before, and it was making them stressful. The following are some of the comments made:

“Quite often, more than once a day. A bit annoying actually...” - ID01

“I get many notifications on a daily basis, and I must say that I am not very fond of the notifications and they are so many...” - ID03

“I had to turn of the notifications cause I got tired of receiving many a day” - ID05

“I choose when to receive notifications so I choose to receive one notification at 20.00 every evening...” - ID07

However, too many notifications have shown to not cause a higher engagement. This is because only 3 of the interviewees said they follow the notifications/reminders they receive, 2 of which are those that have either customized notifications to receive one a day at a preferred time or only receive one per week. The rest, 6 interviewees, expressed that they don't follow the notifications they receive, and all of them were the ones that receive notifications too often, or used to receive notifications too often and have now disabled them. One of them said that they try to follow the notifications but didn't concretely say whether they do or don't. Figure 8 shows a diagram clarifying the pattern seen in above results.

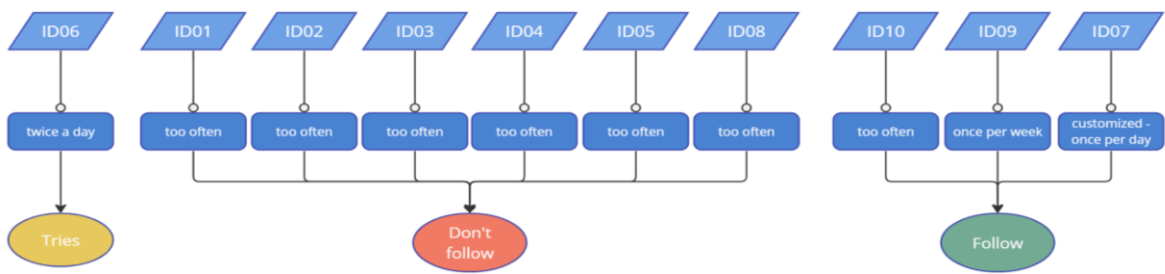


Figure 8: a diagram showing the pattern that exists regarding the notification frequency and engagement.

The parallelograms represent the interviewee numbers as their names are treated confidentially. The rectangles show the frequency of notifications received which too often means more than two notifications a day. The oval shapes show whether the interviewees follow notifications or not.

Here are some of the comments made when asked about whether they follow notifications or not:

“No, I ignore them. I only use the app when I need it. Mostly daytime. Definitely in the morning, I receive telling me to wake up and work out. There should be a place where I can choose to not receive” - ID01

“Almost never. Because I like to work out on my convenience and when I can... it should be about knowing when is good for a user to receive the notification, maybe then they will be more useful” - ID03

“Not really. There are occasions where they do remind me to “just do it”.. and get a workout in, but often I'm very busy and can not spontaneously drop things and find time to follow a reminder” - ID08

“At the beginning I did but after a while, they were just out of control and hard to manage so I stopped ignoring them and eventually had to turn them off “ - ID05

The above comments show a lack of customization and tailoring hence why notifications are either ignored or turned off all at once.

When it comes to the emotional response from health app notifications, only 3 out of the 10 interviewees experience a positive emotional response when receiving notifications, which turned out to be interviewee numbers ID07, ID09, and ID10, the same interviewees that mentioned they follow the notifications they receive. See Figure 9.

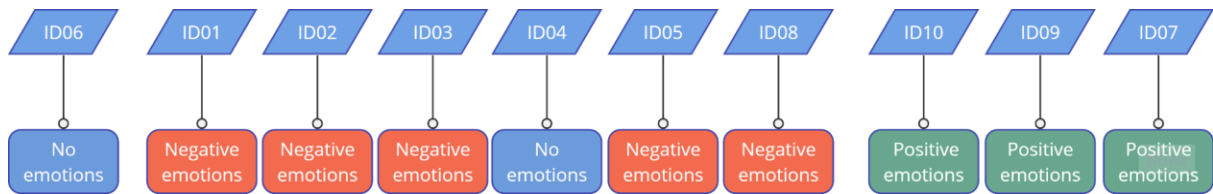


Figure 9: a diagram showing the impact of notifications and the pattern that exists

The 5 interviewees that mentioned they experience negative emotions expressed that they “feel like they’re not doing enough”, and “feel bad” as it reminds them, they haven’t reached their goal, “feel like a loser”, “feel sad” and “feel stressed and guilty”. The following are some of their comments:

“Honestly not good because the app makes you feel like a loser sometimes when sending notifications and telling me that I didn’t achieve my goal especially when I had a lot to do that day” - ID03

“In periods like these, where I’m already stressed over work and have very little time, I get even more stressed and feel bad about not doing my workouts, which does have an effect on my mood as it makes me feel guilty at times” - ID08

The following are comments from interviewees whom experience a positive emotional response:

“It has a positive impact on me, I’ve got a healthy routine in my everyday life and for my well-being. I get very calm when I receive the notification in the evening” - ID07

“I usually get the notification on Mondays and that makes me happy cause it tells me about my progress, and I look forward to reading it when I receive it.” - ID09

The reason why half of the interviewees experience negative emotions can be due to the speech of the notifications, where 5 of the interviewees mentioned that the message within the notifications are annoying, sometimes overwhelming, pushy, commanding and demanding. The rest mentioned that the notifications are calming, witty, fun, and motivational. The following are some quotes from interviewees that experience both negative and positive emotions:

“I would say a bit pushy. It feels very not personal because sometimes I have a bad day or sleep badly, and I don’t have the energy workout but the app keeps sending notifications” - ID03

“Not easy to manage because they were like commanding and demanding if I am gonna be honest. And I didn’t like that kind messages from an app” - ID05

“The notifications and the messages in the notifications are pretty easy and calming, I mean they shouldn’t be stressful...” - ID07

“Sometimes they are quite witty and fun, but most of the time they are encouraging and motivational aimed to make you take action” - ID08

Half of the interviewees also mentioned that they feel like notifications are not necessary or that they’ve turned them off, mainly because they do advertisements, are annoying, are pushy and lower motivation, cause stress, the speech within the notification is not likable, and can demotivate in periods of stress. Whereas 3 of the interviewees mentioned that notifications are necessary or good to have. One interview didn’t elaborate on this topic and another mentioned that the necessity of the notifications depends on their mood. Here are some of the comments made:

“I think I can manage without them. Although sometimes they are good to get you up and workout but it is just the way they keep coming several times a day and being pushy makes you not wanna receive them at all” - ID03

“I think they are not that necessary for me, that's why I turned them completely off. Mostly because I didn't like the messages in the notifications” -ID05

“The notifications are good but they are annoying because a process needs commitment. But maybe some flexibility about to choose when I wanna receive the notification” - ID02

“They are necessary, they kinda push me to move and be active so for that reason they are necessary” - ID10

To understand whether users directly take action or do nothing at all as a result of the stress caused, they were asked how they manage notifications at times of stress, and whether they take action or don’t engage at all. 6 out of 10 interviewees mentioned that they don’t take any action as a result of the stress caused the only action taken is deleting the notification. Whereas 3 of the interviewees mentioned that they take or try to take action right away as a result of the stress caused, thus showing a not so mentally healthy engagement. The following are some of the comments made:

“I usually get more stressed because it is like an additional expectation from me so I just delete the notification, immediately, that is the action I take” - ID03

“I had to engage with the notification by deleting it from my screen because it was making me more stressed seeing it” - ID05

“I think when I get a notification or any update, I am more like a “do it now” person. So I try to not get overwhelmed and try to do what is asked of me...” - ID09

“If I am stressed, then I take action right away when I receive notification. Otherwise, if I don't have the energy or time, then I ignore the notification” - ID07

When it comes to the indirect negative consequences of notifications such as longer phone usage, 8 of the interviewees said they use their phones more as a result of the notifications. However, it was not clear whether their higher usage is only dedicated to the health app or results in the use of other non-health related apps. Except for one interviewee which concretely stated that they used the other apps more because of the notifications received from health apps. 2 of the interviewees mentioned that they use the phone less. These are some of their comments:

“If I have a notification, I don't wanna look at the phone. I use it less often because I don't wanna even see them” - ID01

“The notification does make you use it more, I have to look at it right away, and I get distracted easily” - ID02

“Probably I would use it more often if I'd get notifications from these apps” - ID04

*“It does make me use my phone more often.. Sometimes for the notification itself but often it makes me pick up my phone and eventually start looking into other apps” -
ID08*

Finally, when asked about what kind of improvement they wanted to see, most of the suggestions targeted tailoring and personalization. Below are some of the suggestions given:

“I'd say that the notifications are the worst part of the app because they almost make me wanna not use the app at all. I only want to use the app as a tool to do my workout and yoga so I don't wanna get demanding messages like “you can't miss on your workout again” and so on. That doesn't make you feel good.” - ID05

“Sometimes the notifications can sound a bit mean, especially when I don't reach my goal of steps. Maybe the messages in the notifications can be a bit more polite.”

-

ID06

“They should be more flexible and adjustable. It sometimes makes me wanna delete the app...” - ID03

“I would love for the notifications to be more adjustable, especially for frequency.” - ID08

5. Discussion

An interesting point raised during the data gathering phase was the need to be independent of notifications and be able to have determination when it comes to building health habits, without notifications. However, the intention behind notifications has been to act as reminders and eventually help form an automated response to users' health related duties. But it can be that health notifications instead make users rely heavily on notifications for their memory and motivation thus not making any progress with inner motivation and needing more "perfect notifications". This means that notifications may never reach a level where it is considered without flaws. With more people joining health apps, different kinds of personalities, ages, and backgrounds will join these platforms, meaning more advanced and varying customizations will need to take place on a small scale.

In addition, as people are becoming busier in their daily life, it can get harder to persuade users to do something beneficial for themselves via notifications, hence why every single detail matters. This includes for example the speech of the notifications, where results showed that it has the power to engage and disengage a user. This means that both a busy lifestyle and the existence of a broader range of personalities will put a higher pressure on notification optimization which may not be achievable in the near future.

As mentioned in the results, the study showed the existence of an important pattern where those that customized or received less frequent notifications were the ones that followed notifications and engaged with the app. However, less frequent notifications may not, in all cases, lead to more engagement. For instance, people with bad memory or a busier lifestyle may require more reminders and/or a notification that reminds them of the upcoming notifications which will require them to actually workout or meditate... etc. But again, this would need to be part of the notification customization abilities to account for every user.

While results also showed that current notification deficiencies can lead to stress and an overall negative response, it would be interesting to measure the negative impacts against not exercising or meditating. For instance, is the impact of a negative emotional response equal to the negative impact of not exercising? This would better help in understanding the strength of the phenomena in this study along with its negative impacts on human health.

The findings of this study are in line with some of the papers analysed regarding health apps' notification design. Woodward et al. (2021) concluded that notifications are not following design recommendations in areas of frequency and tailoring, which turned out to be two predominant causes of the negative emotional response experienced by users in this study. Bidargaddi et al. (2018) discussed the presence of inefficient engagement from notifications which this study confirmed to be true as 53% of participants never or rarely take action from notifications and 72% never or rarely

prioritize notifications from health apps among other notifications. Bidargaddi et al. (2018) also discusses how lack of tailoring can result in demotivation, focusing greatly on content tailoring as the main motivator. This is in line with the results of this study, as 65% of survey participants mention speech content as a form of improving notification effectiveness and 50% of interviewees who experience negative emotions also mentioned that the speech content is annoying, sometimes overwhelming, pushy, commanding and demanding. The findings of this study also confirmed that the current deficiencies within notifications indeed have the potential to demotivate users, by going in depth into the negative emotions experienced and the magnitude of this phenomenon.

This study not only extended the knowledge in the field of notification design optimization in health apps, but also showed that current notification designs can have a negative impact on users' emotional response, which further affect a proper health progress and is something that is the opposite of what health apps intend to do. The findings of this study contributed to the development of both research areas, notification design and human health. In addition, it will contribute to the creation of new research opportunities and act as a starting point for researchers to delve deeper into this field, with a focus that truly prioritizes human health. The range of new studies coming from the perspective studied in this thesis will significantly improve health apps. This means that in the long term, more users will be interested in joining health apps, it will be safer for their mental and physical well-being, better health progress can be seen, demand on hospitals and healthcare centers can decrease, and app developers or businesses will experience a better economy. This study acts as a starting point for all of this to happen in a safer manner.

As this study is aimed for designers and developers, what do the results mean for them? Below are some key recommendations and takeaways to improve health app notifications.

Personalize the Notifications:

Users get annoyed by generic notifications as they don't target any specific preference nor need. Underline how apps should collect data (consent and privacy in consideration), only for the purpose of personalizing the notifications according to workout routines, meditation and dieting.

Cues and Relevance in Context:

It is very important to provide notifications in the right context and appropriate time. Receiving notifications in the middle of a busy working day causes more stress, while receiving notifications during peaceful evenings can be more conducive. Making it easy for the user to optimize contextual cues like how often or when during the day to receive notifications.

Tone of the Language and Motivational Speech:

Using a motivational speech than a speech that is directive would be more helpful and engaging. Notifications that include inspiration and empowerment messages are more prone to be well-received by the users than notifications that are obnoxious and demanding. Including encouraging remarks, motivational sayings or customized messages that recognise users' accomplishment and hard work.

Setting and Preferences:

Giving the opportunity to the user to tailor the notifications to suit their preferences and threshold. Making it possible for the user to have price control over the timing, kind and the duration of the notifications allows the user to customize the app to fit their lifestyle.

Feedback:

Integrating feedback systems (or asking users directly) within the app in order to get users feedback regarding the usefulness of the notifications. By doing that, it encourages the users to highlight the negative sides of the notifications and in return helps the apps on how to improve the notifications. This iterative process helps refine and improve notifications to users' experience with notifications.

Regular Iteration:

It is important to acknowledge the iterative character UX design and the importance of regular optimization based on user feedback is essential. Encourage app developers to adopt a mindset that prioritizes continuous improvement. This will enable them to consistently assess the significance and the influence of notifications on user engagement and develop apps and notifications that prioritize user satisfaction and a positive user experience by using empirical data.

While this thesis provided valuable insights regarding the impact of health app notifications on users' emotional response, it is essential to acknowledge some limitations that could have influenced the results, mainly due to the time and scope of the thesis.

Firstly, the data gathering methods were in English even though the study was conducted in Sweden. This is because Sweden is culturally diverse and most Swedes can speak English as well, thus reaching a wider audience. Secondly, the study did not include public health care since the targeted apps are the ones that people download voluntarily to improve their mental and physical health. Hence not providing, for instance, any insights on how doctors or nurses feel from the notifications they receive

regarding their patients. Thirdly, the limited time of this study could attract 32 survey participants and 10 interviewees which was better than expected.

However, a longer timeframe would allow the attraction of more participants, hence influencing results.

It would be beneficial to conduct similar studies in other countries, with longer timeframes and different methods. Other nations may have different attitudes towards general health and health apps, a longer time frame could attract more participants, and other methods could confirm the phenomena provided by this study or add more insights. For instance, studies could do observations, which might provide a better understanding on how users feel when they get notifications. However, it could affect the way users interact with their health apps, as people may act differently knowing that they are being observed.

6. Conclusion

The aim of this study was to investigate what impacts health app notifications have on users' emotional responses, which was done through a mixed-method approach in the form of interviews and a survey.

To conclude, developers need to be more cautious when dealing with notification design, as it can negatively affect users' emotions which in turn have the potential to affect their health progress, something that is quite the opposite of what health apps are trying to achieve. To be specific, findings showed that 37,5% have a negative emotional response when receiving notifications, 37,5% have a positive emotional response and 25% have no emotional response when receiving notifications. Focusing on stress increases the percentage, where 50% of participants have experienced stress from notifications. When translating these emotions into actions, 53,2% never or rarely take action from notifications (no engagement). In addition, 72% never or rarely prioritize health notifications among other notifications.

The experience of negative emotions and disengagement mostly comes from notification frequency and speech content, where 47% of survey participants feel overwhelmed by the number of notifications. When it comes to the interviewees, a pattern was observed, where those that receive too many notifications are also those that experience negative emotions and don't follow/engage with notifications, which were about 50% of interviewees. Those that receive less or customized notifications experience positive emotions and engage more. As for notifications' speech content, 65% of suggestions made via the survey mention speech content as a form of improving notifications effectiveness.

In addition, 50% of the interviewees that experience negative emotions mentioned that the messages within the notifications are annoying, sometimes overwhelming, pushy, commanding and demanding. Furthermore, most of the suggestions from interviewees mention that notification frequency and content need to be improved.

When notifications fail to engage users, they provoke an additional negative emotional response, where 47% of participants feel guilt, frustration and annoyance when ignoring notifications. The stress experienced by some users makes them take action right away, which shows that some users are engaged in an unhealthy manner. Based on this study's findings, developers can improve emotional response by changing the tone of the messages, personalizing notifications, providing the opportunity to choose frequency and timing and integrating feedback systems, among others.

Future research could explore the different definitions of engagement and which definition should be focused on for each design area/focus. This is because the study found an unhealthy engagement in some cases, where the stress felt by some participants made them take action right away. While some studies would count these participants as part of those that are "engaged", it may not be effective to go by definition when there is a negative emotion attached to that action taken.

Future studies could also focus on one most common emotion such as stress and/or investigate how these emotions affect overall mental or physical health in depth. Furthermore, studies can also explore potential differences in the emotional responses regarding age, gender and other social skills, such as how comfortable they are with technology and app usage.

This study confirmed that there is indeed a lack of tailoring and unfollowing of notification recommendations as found in other studies. However, this study extended the knowledge in this field by showing that these deficiencies can negatively impact users' emotions which in turn affect proper health progress. Thus providing valuable insights on user experience, engagement and health apps' effectiveness. Prioritizing user experience and optimizing notification tailoring will provide a sustainable user engagement, which will not only result in health apps' success but also result in improved health apps.

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8. Appendix

A. Survey Form

Health apps (workout, diet, meditation)

This survey is about how notifications from health apps make people feel when they receive them. The survey and the answers are anonymous, but it is very important to answer the questions accurately to ensure rich data for the study.

* Anger obligatorisk fråga

1. Age

2. Occupation *

Markera endast en oval.

Student

Working

Working and studying

Parental leave

Not working Övrigt:

3. What kind of health app/s do you use? **Markera endast en oval.*

Workout/running

Meditation

Diet Övrigt:

4. How do you find the interface of the health app? *

Markera endast en oval.

Easy to use/interact

Somewhat easy

Not so easy Complicated

Övrigt:

5. How do you feel receiving notifications from the health app?

Markera endast en oval.

Motivated

Energized

Stressed

Anxious

Neutral Övrigt:

6. Do notifications from the health app influence your mood or emotions?

Markera endast en oval.

Positively

Negatively

Not at all Övrigt:

7. How often do you take action with notifications from health apps?

Markera endast en oval.

Right away

Later

Not often

Never

Övrigt:

8. Do you believe that notifications from health apps contribute to your overall health?

Markera endast en oval.

Most definitely

Definitely

Neutral

Not at all Övrigt:

9. How often do you get notifications from health apps? *

Markera endast en oval.

Very often

Often

Not that often Övrigt:

10. Do you ever feel overwhelmed by the number of the notifications from the health apps?

Markera endast en oval.

Yes, often

Not that often

Not at all Don't

know

Övrigt:

11. What emotions do you experience when ignoring notifications from health apps?

Markera endast en oval.

Guilt

Frustration

Relief

Don't know Övrigt:

12. Do you customize the notifications of your health apps to suit your preferences?

Markera endast en oval.

Yes

No

Rarely

I don't know how Övrigt:

13. Do you feel stress or pressure receiving notifications from health apps? * *Markera endast en oval.*

Yes

Sometimes

No

Övrigt:

14. How do you prioritize notifications from health apps among the other notifications?

Markera endast en oval.

Always prioritize first

Sometimes prioritize

Rarely prioritize Övrigt:

15. Do you find notifications from health apps helpful to maintain consistency in your health related activities?

Markera endast en oval.

Yes, always

Yes, sometimes

Rarely

Never Övrigt:

16. Have you experienced stress or negative emotions caused by notifications from health apps?

Markera endast en oval.

Yes

Sometimes

No

Övrigt:

17. How do you manage stress or negative emotions caused by notifications from health apps?

Markera endast en oval.

Take a break from the app

Adjust the notifications

Delete the app

Övrigt:

18. What do you do when you want to take a break from the health app or get sick?

Markera endast en oval.

Pause it

Turn off the notifications

Don't know how to manage the notifications

Delete it Övrigt:

19. Do you have any suggestions for improving the effectiveness and the impact of notifications from health apps?

B. Interview Questions

1. Tell me about yourself. Age, gender, and work?
2. Tell me about a health app you are using now.
3. What do you like about the app?
4. Why do you use it?
5. Do you think the app helps you to reach your goal?
6. How is your workout/meditation now compared to before using the app? Any progress?
7. How often do you get notifications from the app?
8. Do you follow the notifications/reminders from the health app?
9. How are the messages in the notification? Easy to manage, overwhelming?
10. Can you give examples of how notification has impacted your emotions or behavior?
11. Tell me about the interface of the app? Easy to use and navigate?
12. What happens when you miss your goal?
13. How do you feel about the necessity of the notifications/reminders from the health app? (how necessary are they)
14. How do you manage the notifications/reminders when you are stressed? Take action right away or you don't engage at all?
15. Do you use your phone more often or less often regarding the notifications?
16. Is there anything else that you would like the designer or developer to improve in the future in the app?

C. Consent Form

This interview aims to gather data from the interviewee's thoughts and opinions about how they experience and feel when receiving notifications from the health app that they use most. The gathered data will be used for this study only. From the data, Mehmet will pick and apply parts of it to the study that he thinks it is crucial. The data will be included when the study is presented in front of classmates, supervisors, professors, and others at Malmö University at the end of May 2024.

The interview will be audio recorded for not missing out on any important details. Only Mehmet will listen to the audio record and transcribe it. All the information in the recording and personal information will be treated confidentially. The interviewee will be anonymous when the study is presented verbally and in the report. The interviewee will be named as ID01, ID02, ... and so on. During the interview, the interviewee can ask questions and know that they can end the interview at any time if they please.

The material will only be used for the course called Data and Information Technology, VT24, 15 credits.

Hereby I certify that I choose to participate voluntarily in this interview.

Interviewee:

Name _____ Surname _____

Signature _____ Date _____ City _____

D. Survey Participants' Suggestions for Improving Notification Effectiveness and Impact

1. Better interface and more reliable.
2. More customisation.
3. The user should be able to choose the frequency and type of notification from the app.
4. Less promotion of other products or services, as it becomes quite pushy.
5. It's a difficult subject, but if there is a way to remove the guilt and pressure of the apps, keeping them motivational. But I also understand that this often

comes from the person using the app. If we are stressed or in an inconsistent pattern of workouts, then we probably read the notifications in a certain way.

So not sure how this can be done as it is based on human nature and emotions.

6. Include data about what my friends are doing.
7. The tone of the notification speech could be improved by maybe making it more thoughtful and personalized.
8. Creative notifications, like including humour etc. can improve a persons' approach towards it... must reduce being like an alarm.
9. More challenging interfaces e.g showing a racing field to reach per day.
10. It would be good to add why I should start workout or meditating. Catchy words" to get me going" immediately.
11. Maybe reminding me of the benefits of this habit would help so that I remember why I have the app in the first place.
12. Be able to customize notifications according to the goal of why I use the app.
13. Meet ppl IRL and teach them self-motivation it Will stay all life.
14. Must be relevant.
15. Customize them on your preferences.
16. It should be easier to turn off completely.
17. More personalized (schedule, habits, hours, types etc.) and less invasive notifications would be helpful and more effective.