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# ENHANCING USABILITY OF MOBILE HEALTH APPLICATIONS FOR TIME-STRAPPED OFFICE WORKERS WITH BUSY WORK LIFE

Master of Science Thesis
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# ABSTRACT

Husnain Ali Khan: Enhancing Usability of Mobile Health Applications for Time Strapped Office Workers with Busy Work Life
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In today's fast paced contemporary world, where office workers often find themselves managing a multitude of tasks and responsibilities, the role of mobile health applications has become pivotal in delivering accessible and effective healthcare support. Modern office workers face the challenge of balancing demanding work schedules, family commitments, and personal obligations, leaving limited opportunities to maintain a healthy lifestyle. Mobile health applications have emerged as a vital solution in this digital era, addressing the needs of individuals striving to sustain their well-being amidst the demands of their professional careers and personal lives. As the pressures of the contemporary workplace increasingly encroach on leisure time, it is imperative to examine and optimize the usability of mobile health apps to ensure they effectively engage and satisfy users.

This thesis addresses the specific challenges encountered by office workers in the adoption of mobile health applications, explores potential solutions to overcome these challenges, and investigates strategies for enhancing usability and user experience. Initial user Interviews (8 Participants) revealed several issues experienced by office workers while using mobile health applications, including usability concerns, navigation difficulties, frustrations with manual data entry, accessibility, and privacy issues, among others. In response to these key pain points identified in the initial interviews, an interactive high-fidelity prototype of the mobile health application "Health Mentor" was developed to support office workers in their daily lives. "Health Mentor" offers a simplified user interface, personalized health monitoring and exercise plans, enhanced self-care tools, efficient health management, and social connectivity features.

To evaluate the design and usability of the "Health Mentor" application, evaluation interviews (6 Participants) were conducted to assess its alignment with user needs and preferences, yielding promising results. Users expressed a favorable inclination towards the design, particularly appreciating the health monitoring and customizable health features, indicating a willingness to utilize the application to maintain their fitness and overall well-being. This research effectively elucidates the challenges faced by office workers in their daily lives and proposes "Health Mentor" as a tailored user-centric solution to address to empower office workers in managing their health and well-being effectively. Application designers need to consider more user-friendly designs with motivational reminders, keeping in mind different user groups, goals and ethnicities for an all-inclusive design for better usage.

Keywords: Health Application, Effective Healthcare, Office Workers, Work Schedules, Accessibility, Health Monitoring, Enhanced Self-care.

# PREFACE

The basis of this research study is derived from the daily life struggles of office workers, my desire to do something better for society and contribute to the field of Human Technology Interaction. Over the course of five months, this endeavour has been a labour of dedication, hard work, and intellectual exploration.

First, I am grateful to the Allah Almighty the most merciful and beneficent who gave me the courage and determination to conduct all the required tasks of this research study effectively. I would like to express my heartfelt gratitude and appreciation to my thesis supervisor Senior Research Fellow Päivi Majaranta who helped me throughout this research study and guided me to determine the correct way to carry out each task and showed her concern as a mentor and supervisor during the study, and it wouldn't have been possible to bring this proposed idea into reality without her continuous exemplary guidance. I am extremely grateful to her for all this.

In the end, I am equally thankful to all the participants who took part in my study and helped me fulfill the goal of this study and my friends and every other person for their various suggestions and support throughout this whole process.

Tampere, 23 November 2023

Husnain Ali Khan

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# 1. INTRODUCTION

Modern office workers often find themselves juggling demanding work schedules, family responsibilities, and personal commitments, leaving limited time for maintaining a healthy lifestyle. Mobile health applications have the potential to bridge this gap by providing convenient access to health and wellness resources (Greenberg et al., 2023). In today's fast-paced world, where office workers often find themselves juggling multiple tasks and commitments, the role of mobile health applications has become crucial in providing accessible and effective healthcare support. The contemporary era is characterized by an ever-increasing reliance on technology, and this trend has significantly influenced various aspects of our lives, including health management. Mobile health applications have emerged as a pivotal solution in this digital age, catering to the needs of individuals striving to maintain a healthy lifestyle amidst the demands of their busy work schedules. The significance of these applications is underscored by the challenges faced by time-strapped office workers in balancing their professional commitments with personal well-being. As the demands of the modern workplace increase upon leisure time, there arises a need to explore and optimize the usability of mobile health apps to ensure effective engagement and satisfaction among users.

This thesis aims to delve into the realm of enhancing usability for busy lifestyles by optimizing mobile health applications, specifically catering to the needs of time-strapped office workers.

Objectives:

1. To identify the usability challenges faced by time-strapped office workers when using mobile health applications.

2. To explore the preferences and requirements of this demographic concerning health and wellness information and features.

3. To design a health application prototype for optimizing the usability of mobile health applications for office workers with busy lifestyles.

Through an in-depth exploration of these research objectives, this thesis seeks to uncover the challenges office workers encounter when engaging with health applications and to propose actionable strategies for optimizing the usability of such applications. By

addressing these objectives, the study aims to contribute to the development of user-centric mobile health solutions that align with the realities of time-constrained office workers and empower them to seamlessly integrate healthy practices into their daily routines. The research question will also address the usability challenges faced by time-strapped office workers when using mobile health applications. By optimizing the usability of such applications, the research hopes to provide a practical solution for busy individuals to improve their health and well-being. Ultimately, this research contributes to the ongoing efforts to create a healthier and more balanced lifestyle for the modern workforce.

The introductory chapter (Chapter 2) of the thesis provides a comprehensive overview of the research focus on mobile health applications (mHealth). The exploration begins with a discussion on the background of mHealth apps, delineating the various types available in the market. Moving forward, the study (Chapter 3) delves into the pre-development pilot study, signifying the importance of user interviews in shaping the research methodology. The MECE (Mutually Exclusive, Collectively Exhaustive) framework is adopted for methodological structuring, with a meticulous choice and rationale for interview methodology. The research design is outlined, incorporating background questions, consent form queries, and main interview topics. The subsequent discussion focuses on the study process and analysis, presenting participant information and key thematic insights derived from user interviews. These themes encompass motivations for using mHealth apps, encountered challenges, perceived usefulness, and factors influencing download and sustained usage, among others. Further, the thesis unfolds with the design phase of the "Health Mentor" mobile health app as showcased in Chapter 4. The conceptual design is elaborated, setting the stage for the subsequent exploration of post-development and feedback. Post-development interviews (Chapter 5) are conducted, centering around evaluation questions that assess users' initial impressions, user-friendliness, perceived benefits for maintaining a healthy lifestyle, and features catering to specific user groups. Thematic insights from these interviews include impressions on the initial design, user-friendliness, perceived benefits for different user groups, identified areas for improvement, and additional features suggested to enhance usability and user experience. Chapter 6 acts as a concluding section which touches upon the limitations of the present study and future implications.

# 2. MOBILE HEALTH APPLICATION

Today, most people use health care technology in one form or another. With the advancement of technology in the contemporary world, e-health initiative is changing the delivery of health care. One of the widely used components of e-health technology is Mobile Health, also known as mHealth. In simple terms, mHealth refers to technology like smartphones, computers, GPS and health monitors (Greenberg et al., 2023). These apps have two main purposes: helping manage diseases and promoting overall wellness and fitness. People often use mobile apps (also known as mApps) that facilitate them in keeping healthy behavior. In 2015, nearly 38% health related apps available in app stores were designed to promote fitness. Health apps are not only limited to fitness, but they are also very cost effective in disease management. These apps are used by patients to remind them about their timely medication, hence, playing a vital in the well-being of people. The primary goal of mApps is to motivate and support people in adopting healthier lifestyles. Moreover, an app helps users to monitor their own health, track progress and keep their physical health in check. Due to physical inactivity, because of ease of work due to technological revolution, people are facing many health issues. The motivation to develop such healthcare applications originates from the problem of physical inactivity.

According to WHO (World Health Organization), lack of physical activity leads to millions of deaths each year (Hall et al., 2021). In 2010, it was reported that one in four adults engaged in less than the recommended physical activity per week, which 150 minutes. To solve this, researchers are trying to explore innovative ways to engage people in more physical activity. According to Yang and Königshofer (2021), it is currently unknown that how much these apps are impacting the lives of people by motivating them to do physical activity. Also, many such apps are not made based on health behavior theories or any evaluated scientific methods. Firstly, there is a need to identify ways to engage people in such healthcare apps. By understanding such interests, it will help the healthcare sector to get insight on developing and designing interactive mhealth application to engage more people to such applications. Such healthcare applications can help in designing better health programs. This review aims to find how smartphone apps use behavior change techniques to make people more active, using the established set of behavior change techniques.

## 2.1 Background

In order to make a better understanding about health interventions and mobile apps, there is a need to understand how to develop them effectively. This section takes its inspiration from Kuru (2018) for topic and thesis development. To develop an understanding about how mobile apps work Kuru (2018), did a systematic review to find out how different behavior theories can be used to get the idea of how these apps can be developed more effectively. For example, they found out that setting specific goals can help to make the apps more effect and this idea was derived from control theory. Moreover, they also pointed out that "providing information about what other people think can be useful and this idea comes from the theory of reasoned action, the theory of planned behavior and the information-motivation-behavioral skills model" (Kuru, 2018 as citied in Sezgin et al., 2018). So, they used different theories in their study to see what will best work to make such applications effective. According to their research an individual can control his own behavior and it depends on their intentions make the actions performed by certain individua. Basically, intentions depend on two main factors like actions and people supporting those actions. The theory of planned behavior describes how an individual behavior results in their ability to control the resources, opportunities, and skills required to carry out their intentions and their affects. Relation between the environment, personal factors, and attributes of the behavior is explained by Social cognitive theory, this theory specifically focuses on self-efficacy, and defines it as the most important factor of behavioral change (Bandura, 1997, as cited in Haug et al., 2022). The information-motivation-behavioral skills model mainly works with the thinking part of our mind; it uses information to help change our behavior. Control theory says that what drives our actions is what we want the most, like basic needs staying alive, love, power, freedom, or other needs (Carver & Scheier, 1982 as citied in Sezgin et al., 2018). The operant conditioning theory is more about changes in what we do that we can see, and it explains that when there are new or ongoing outcomes, our behaviors can change (Leeder, 2022; Skinner, 1998).

Various information technology tools like clinical information systems, electronic patient records, and telemedicine have been successfully used in the field of healthcare. This actually verifies that they have the potential to give the quality of medical care and can tell how healthcare is managed (Rao et al., 2011). In this regard, research and more work are done in this field which leads to more innovation. This innovation has created new possibilities and healthcare concepts, using a combination of information, technology, and knowledge in healthcare. Because of all this, the prediction in the near future is

that healthcare technologies, especially things like mobile health (mHealth), will become largely computerized (Crompton, 2001 as cited in Dwivedi et al., 2006).

## 2.2 Types of mHealth Apps

This section includes the introduction of different types of health apps such as apps to promote health, raise awareness about disease management and access of treatment via online platforms.

The prevalence of smartphones has led to the emergence of mHealth apps as a prominent aspect of 21st-century healthcare (Vaghefi & Tulu, 2019). These apps, integrated into smartphones, have been devised to enhance health outcomes, medical research, and healthcare services (Nouri, 2018). In comparison to interventions delivered through computers and laptops, mHealth apps offer a more cost-effective and easily accessible platform.

The landscape of mHealth apps in healthcare encompasses various categories, as depicted in Figure 1. These categories span diverse healthcare practices and functions, showcasing the versatility and potential impact of these applications.

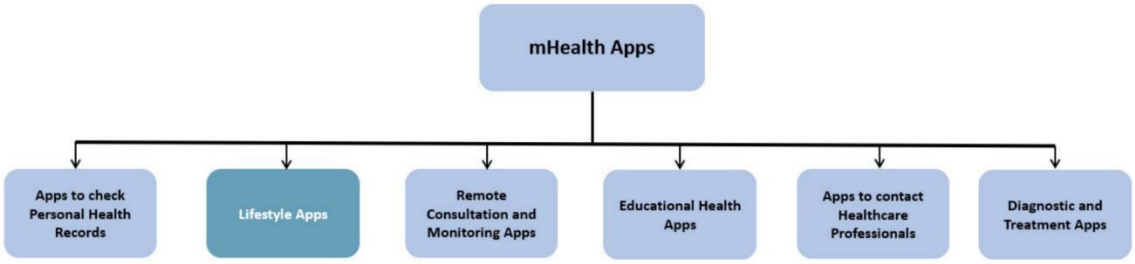


***Figure 1.*** *A summary of the various types of mHealth apps. Adapted from Shabir et al., (2022).*

With its wide reach and user-friendly nature, the adoption of mHealth apps is a significant stride in augmenting healthcare accessibility and effectiveness. By leveraging the ubiquity of smartphones, these apps have opened avenues for improved health management and research that were previously constrained by traditional technological channels.

The proliferation of mHealth apps fueled by the smartphone revolution has revolutionized healthcare practices. The integration of these applications into daily life has paved the way for enhanced health monitoring, research, and service delivery, promising a more inclusive and efficient healthcare landscape.

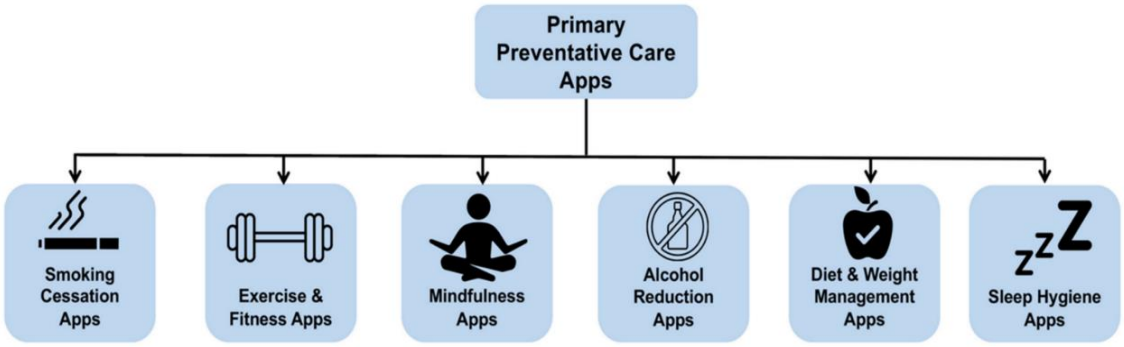


***Figure 2.*** *Types of Primary Care Apps. Adapted from Shabir et al., (2022).*

### 2.2.1 Health Apps for Health Promotion and Prevention

Many health apps aim to target factors that can influence a person's health, to promote health and prevent issues related to it. There are many health apps available, who claims on app store and other platforms that they are helping individuals to live a healthy lifestyle, for instance, by helping users in quitting smoking, to adopt to healthier lifestyle by having healthier diets, by motivating them to do daily exercise and to help them in drinking less alcohol. Such applications are important because in the contemporary world many new diseases are taking birth and people are getting sicker because of lack of exercise and eating.

### 2.2.2 Health Apps for Disease Management

With advancement in technology, health apps have become not only a part of the health sector but also a part of many people's life. Such apps are being used frequently in hospitals by healthcare professionals to help patients in managing diseases, mostly long-term diseases such as heart diseases, diabetes, mental health problems and cancer. Moreover, health apps are helping healthy people to monitor and track individual's step count, to check pulse rate, blood oxygen level and many other health related things. Furthermore, for patients such apps are helping them to keep records of their medication, to keep track of the symptoms of the disease and in educating them about their health condition. Health apps are adding more such features to support patients with self-management. For instance, they have automatic reminders functionality to remind patients

about an appointment or about the time to take medicines. Health apps are very beneficial for patients who are facing psychological difficulties and are prone to anxiety quickly. Such patients face breathing difficulties, which can significantly affect one's quality of life. Health apps educate people with breathing techniques to control their anxiety and panic attacks. Such self-management applications play an important role in helping people who are not financially stable or have a long-term disease. Here it is important to share that not all health apps are designed to target patients only. Many apps provide an interface for both patients and doctors to interact with each other online. Such applications help in saving time, in preventing the spread of a disease like COVID-19, and in handling emergency situations. Moreover, there are apps for doctors and other healthcare professionals to help in decision making. For example, in a study it has been observed how often doctors at university hospitals have prescribed antibiotics to patients (Pauwels et al., 2021). The researchers instructed the doctors, before providing them an app, on when to prescribe the antibiotics because antibiotics were being prescribed a lot before. The result of this research amazed everyone as the doctors prescribed very few antibiotics to patients, which helped people to get better and helped saving their money.

### 2.2.3 Health Apps for Remote Access to Treatment

Health applications are getting more popularity because of easy remote access to treatment in any region of the world. Health apps are being designed in such a way as to provide treatments within the app itself, for example, by audio meditation or by helping in communication with healthcare professionals or other people who can provide support. Moreover, online appointments with doctors can be booked easily and patients and doctors can have online sessions through the application itself. These applications were very effective during the time of COVID-19. It is evident to say that health apps are frequently being used by people living in rural areas, by people with mobility issues, as well as by those who are busy in their jobs. Health apps are easy to use and are available all time at a very low cost. People who are well versed with technology find no difficulty in using such health applications. In the UK, the National Institute for Health and Care Excellence now suggests that kids and young people who are suffering from depression should go through digital cognitive behavioral therapy to get better.

## 2.3 Usability in m-Heath Apps

Usability, in the context of mobile applications, refers to the user-friendliness and ease with which individuals can interact with the software. It encompasses aspects such as

intuitive design, seamless navigation, and efficient task completion. The concept of usability assumes paramount importance in the realm of mobile health applications as it directly impacts user engagement and satisfaction. Research by (Manzano-Monfort, 2023) indicates that apps with higher usability ratings tend to have greater user retention rates and increased adherence to health-related activities. This highlights the intrinsic connection between usability and the effectiveness of mobile health apps in fostering healthy behaviors.

The evolution of mobile health applications has been remarkable, mirroring the advancements in technology and the shifting paradigms of healthcare. These apps have transitioned from basic step counters to comprehensive platforms offering features such as personalized workout plans, dietary tracking, and stress management techniques. Categorically, mobile health apps can be classified into fitness trackers, wellness guides, and medical monitoring apps. Each category addresses specific aspects of health management, catering to the diverse needs of users seeking convenience and customization (Van der Kamp, 2023).

For individuals grappling with time constraints due to office commitments, mobile health apps offer a lifeline to a healthier lifestyle. The apps provide flexibility in terms of when and where health-related activities can be pursued. For instance, apps like "FitLifeNow" enable users to engage in quick workouts during short breaks or participate in virtual yoga sessions to alleviate stress. These apps are aligned with the busy routines of office workers, ensuring that health remains a priority without disrupting their work schedules. Furthermore, the popularity of apps like "Healthy Hub" (Borali & Cupati, 2023) and "Work Well" (Bloom, 2022) exemplifies the demand for features tailored to the unique challenges faced by this demographic. These apps integrate features such as office-friendly workouts and healthy meal delivery services, catering to the specific needs of individuals with time constraints (Cruz et al., 2022).

However, the efficacy of these mobile health apps hinges on a profound understanding of the needs and limitations faced by time-strapped office workers. The demands of office work often disrupt regular routines, leaving little time for exercise, nutritious meals, and relaxation. This sedentary lifestyle is compounded by psychological factors such as stress, which can lead to unhealthy habits as coping mechanisms. Researchers like Qi et al. (2018) have pointed out that the prevalence of stress among office workers is intricately linked to their adoption of unhealthy behaviors, such as consuming comfort food and neglecting physical activity. Motivating time-strapped office workers to embrace and sustain a healthy lifestyle is a multifaceted challenge. The lack of time and the pressures of work can diminish their motivation to engage in health-related activities. Additionally,

the inertia associated with habit change poses a psychological barrier. Convincing individuals to transition from familiar, albeit detrimental, routines to newer, healthier habits requires strategic intervention. Insights from behavioral psychology, as highlighted by Rodríguez-Romero et al. (2020) emphasize the importance of targeted motivation techniques that align with the unique mindset of office workers.

Central to the adoption and effectiveness of mobile health apps is their usability, which is governed by key principles and elements. Usability encompasses aspects such as learnability, efficiency, memorability, and error prevention (Peng et al., 2016). For time-strapped users, intuitive design and user-friendly interfaces are of paramount importance. The app's navigation should be streamlined to minimize cognitive load and ensure swift access to essential features. A study by Fox et al. (2022) demonstrated that users are more likely to engage with an app if its interface is designed with simplicity and efficiency in mind. However, the usability of mobile health apps is not without its challenges, particularly for busy individuals. The fragmented nature of their schedules can lead to interruptions during app interactions, affecting the overall user experience. Additionally, the abundance of features within these apps, while beneficial, can sometimes overwhelm users and deter engagement. This issue of "feature fatigue" underscores the importance of offering customization options that allow users to tailor the app's functionalities to their specific needs (Lobo et al., 2023). Moreover, the presence of usability obstacles such as small font sizes, complex navigation menus, and excessive data entry requirements can hinder the app's effectiveness in facilitating health behavior change.

To optimize the usability of mobile health apps for time-strapped users, a strategic design approach is imperative. Tailoring app features to cater to the convenience and immediacy required by busy individuals is pivotal. This could entail integrating features that offer quick, yet effective, workouts, easy meal planning, and stress reduction techniques. Moreover, customization options that allow users to define their preferences and schedules can enhance engagement and adherence. The design principles governing these apps should prioritize simplicity, clarity, and accessibility. Appropriate use of visual cues, well-defined icons, and logical information architecture can contribute to a streamlined user experience. Minimizing the learning curve for new users, especially those unfamiliar with health-related terminology or technology, is also crucial. By offering clear onboarding processes and contextual prompts, app designers can facilitate user engagement and retention.

The realm of mobile health applications holds immense potential in revolutionizing health management, particularly for time-strapped office workers. The fusion of technology and health promotion aligns with the demands of the modern lifestyle, where convenience

and efficiency are paramount. Optimizing the usability of these apps is a critical step in ensuring their effectiveness and sustained engagement among users. By understanding the unique challenges faced by time-constrained individuals and tailoring app features accordingly, designers can empower users to prioritize their health without compromising their professional commitments. The journey towards a healthier and more balanced lifestyle begins with user-centric, seamlessly usable mobile health applications.

## 2.4 Advantages and Benefits of Delivering Interventions via Health Apps

It is important to know that delivering interventions digitally using health apps or other digital means can have more benefits than in person sessions for several reasons. As per Davies and Muller (2020) following are the benefits of the health apps interventions:

- **Affordability:** Health apps' only big investment is the development cost, afterwards the maintenance cost is low. It is evident to say that health apps are cheaper than face-to-face interventions. Research has been done into the costs and advantages of digital health interventions. It showed that 74% of the studies they have looked at had a positive result about how these interventions are good value for money, however, they have also noticed that some important financial details were missing in these studies.
- **Scalability**: Health apps have great potential to expand digital interventions and to target large audiences, however, in person interventions requires a tangible place, logistics and staff. All of this requires a big cost to manage. Hence, it can be clearly seen that in this digital era, digital interventions have more potential to be scaled up to large audiences.
- **Flexibility**: Health apps are unique in the way that they are accessible all the time and from any location. It only requires an Internet connection. It saves the user from face-to-face interventions, which not only save their transport cost but also it saves user to follow a specific time and pace for the appointment. Health apps provide flexibility by providing users an opportunity to book appointments according to their unique schedule. This feature is particularly important for those users who have more work and little time for themselves.
- **Tailoring and personalization**: Tailoring interventions via health apps also empowers users to take a more active role in their healthcare (Helbostad et al., 2017). With the ability to customize the app settings, users can set goals, track

progress, and receive feedback that is aligned with their specific health objectives. This sense of ownership over their healthcare journey fosters a deeper commitment to interventions and promotes a more holistic approach to well-being.

- **Interactivity**: Digital apps are more interactive than things like leaflets and booklets. Apps provide different features to engage users with the application. The interaction can be in the form of chatting with other users or healthcare professionals. Moreover, when a user is using the app, it can still be interesting because the user can do things like tap on the screen and the screen changes to keep the attention of the user. Advertising of different medical products can keep the user engaged.
- **Anonymity:** Anonymity for some people is very important because of many reasons such as anxiety, depression, self-harm scars and many others. For people with sensitive health concerns, health apps provide them with increased anonymity to make them feel comfortable. People will feel more comfortable in downloading an app rather than seeking face-to-face interventions. A study was done on why people use digital health tools, which showed that it is a big deal to make the users feel that they can keep their health concerns private, especially for problems like mental health and sexually transmitted diseases.
- **Widespread availability**: According to a report by Silver (2019), there are 5 billion people with mobile devices and over 2.5 billion of these have smartphones across the work. Moreover, in developed countries 76% of people own smartphones. Among younger population like those aged between 18 and 34 years in developed counters, almost 90% of them have smartphones. It is important to mention that older people of age 50 and above have lower smartphone ownership percentage which is about 55 percent in advanced economies. However, since 2015 this gap of ownership percentage between youngster and old people is narrowing down. It is also notable that the percentage of people having smartphones can be different from one country to another country. For example, as compared to the percentage of developed countries, only 45% of people have smartphones ownership in developing countries.

## 2.5 Disadvantages and Challenges of Delivering Interventions via Health Apps

While health apps offer many advantages and benefits, it's important to acknowledge that it has many significant challenges and limitations which should be taken into consideration when delivery health interventions through mobile technology (Davies & Mueller, 2020).

### 2.5.1 Lack of regulation:

The main concern about these health apps is that there is no official department who can check the accuracy of the content provided by these apps. It implies that one cannot guarantee the accuracy and safety of the interventions provided through these apps. In the contemporary world anyone who knows how to build an app can develop it and upload it on the app stores without any requirements for medical quality control. There are number of examples of such poor-quality health apps, for instance, a study was done by Taki and his colleagues (2019) on apps related to infant feeding. They carefully evaluated 46 apps, and it was shocking to know that 78% of them were considered poor quality and no app was rated excellent. It is to be noted that these apps had issues related to navigation, their design, readability and accessibility especially for people with visual impairments. Lack of regulation can lead to ineffective health intervention. Many such cases have been seen where due to lack of regulation lead to serious negative results. Take, for example, an app related to pregnancy and diet app that encourage pregnant women to include salmon and mackerel in their diet during pregnancy. However, the app does not mention that it is important to consume these in moderation as they can have harmful substances like dioxins and polychlorinated biphenyls. Another example includes apps that claim to provide accurate estimate of blood alcohol concentration and help users in making decision whether they are fit to drive or not. By this they claim to promote safer consumption of alcohol by the users. However, such apps do not have the capability to give accurate estimates regarding blood alcohol concentration. It is important to mention that to address such issues, there are initiatives to provide citizens with quality-controlled health applications like NHS Apps Library of the UK National Health Service which aims to mitigate such issues. This library has apps that meet the standards drafted by NHS Digital, which ensures that these apps are safe, secure and have technical stability.

### 2.5.2 Lack of face-to-face contact:

Remote consultations and support help the patients a lot by saving their time and in conditions when there are emergencies, or the patient cannot be moved easily from one place to another. However, one cannot deny the value of in-person interaction between doctor and patient. There are many cases when physical examinations are necessary to diagnose the disease and to build a trustful relationship between doctors and patients as discussed by Stevens (2019). Such face-to-face intervention force patients to follow the prescription as it is instructed by the doctor because in their mind, they know that they will be answerable to their doctors. Lack of face-to-face intervention may lead to decrease in compliance with treatments. However, we cannot overlook the research that shows that healthcare given by face-to-face interventions or by through digital means, does not really affect the health outcomes, trust factor, or professional practices. For instance, research was done by DeNicola et al., (2020), he conducted a study in which he compared web-based interaction with in-person interventions for gynecological health problems. His study found no differences in the interpersonal relationship, the decision-making factor or the exchange of information between doctor and the patients.

### 2.5.3 Digital divide:

According to study by Makri (2019), it is noted that there is digital divide between different population groups, meaning they do not have equal access to the digital technology. For instance, developed and developing countries have a huge gap between the ownership percentage of smartphones. Makri noted that half of the world's population still does not have access to the internet. Moreover, even if a region has equal access to technology, there are other barriers which may create further issues. For instance, a high level of health or medical literacy is often required for using such digital health applications. As mentioned above, this digital divide can be seen on a global scale. A study by International Telecommunication Union (2017) showed that in developed countries, about 81% population have access to the internet and in contrast to that, only 41.3% of people in developing countries use internet. Other than lack of access to the internet or smartphones, there are other issues for different user groups which creates barriers in using such apps. For example, people who are unable to read and write need an application with Speech-to-text or text-to-speech features, but most apps do not have these functionalities. Furthermore, Harper and his colleagues (2020) stated that there are some people with health problems that make it harder for them to move, think or see. Such issues make it more difficult for them to use smartphones and health apps. In another study done by Silver (2019), it is mentioned that older, less educated and people of low

financial status are less likely to buy a smartphone. That makes it harder for them to take proper healthcare and thus have more health issues than other people. It is important to note that such digital divide may increase the gap between people's health even bigger, that is, people with low access to such apps and have health issues might become sicker and this can lead to increase in health inequalities.

### 2.5.4 Rapid change of technology vs. slow pace of evidence-based development and evaluation:

In addition to the lack of regulation, it is really hard to find apps that are proven to work as to find such apps, one has to follow lengthy processes involved in the evaluation of apps and to share the result through proper channel. When academic institutions or experts want to evaluate such apps, they find many hurdles such as from applying for fundings to do the testing and requires months or even years to publish their findings. It is noticeable that technology is changing rapidly, digital devices are evolving day by day. Same goes for the digital applications, and when one is finished evaluating such application, the technology used in the app might already be outdated, resulting in no proper findings.

### 2.5.5 Data security concerns:

Using health applications may sometime cause security concerns for the users. As such apps often require providing personal and sensitive data by the users. Personal data includes name, contact details, age, gender, blood group, weight and address of the users. Such information is stored in the user's own device, however in many cases, this data is stored in the databases of the health apps. Such databases might be hacked, hence increasing the risk of data breaches. That data can be used for harmful purposes and thus raises data security concerns. For example, research shown by Griffiths and his colleagues (2017), showed that digital communication between doctor and patient has a risk of sharing sensitive information. There is a high chance that someone can hack into their conversation, or the data or information can be sent to another person accidentally. All of these issues raise data security concerns. There are existing laws to protect data such as European Union's General Data Protection Regulation (GDPR) and set of guidelines to follow good practices, however, mostly such apps do not follow such regulations and guidelines thus creates serious data privacy risks.

### 2.5.6 Resistance to implementation:

It is mentioned by Wu (2022), that such health apps might not get acceptance by many people, even including healthcare workers. The reason can be the concerns about the

accuracy of such apps. For instance, healthcare workers might raise the factor that such apps do not meet the guidelines for good practice, or it can be time consuming and may disrupt the flow of the whole organization. Moreover, it is also possible that the patients may also resist using these apps. They might think that the apps are not effective and do not help in improving their health because of the widely known fact that these health apps are not accurate. Moreover, they might think that these apps are harmful for their health because of the inaccuracy of such apps.

### 2.5.7 Technical failures:

There is another factor which creates serious issues regarding patient safety, that is, technical failure. During digital communication between doctor and patient, the health app might crash which can compromise patient's safety if he is in serious condition. One such study was done by Griffith and his colleagues (2017), they evaluated how people with long-term disease use such applications to communicate with their healthcare professional. They found that such communications are prone to be affected by technical issues such as not having a good internet connection, app crashing, battery failure or there is not enough space in the device to record content. Moreover, in another study which was done by Reade and his partners, they tested an app whose purpose was to track chronic pain, physical activity and weather data. It was noticed that people started to leave the application very quickly as the app used up battery really quick because it was constantly collecting data. This meant that the user could lose their data and thus it led to user disengagement.

### 2.5.8 High dropout:

Another issue of such apps is that they have a high dropout ratio. It is clearly seen that these apps can be accessed very easily and mostly they are free of charge but still not many people stick to them for long. In the study done by Böhm et al., (2020), shows that users usually decide whether they will stick to the app or not within the first 3 to 7 days and most apps lose more than three quatres of their users just 3 days after they are downloaded. Another research done by Hermsen (2017), stated that after 3 months, only 5% of the users can be seen using such application. There are many applications on app stores but there are only few applications which can keep people engaged for a long period.

# 3. PRE-DEVELOPMENT INTERVIEWS

In contemporary society, there is a growing recognition of the need to enhance the usability of products and services for individuals leading hectic lives. This research is dedicated to the optimization of mobile health applications, with a specific focus on tailoring them to cater to the unique requirements of office workers who are constrained by time. For this reason, the researcher aimed to collect valuable information of office workers on the usability and design of applications specially catering to the physical activity of the workforce. In the pre-development pilot study chapter, the focus revolves around the strategic step of conducting interviews prior to the actual development of the mobile health application. This crucial phase is introduced with an emphasis on the significance of user interviews in informing and shaping the subsequent stages of the research. The MECE (Mutually Exclusive, Collectively Exhaustive) framework is employed to ensure a comprehensive and organized approach to the methodological structure. The chapter further expounds on the intricacies of the research design, providing insight into the thought process behind the choice of methodology and a clear rationale for the utilization of interviews. By detailing the background questions, consent form inquiries, and main interview topics, the chapter establishes a robust foundation for the subsequent investigation. The overarching goal is to elucidate the meticulous structuring of the methodology employed in gathering essential insights that contribute to the informed development of the mobile health application Furthermore, this chapter provides an in-depth analysis of how the methodology is structured. By delineating a clear and coherent path, it plays a pivotal role in creating a robust research design. This, in turn, ensures that each step is logically and seamlessly linked to the next, thereby upholding the overall integrity of the study.

To embark on this exploration effectively, it is essential to emphasize the profound importance of conducting user interviews. Engaging with potential end-users offers invaluable insights, providing a deeper understanding of their preferences, challenges, and specific requirements (Rough & Quigley, 2020). By incorporating user perspectives into the design process, mobile health applications can be finely tuned to meet the exacting demands of the target demographic, thus greatly enhancing their usability and overall effectiveness.

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## 3.1 Research Design and Methodology

The following chapter outlines the research methodology employed in this thesis, which aimed to gain insights into the requirements and preferences of office-strapped workers concerning a health exercise application. To achieve this, a comprehensive interview plan was developed, consisting of background questions and main interview questions. These interviews served as a vital data collection method to understand the expectations and challenges of potential users in the context of mobile health applications.

In this context, a qualitative approach, predominantly centered around in-depth interviews, was employed to delve profoundly into the perceptions and experiences of office workers constrained by time. This qualitative methodology is particularly well-suited to capture the nuanced intricacies of their preferences and needs (Robinson, 2019).

The rationale behind selecting interviews as the primary method of data collection rests on its exceptional capacity to elicit rich, context-specific information. Interviews offer a dynamic platform for respondents to articulate their viewpoints, allowing for the comprehensive exploration and understanding of the subject under investigation (Clark, 2018).

## 3.2 Background Questions or Consent Form Questions

The initial set of questions included background inquiries (See appendix E for more information) to establish a baseline understanding of the interviewee's demographics and general attributes. These questions provided a foundation for categorizing and analysing the data.

- **Age**: One of the fundamental demographic aspects is the age of the participants. Age can significantly influence digital literacy, preferences, and overall experience with mobile health applications.
- **Nationality**: Understanding the nationality of the participants helps identify potential cultural differences that may affect their expectations and needs in a health exercise app.
- **Gender**: Gender plays a role in determining specific health and fitness goals, as well as potential variations in app preferences between different genders.
- **Work Experience**: Since the app was specially designed for office workers. Time strapped office workers were recruited for this study for a better understanding of the end users.

In adherence to sound scientific practices and ethical considerations in user research, the pre-development interviews underscore the commitment to protecting participants' privacy and upholding ethical standards throughout the research process. A paramount aspect of this commitment is the incorporation of informed consent, as detailed in the following appendix (Appendix A, B & C). The narrative emphasizes the conscientious approach to user interviews, ensuring that participants are fully informed about the study's purpose, procedures, and potential impacts. By explicitly following ethical guidelines, including privacy protection measures, the study maintains a rigorous commitment to good scientific practice. This holistic approach is vital in fostering a research environment that not only elicits valuable insights but also upholds the ethical responsibility towards the participants involved in the study.

## 3.3 Main Interview Questions

The primary section of the interview encompassed a series of questions designed to delve into the participants' experiences, challenges, and expectations regarding mobile health applications. These questions were instrumental in identifying the key factors that influence their decision-making processes.

- **Comfort with Mobile Devices and Digital Literacy**: Investigating the level of comfort with mobile devices and digital literacy was critical to understanding the participants' technological proficiency. Some of these are: “How comfortable are you with using mobile devices in general? Do you consider yourself to have a high level of digital literacy, or do you face any difficulties with technology?”
- **Experience with Mobile Health Applications**: Participants were encouraged to discuss their experiences with mobile health applications, specifying which applications they had used and the motivations behind their usage.
- **Challenges and Difficulties**: The identification of challenges and difficulties encountered when using mobile health applications shed light on areas that may require improvement in future app designs. These include questions like: What challenges or difficulties have you encountered when using mobile health applications?
- **Useful Features and Benefits**: This question aimed to identify specific features and aspects of mobile health applications that participants found valuable for their health and well-being.

- **Confusing Features and Navigation Difficulties**: Identifying features and functionalities that users found confusing or difficult to navigate was essential in pinpointing areas for potential enhancement.
- **Decision-Making Criteria**: Understanding the factors influencing participants' decisions to download and continue using a mobile health application provided insights into the criteria that shape user choices.
- **Accessibility Challenges**: This question aimed to reveal any accessibility issues faced by users, including difficulties in accessing certain features of mobile health applications. These include questions such as: Have you ever encountered any accessibility issues or challenges when using mobile health applications? Can you provide examples or describe any difficulties you faced in accessing or using certain features?
- **Privacy and Security Concerns**: Participants' concerns regarding the privacy and security of mobile health applications were explored to gauge the significance of these factors in app selection.
- **Unmet Needs and Suggested Improvements**: Users were asked to describe instances where mobile health applications did not meet their needs and to suggest improvements for usability and user experience enhancement.
- **Ideal Mobile Health Application for Office Workers**: The final question encouraged participants to envision an ideal mobile health application tailored for office workers and highlight the features, functionalities, and design elements they would prioritize. Sample questions included: How do you envision an ideal mobile health application designed specifically for office workers? What features, functionalities, or design elements would you prioritize?

The data collected through these interviews were instrumental in shaping the subsequent chapters of this thesis, providing valuable insights into the design and development of a health exercise app that effectively caters to the needs of office-strapped workers. The analysis and synthesis of the data will be presented in subsequent chapters, contributing to a comprehensive understanding of the subject matter.

## 3.4 Study Process:

For the initial user study, interviews were conducted through two modes i.e., online interviews and face to face interviews. Online interviews were conducted through teams meeting or Zoom meeting and they were audio recorded while face to face interviews

were conducted in the common room of the residents housing. Both online and face to face interviews were audio recorded, the introduction about the topic and other necessary information about the interviews were explained to participants before the start of the interview and the recording was started when the actual interview questions started. The main reason for the face-to-face interviews was that the face-to-face interviews were more interactive, and participants also looked more involved and interested in the process. More detailed responses were observed in face-to-face interviews compared to remote interviews, which helped me to aim at the right information and right details. On the other hand, remote interviews were easy to audio record and both the audio recording and automatically generated transcripts were analyzed later for documenting the final transcript.

Interview analysis has been done using 'Thematic analyses' method to get more details. Thematic analysis has been widely used for analysis of qualitative data. It is a form of qualitative analysis that is used to categorize data and highlight themes or patterns. Thematic analysis is alike content analysis, but it involves more in-depth, explicit analysis of the meaning of the data compared to content analysis. Thematic analysis is considered as a suitable method for any study that aims to find different interpretations within the data. Qualitative research requires recognizing and collecting many elements and facts, and the ability to understand the potential of any topic more comprehensively is afforded by thematic analysis (Marks & Yardley, 2004) To analyze data, user interviews are transcribed, main findings are extracted, and several themes are defined.

In Table 1, Participant Information, a detailed overview of the diverse demographics of the study participants is presented. This tabulated information provides key insights into the cohort, including participant IDs, ages, genders, nationalities, and the mode of interview employed. The dataset encompasses a range of cultural backgrounds and interview modalities, offering a comprehensive view that contributes to the richness and diversity of the study. Each participant's unique profile adds depth to the subsequent analysis and interpretation of findings, allowing for a nuanced understanding of the varied perspectives and experiences that shape the research outcomes. This participant information serves as a foundational reference for the subsequent thematic analysis, connecting individual experiences to broader trends and patterns within the study on mobile health application usage.

**Table 1: Participant Information:**

| ID | Age | Gender | Nationality | Mode of Interview |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 01 | 25 | Male | Pakistani | Online |
| 02 | 30 | Female | Indian | Online |
| 03 | 24 | Male | German | Online |
| 04 | 32 | Male | Swedish | Online |
| 05 | 27 | Male | Pakistani | Face to Face |
| 06 | 29 | Male | Pakistani | Face to Face |
| 07 | 28 | Male | Bangladeshi | Online |
| 08 | 35 | Male | Finnish | Online |

## 3.5 Result of Pre-Study Development Interviews

Following the comprehensive interviews conducted in the pre-development pilot study, a meticulous thematic analysis was undertaken to distill and interpret the wealth of information gathered. This analytical phase serves as a crucial bridge between the raw data acquired through user interviews and the meaningful insights derived from it. Thematic analysis allows for the identification and exploration of recurring patterns, themes, and nuances embedded in participants' responses. Through a systematic and rigorous approach, the study endeavors to unravel the multifaceted motivations, challenges, preferences, and expectations expressed by the diverse participant cohort. This analytical depth not only enhances the validity of the findings but also enriches the narrative by presenting a nuanced understanding of the users' perspectives on mobile health applications. The following section provides a detailed exposition of the thematic analysis results, offering a comprehensive synthesis that aligns with the overarching research objectives and contributes to the broader discourse on mHealth app usability and user experience. The analysis is first described in a general way to provide the overarching theme, followed by the individual responses given. Limitations and implications of the analysis of that particular theme based on the responses concludes the analysis.

## Theme 1: Motivation behind Use of Mobile Health Application

*Description*: Theme 1 explores the motivations that drive users to engage with the mobile health application. Participants expressed various reasons for using the app, including fitness goals, activity tracking, progress monitoring, and wellness. Motivation is a central aspect of user engagement.

Participant ID1 seeks to improve overall health and fitness despite a busy office schedule.

Participant ID2 uses the app to track both menstrual cycles and daily activity, finding motivation in hitting daily step goals.

Participant ID3 uses the app for progress monitoring and motivation.

Participant ID4 values goal setting and achievement records, along with reminders for activities like drinking water and stretching.

Participant ID5 aims to maintain a healthier lifestyle alongside daily routines.

Participant ID6's motivation includes improving overall fitness and tracking daily calorie intake, as well as incorporating mindfulness practices for well-being.

Participant ID8 appreciates the app's goal-oriented features.

**Implications**: Understanding the diverse motivations behind using the mobile health application can help tailor the app to better meet the individual goals and needs of users. Different users seek the app for various reasons, ranging from fitness and progress tracking to stress management, and the app can cater to these distinct motivations.

**Limitations**: The limitations may include the potential for users not fully disclosing their motivations or the limited scope of motivations covered in this theme.

**Conclusion**: Theme 1 underscores the importance of recognizing users' motivations for engaging with the mobile health application. These motivations drive user engagement and inform the features and design elements that are most relevant and appealing to different user groups. Future research can delve deeper into understanding how these motivations affect long-term app usage and the effectiveness of the app in helping users achieve their goals.

## Theme 2: Challenges Encountered in Mobile Health Applications

*Description*: Theme 2 focuses on the challenges that users encounter when using mobile health applications. Participants highlighted various issues related to data input, information overload, scheduling difficulties, workout plans, app selection, manual data entry, user interface, premium subscriptions, and data synchronization.

Participant ID1 found it challenging to input data accurately due to time constraints, especially during a busy schedule.

Participant ID2 felt overwhelmed by the amount of information and tasks required to maintain the app's recommendations.

Participant ID3 mentioned the difficulty in establishing a consistent routine when starting from scratch.

Participant ID4 expressed challenges in adhering to scheduled activities, particularly during work hours.

Participant ID5 struggled with prescribed exercise plans, especially when they were new to the gym.

Participant ID6 highlighted the challenges of app selection, manual data entry, and user interface issues.

Participant ID7 mentioned challenges related to premium subscriptions.

Participant ID8 experienced synchronization problems with smart devices, hindering data transfer.

**Implications**: Theme 2 sheds light on the common challenges faced by users when engaging with mobile health applications. These challenges encompass issues related to time management, information overload, consistency in routines, workout plans, app selection, data entry, user-friendliness, and technical obstacles. Understanding these challenges can guide app developers in addressing user concerns.

**Limitations**: The limitations may include the specific challenges identified in this study, and other studies may reveal additional or varying challenges.

**Conclusion**: Theme 2 emphasizes the importance of recognizing and addressing the challenges users face when interacting with mobile health applications. By acknowledging these hurdles and seeking solutions, app developers can create more user-friendly and effective platforms. Future research can delve deeper into specific solutions and strategies to mitigate these challenges, improving the overall user experience.

## Theme 3: Useful Features of Mobile Health Applications

*Description*: Theme 3 highlights the features of mobile health applications that users find beneficial and valuable for their health and well-being. Participants mentioned specific features that they appreciated and found useful in these apps.

Participant ID1 found features such as step tracking, meal information (calorie tracking), and workout plans to be beneficial.

Participant ID3 highlighted the importance of progress tracking over the months as a source of motivation.

Participant ID4 mentioned the utility of heart rate monitoring and setting warnings based on body mass index.

Participant ID5 appreciated health monitoring features, including heart rate and daily step counts, along with the ability to set weekly or monthly health goals.

Participant ID6 valued health tracking, including sleep patterns and step counters, as well as features like reminders and personalized goal setting.

Participant ID7 specifically mentioned using the BPM (Beats Per Minute) feature to track stress levels and blood pressure.

**Implications**: Theme 3 underscores the significance of offering a diverse range of health-related features in mobile applications to cater to the varied needs and preferences of users. Users find value in features related to activity tracking, meal information, progress monitoring, heart rate, sleep patterns, and personalized goal setting.

**Limitations**: The limitations may include variations in feature preferences among users, as what is considered useful can differ from person to person.

**Conclusion**: Theme 3 emphasizes the importance of including a variety of useful features in mobile health applications. These features can help users in their health and wellness journey and can contribute to the overall user experience. By offering a well-rounded selection of features, app developers can better meet the diverse needs and goals of their user base. Future research can explore the impact of these features on user engagement and health outcomes.

## Theme 4: Features Hard to Understand and Navigate

*Description*: Theme 4 delves into the features of mobile health applications that users find difficult to comprehend and navigate. Participants pointed out specific aspects of these apps that posed challenges related to usability and clarity.

Participant ID1 mentioned that it's not always clear how to use certain features, particularly in terms of setting personalized plans. Additionally, they found it challenging to locate relevant information quickly due to cluttered interfaces in some apps.

Participant ID2 noted that the abundance of information and the complexity of navigating between different features could be challenging.

Participant ID4 and ID6 highlighted the difficulty of finding specific sports, like squash or badminton, within the app's categorization, requiring multiple steps to locate them.

Participant ID5 and ID8 found certain aspects confusing, such as the lack of guidance for setting customizable goals or performing specific exercises.

**Implications**: Theme 4 underscores the importance of user-friendly interfaces and clear, intuitive navigation in mobile health applications. Users may be discouraged from using apps that have complex or poorly explained features, hindering their overall experience.

**Limitations**: The limitations may include variations in user preferences and technical proficiency, as some users may find certain features easier to understand and navigate than others.

**Conclusion**: Theme 4 highlights the significance of ensuring that mobile health applications are user-friendly and feature transparent navigation. Providing clear instructions, reducing complexity, and improving interface design can enhance user satisfaction and engagement. Future research can focus on assessing the impact of user-friendly features on app adoption and long-term usage.

## Theme 5: Factors Influencing the Download and Continued Use of an Application

*Description*: Theme 5 explores the key factors that influence users' decisions to download and continue using a mobile health application. Participants shared insights on what aspects, such as user reviews, ratings, usability, privacy, and the presence of ads, impact their app adoption and retention.

Participant ID1 highlighted the significance of user reviews and ratings, as well as the app's user-friendliness and performance in fulfilling its intended purpose.

Participant ID2 emphasized the importance of an app being easily digestible and not overwhelming, allowing users to pace themselves without feeling overburdened.

Participant ID3 considered the app's rating and the number of stars it received from previous users as significant factors.

Participant ID4 pointed out the critical role of privacy considerations in their decision to use an app.

Participant ID5 regarded both user reviews and ratings as crucial, with an emphasis on the informative nature of reviews.

Participant ID6 checked the app's reviews and reputation, ease of use, customization options, and offline functionality.

Participant ID7 expressed a dislike for applications containing ads, especially when ads were necessary to access certain features.

**Implications**: Theme 5 underscores the importance of user perception, privacy, usability, and an ad-free experience in the success of a mobile health application. These factors play a pivotal role in attracting and retaining users.

**Limitations**: The limitations may include variations in user preferences, as different users may prioritize these factors differently when deciding to download and continue using an app.

**Conclusion**: Theme 5 emphasizes the need for mobile health applications to focus on factors that influence users' download decisions and ongoing engagement. By prioritizing aspects such as positive reviews, high ratings, user-friendliness, privacy, and a smooth, ad-free experience, app developers can increase their app's appeal and user retention. Future research can explore the interplay of these factors in app success and user satisfaction.

## Theme 6: Accessibility and Privacy Concerns

*Description*: Theme 6 explores the significance of accessibility and privacy concerns in the context of mobile health applications. Participants discussed their views on the critical nature of safeguarding personal data, the importance of privacy policies, and how accessibility issues, such as small fonts and complex navigation, can impact the user experience.

Participant ID1 stressed the importance of privacy due to the personal data shared in health apps, including health information, daily routines, and location.

Participant ID2 considered privacy a matter of personal and individual safety, deeming it highly important.

Participant ID4 highlighted the time spent on reviewing privacy policies and understanding where the data goes, emphasizing its significance.

Participant ID6 and ID5 shared concerns about privacy and security in their use of mobile health apps.

Participant ID6 also noted issues related to accessibility, including small fonts, poor contrast, and small buttons that can make navigation frustrating.

Participant ID7 expressed that they hadn't encountered privacy issues with health applications, as they could choose which data to share.

**Implications**: Theme 6 underscores the critical importance of both privacy and accessibility in mobile health applications. Users are concerned about the safeguarding of their personal data and expect clear privacy policies. Additionally, ensuring that the app is accessible to a wide range of users, including those with visual or navigation challenges, is crucial.

**Limitations**: The limitations may include variations in user privacy concerns and accessibility needs, as different users may prioritize these aspects differently.

**Conclusion**: Theme 6 emphasizes the need for mobile health applications to prioritize user privacy and accessibility. App developers should clearly communicate privacy policies and ensure that the app is user-friendly and accessible to a diverse user base. Future research can explore how user privacy and accessibility are integrated into the design and development of health apps and their impact on user satisfaction and engagement.

## Theme 7: Misaligning with Needs and Improvements

*Description*: Theme 7 delves into users' experiences where mobile health applications misalign with their needs and the potential improvements they suggest. Participants mentioned issues related to excessive notifications and ads and expressed the need for apps to perform their intended purpose. Additionally, they called for more customization options to tailor the app to their unique health journey.

Participant ID1 found excessive notifications and continuous ads annoying and expressed a preference for customizable reminders that align with their schedule.

Participant ID5 stressed the importance of the app fulfilling its intended purpose and recommended that the app work in accordance with the user's body information.

Participant ID6 felt that some apps did not allow them to set their own health goals or preferences, which they found restrictive. They suggested that apps should provide more customization options for users to fine-tune their health journey.

**Implications**: Theme 7 highlights the need for mobile health applications to align closely with users' needs and expectations. Users may become frustrated with apps that inundate them with notifications and ads or fail to meet their intended purposes. Providing customization options can enhance user satisfaction.

**Limitations**: The limitations may include variations in user needs and preferences, as different users may have diverse expectations from health apps.

**Conclusion**: Theme 7 emphasizes the importance of mobile health applications meeting user needs and providing the necessary flexibility for customization. User feedback on excessive notifications and ads, as well as suggestions for aligning the app with their health journey, should be considered in app design and improvement efforts. Future research can explore the impact of aligning apps with user needs on user engagement and long-term usage.

## Theme 8: Envisioning an Ideal Mobile Health Application

*Description*: Theme 8 focuses on participants' visions of an ideal mobile health application. They provided insights into the features and functionalities they would like to see in such an application, including quick and efficient data entry, integration with calendar apps, flexibility, nutrition expert tips, the ability to sync with the user's body, and reminders for physical activity.

Participant ID1 envisions an app with efficient data entry options, voice input, integration with calendar apps, and reminders for stretching and quick exercises.

Participant ID2 desires an app that encourages small movements and breaks, as well as features for nutrition expert tips, community engagement, and informative content.

Participant ID3 emphasizes flexibility, suggesting that the app should provide alternative workouts on busy days.

Participant ID4 prefers calendar synchronization for personalized recommendations based on breaks.

Participant ID5 envisions an app that correlates with the user's body, offers gym alternatives for staying active, and has a user-friendly interface.

Participant ID6 proposes an app that tracks user activities, provides time-based workout suggestions, and includes a community support feature.

Participant ID7 suggests reminders to stand up and tracks prolonged sitting, encouraging users to stay active.

Participant ID8 suggests regular reminders to stand up and perform exercises to combat extended periods of sitting.

**Implications**: Theme 8 reveals the features and functionalities that users consider ideal in a mobile health application. These include integration with daily routines, personalized recommendations, flexibility, user engagement, and proactive reminders for physical activity.

**Limitations**: The limitations may include variations in user preferences for app features, as different users may prioritize different aspects of an ideal health app.

**Conclusion**: Theme 8 provides valuable insights into the features that users would like to see in their ideal mobile health application. App developers can use this feedback to enhance their apps and create a user-centric experience. Future research can explore the impact of incorporating these features on user engagement and the effectiveness of health apps.

# 4. DESIGN OF MOBILE HEALTH APP “HEALTH MENTOR”

Literature review and data analysis from user studies revealed several important factors in terms of the problems being office by office workers even though there are a lot of mobile health applications available i.e., maintaining a consistent exercise routine along with the busy office schedule, finding time to accurately input the data in the application, not having enough guidance to perform some specific tasks or lack of guidance available and several others. So, this means that it’s very crucial to find a solution that will only solve these problems faced by office workers but will also provide them with a better solution to keep track of their fitness and help them stay on a healthy course for a longer period along with motivating them to give more importance to their health.

This cohesive integration of literature and user study insights establishes a foundation for the subsequent discussion, where the design and evaluation of the "Health Mentor" mobile health app are meticulously explored. The ensuing section delves into the development and designing of the application itself based on the thematic analysis discussed in the pervious chapter.

Based on results from the data analysis of the initial user study, the concept design is iterated and transformed into an interactive hi-fi mobile health application design using Figma. In response to the discerning insights drawn from the initial user study's data analysis, the conceptual design of the mobile health application underwent a meticulous iteration process. Iterations involved a systematic evaluation of the previous design versions to identify areas for improvement and refinement. User feedback played a pivotal role in shaping these iterations, with a focus on addressing specific challenges identified in the study, such as maintaining a consistent exercise routine and facilitating user-friendly data input. The iterative process aimed to enhance the overall user experience and align the application more closely with the expressed needs and preferences of the target audience. The culmination of this iterative design process resulted in the development of an interactive, high-fidelity mobile health application using the Figma design platform. The target user group for this health application was supposed to be just office workers but in actual it was beneficial for everyone (as highlighted in the post-development study interviews). Moreover, the user interface of this prototype is designed in a way that is easier to use and understand for everyone while maintaining a clear and intuitive design.

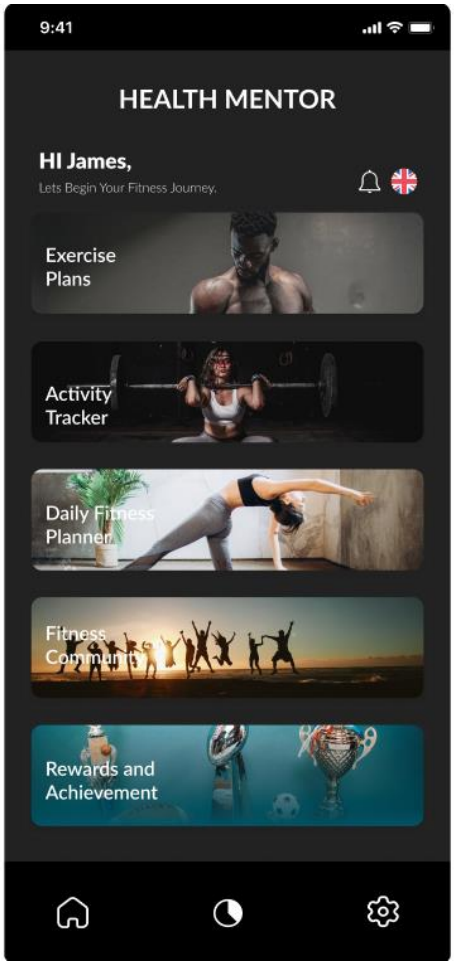


***Figure 3.*** *Home Page of Concept design*

Home page is main page of my concept design application which can be seen in the **Figure 3**, it involves all the main sections with different features and functionalities which includes Exercise Plans, Activity trackers, Daily Fitness Planner, Fitness community and Rewards and achievements. Other than the main features, the home page includes a language icon from where user can change to their desired language, notification icon will notify the user about the new notifications. Menu bar on the bottom of the home page includes home button which when clicked will take the user back to home page from any screen, performance button will show the user daily, weekly, and monthly performance and the settings button will take the user to their profile where they can change the settings etc. The depicted visual representation is a product of the iterative design process and has been created using the Figma design platform.

The home page shows different features which provides different functionalities to the user. The first feature that home page provides is the “Exercise Plans”.

Exercise plans involve multiple exercises that involve exercises without equipment and with equipment both like stretching, workouts and some other options. Users can switch between the sections by just clicking on the name of the exercises they perform. **Figure 4** shows the exercise plans page when the user moves from home page. Exercise plans firstly involves Stretching exercises **Figure 4** which doesn't need any equipment and they can be performed anytime and anywhere. There are multiple exercises for different body parts etc., Each exercise provides the information about the estimated time required to complete the exercise and how many exercises the user needs to perform. When the user clicks on the first exercise as an example i.e., morning warmup a new screen will open as shown in **Figure 5** with the list of exercises user needs to perform and how much time each exercise requires to complete. When clicked on exercise section and an exercise guide page will open **Figure 6**, which will provide the user with all the guidance needed to perform that specific exercise. There will be two visual options of guidance, one is animation and the second one will be a video guidance depending on the user's preference **Figure 6**, there will also be a written description of the exercise and an estimated time for exercise, set automatically but it can be customized if the user feel the need to increase or decrease the time for the exercise. Once user understand the guidance, the exercise can be started which will take the user to the timer screen as shown in **Figure 7**, once done with the exercise, user can press the done button on the bottom of the screen, and it will take the user back to the exercise list page **Figure 5**.

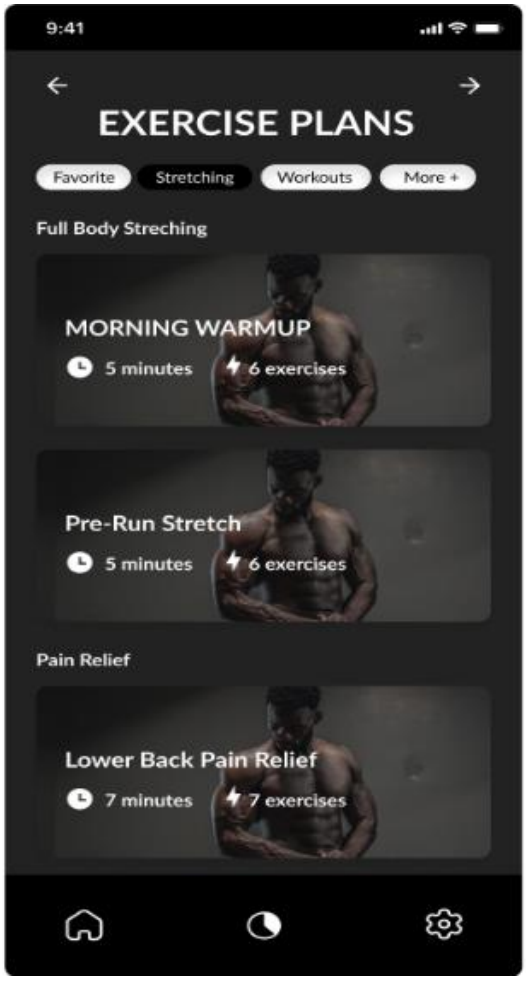


***Figure 4.****Exercise Plans Page Concept Design*

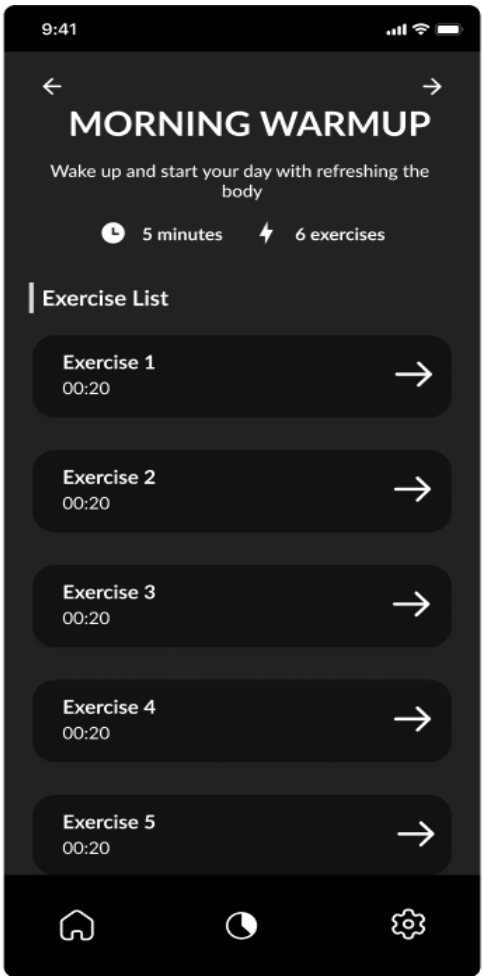


***Figure 5.*** *exercise List Page Concept Design*

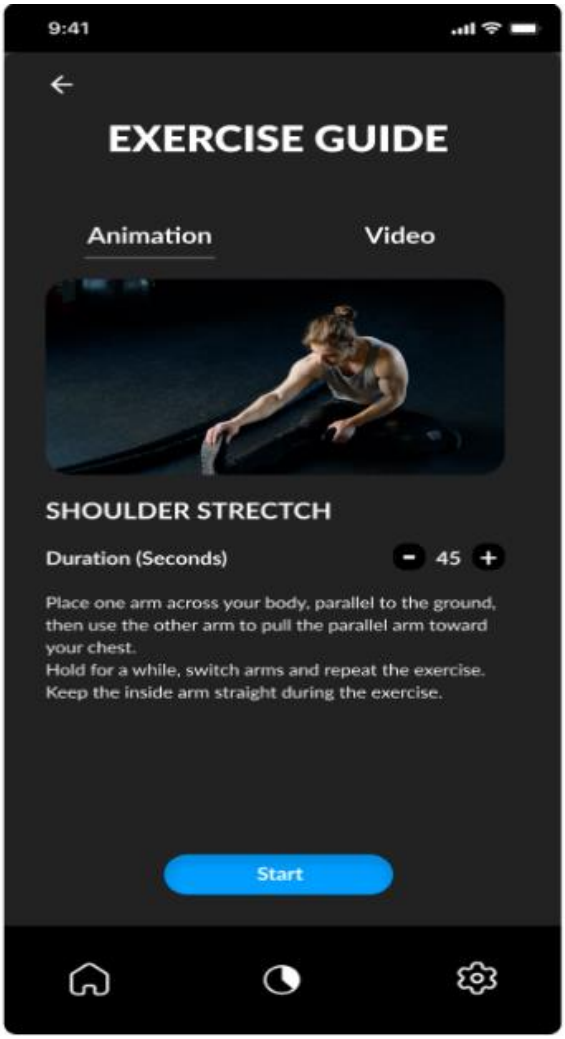


***Figure 6.*** *Exercise Guidance Page Concept Design*

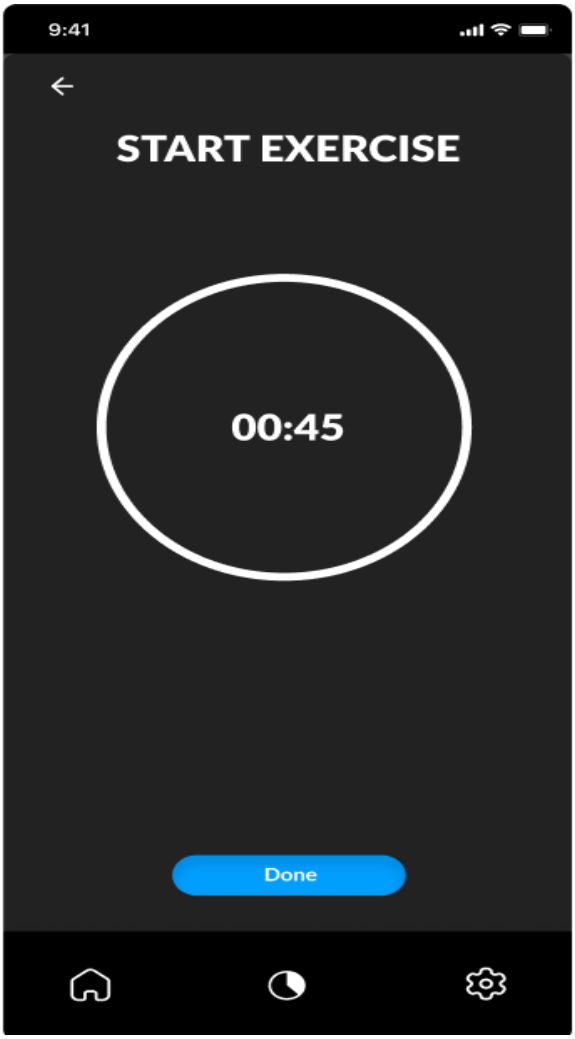


***Figure 7.*** *Exercise timer page Concept Design*

The exercise plans page provides another option for the workouts. What makes it different from the other exercises is that this feature works according to the user's body type and the goal that the user wants to achieve. When the user clicks on the workout option, a new page appears with the user's fitness goal that what users wants to achieve in terms of their body i.e., lose weight, build muscle, or keep fit. When the user selects any of these three options, it leads the users to the next screens, which are user's height, user's weight and user's target weight **Figure 8** which leads user to perform some stamina check exercises as shown in **Figure 9**. There are multiple stamins check exercises which will be available for the user and the user can select any of them to provide their stamins check. Stamina check exercises can be changed which will lead the user to the exercise list page where will user gets the information about exercises i.e., number of

sets and repetitions per set and how much time it's going to take for the whole session, based on the information provided by user and their set target goal as shown in **Figure 9.**

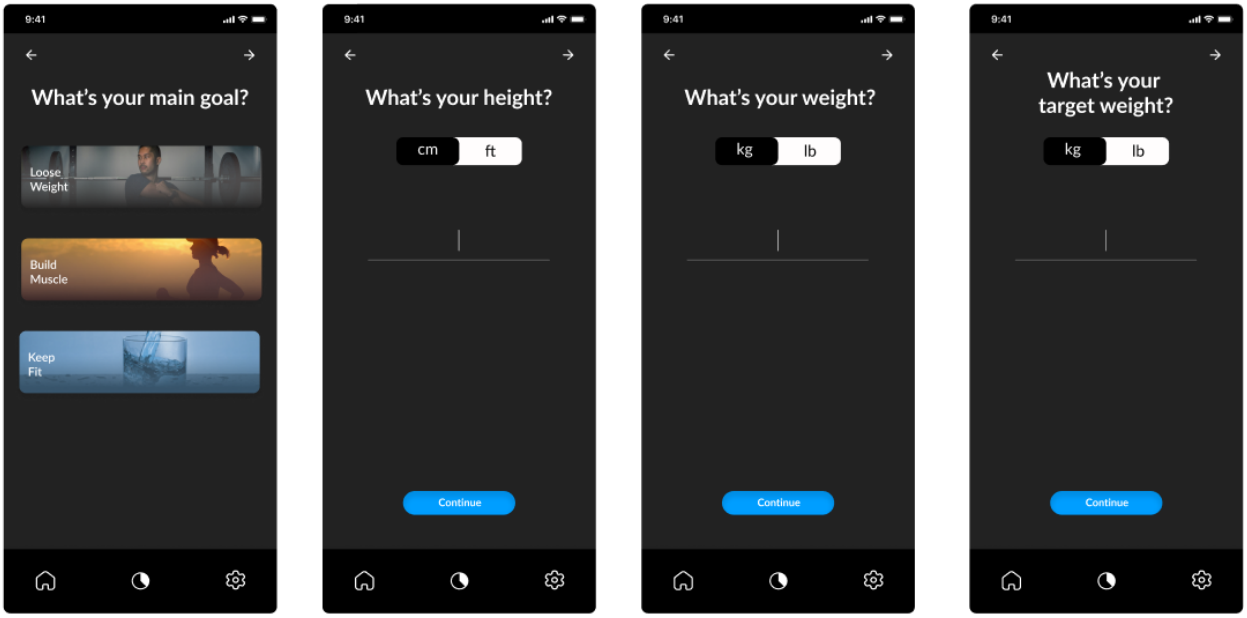


***Figure 8.*** *Fitness Goal Concept Design*

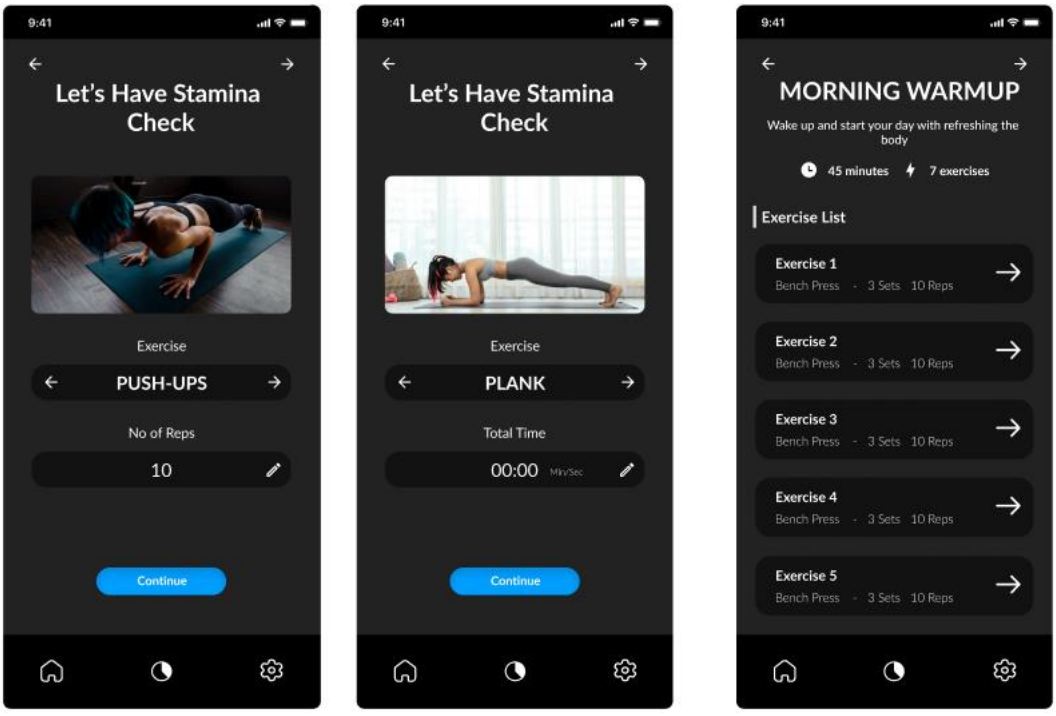


***Figure 9.*** *Stamina Check Concept Design*

The second main feature that concept design provides is the daily activity tracking for the user as shown in the **Figure 3**, there are three main tracking activities that daily activity tracking provides i.e., Activity alert, step counter and water reminders as shown

in **Figure 10**. Activity alert will notify the users when they will be sitting for a longer period of time during office hours, and it will recommend them to perform some quick and affective exercises, so their body has some movement after sitting for a longer period of time. **Figure 11** provides the more detailed functionality of the activity alert. User will be able to customize or set their desired timings for like quiet hours in which users won't get any notifications, users will be able to set their office timings in which user's activity will be checked and they will provide with exercise reminders after a specific interval. Users can adjust the interval timings also according to their own needs. And lastly, the activity alert page will provide the user with the information about the last exercise performed as shown in **Figure 11**. **Figure 12** provides the information about the actual reminder that the user will be provided, and it will provide the user with a recommendation of an exercise that they need to perform and for how long they need to do it along with the textual and visual guidance of how to perform that exercise. Once the user starts to perform the exercise, timer page **Figure 13** will appear that will show how long user needs to do the exercise and once user is done it will take the user back to home page. **Figure 14** provides the information about the daily step tracking activity along with a calendar. Users will be able to see the number of steps that they take in that day, in real time along with the information about the previous record highest steps that they have done in one day. Step counter will also provide the information about the total number calories burned and total distance travelled. Users will also be able to check their previous step counter data of any day from the calendar by selecting the specific date. Water reminder is the third feature that activity tracking will provide as shown in **Figure 15**. In water tracking user will be able to set the time interval after which they will receive a notification about water drinking, it will also provide the user with the remaining time left to their next water reminder and how much water they have already drink.

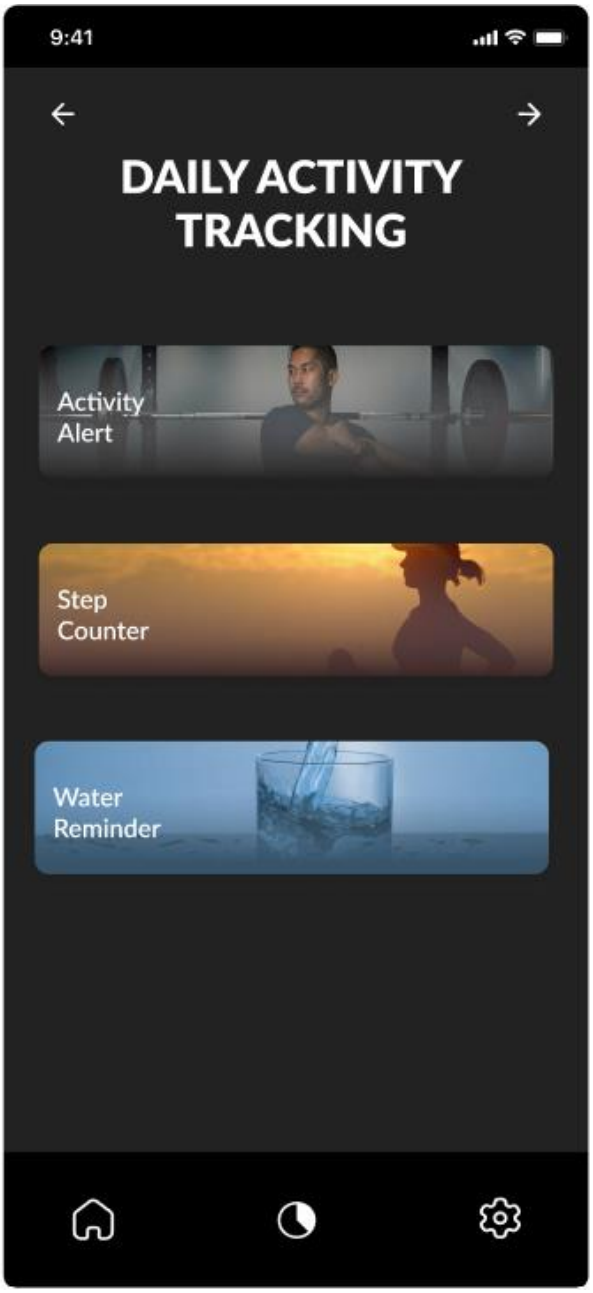


***Figure 10.****Daily activities tracker concept design*

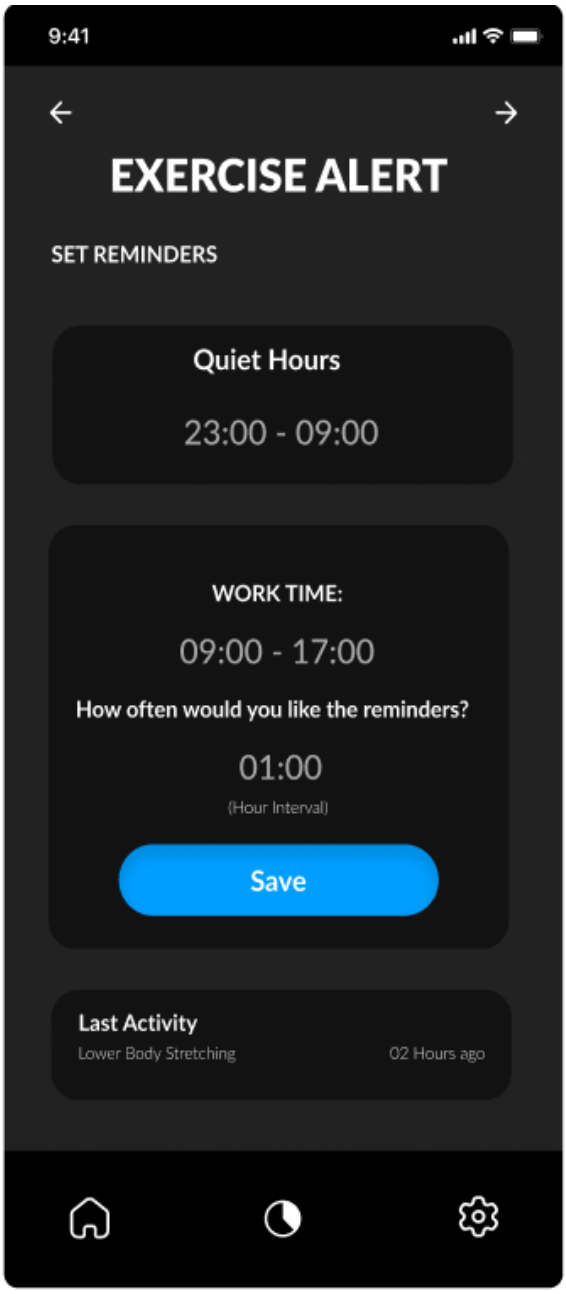


***Figure 11.*** *Exercise Reminder timing customization concept design.*

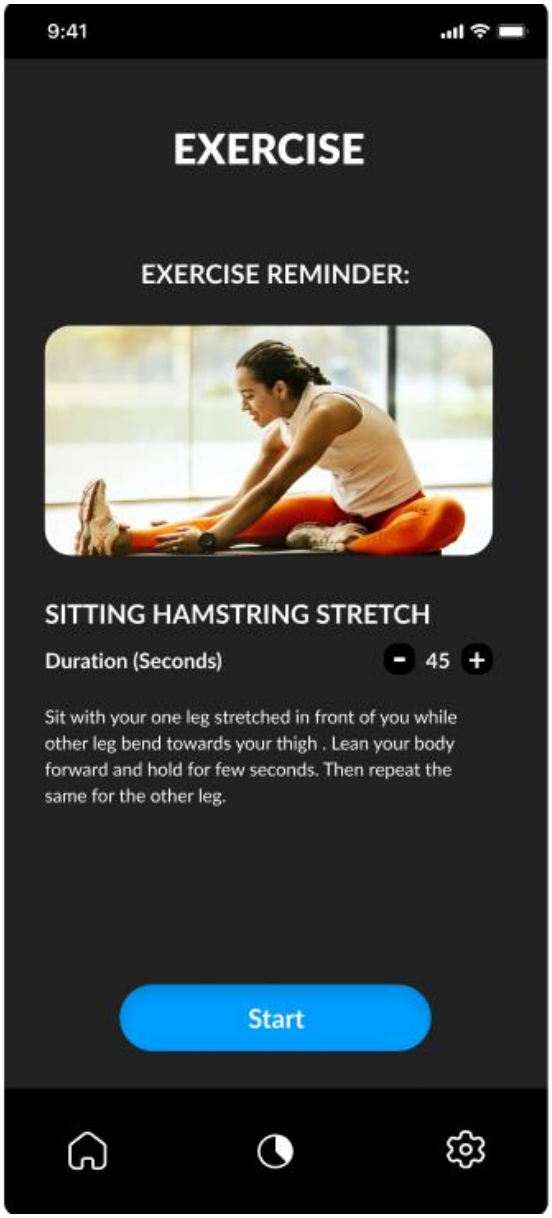


***Figure 12.****Exercise reminder concept design*

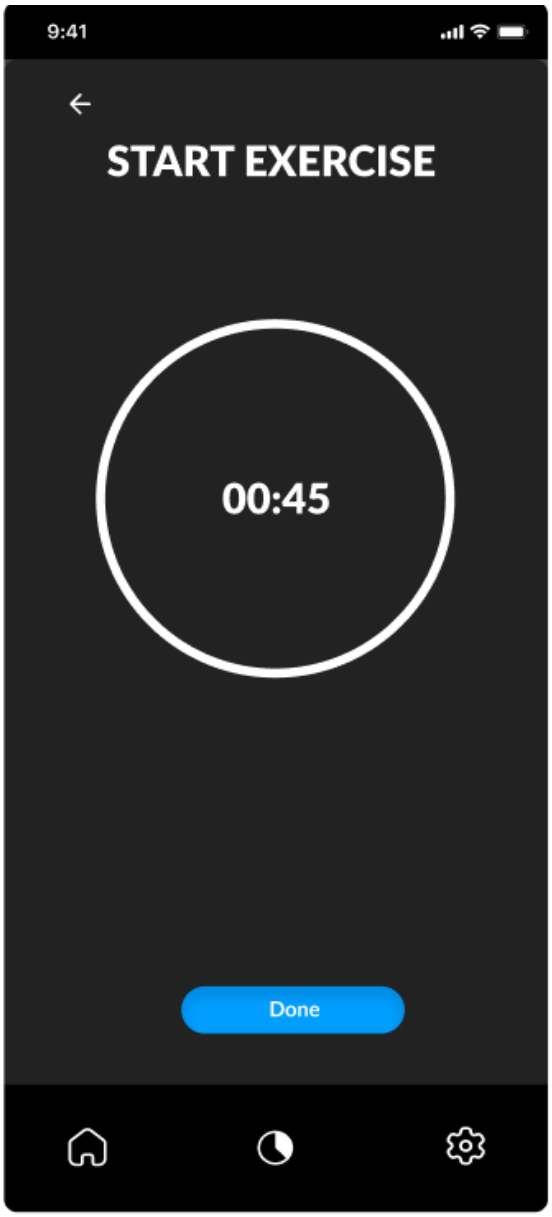


***Figure 13.*** *Exercise timer concept design*

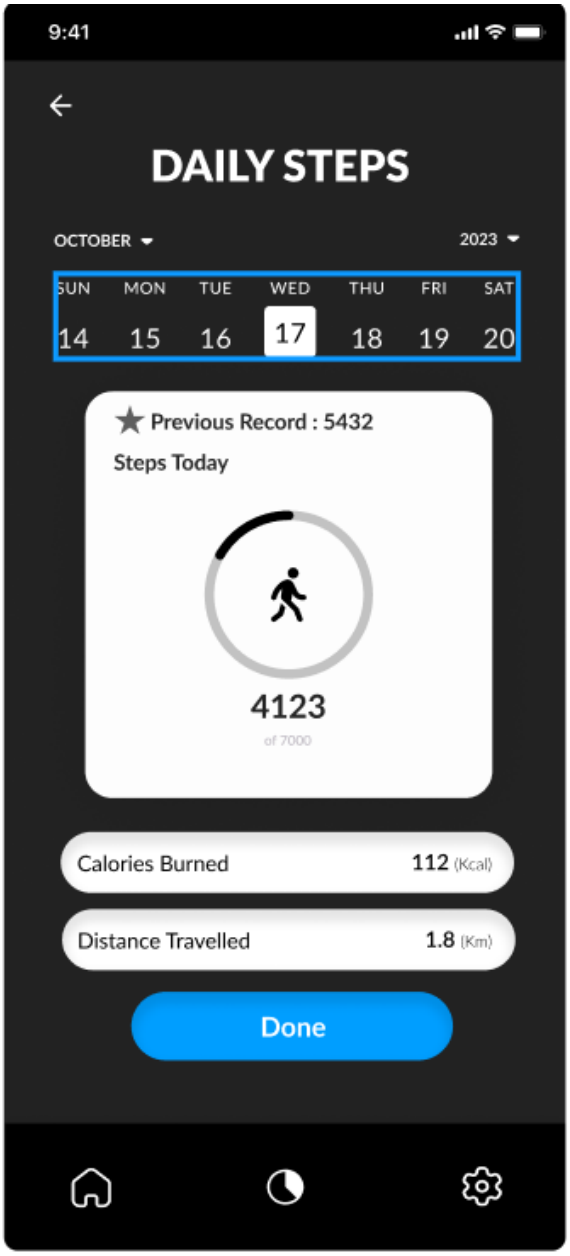


***Figure 14.*** *Step counter concept design*

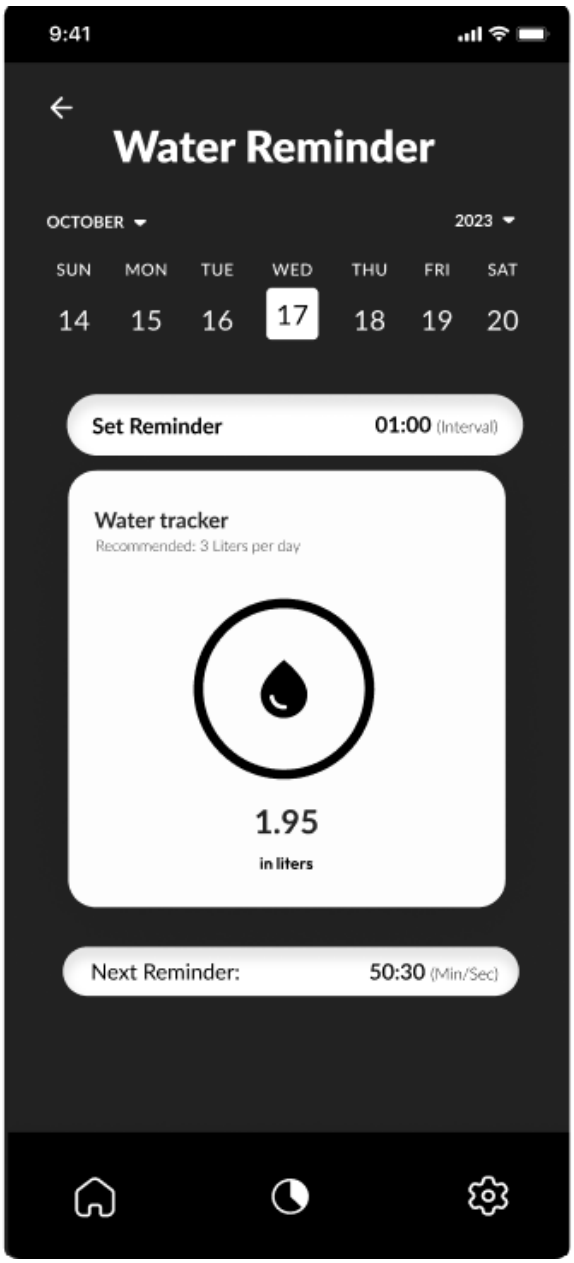


***Figure 15.*** *Water tracking concept design*

The third major feature that the “Health Mentor” provides is the daily activity planner **Figure 3,** in which users will be able customize their calendar and add their daily activities and plan their exercise sessions along with the calendar synchronization with their mobile calendar. Users will be able to set reminders for their desired exercise timings, and if they miss that time, they will have a recommendation for the alternate time. **Figure 16** provides a detailed view of customizable calendar in which user can set their schedule based on their availability for different activities. **Figure 17** shows that if a user had a preset exercise time which he couldn’t follow and missed the exercise on its time, user will get an alternate time recommendation based on user’s schedule and free time to

cover for the missed exercise activity. Another major functionality is the calendar synchronization as shown in **Figure 18**, once calendar synchronization turned own, users' mobile calendar will synchronize with the app calendar and then user will be able to set activities based on that and app will also provide recommendations in sync. **Figure 19** shows where users can edit the activities and save them.

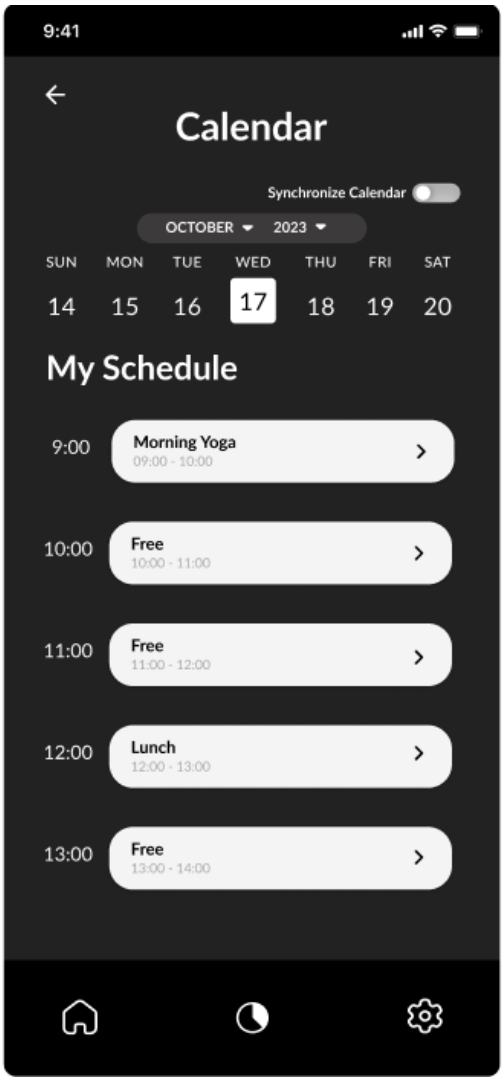


***Figure 16.*** *Calendar showing Added activities and free slots Concept design.*

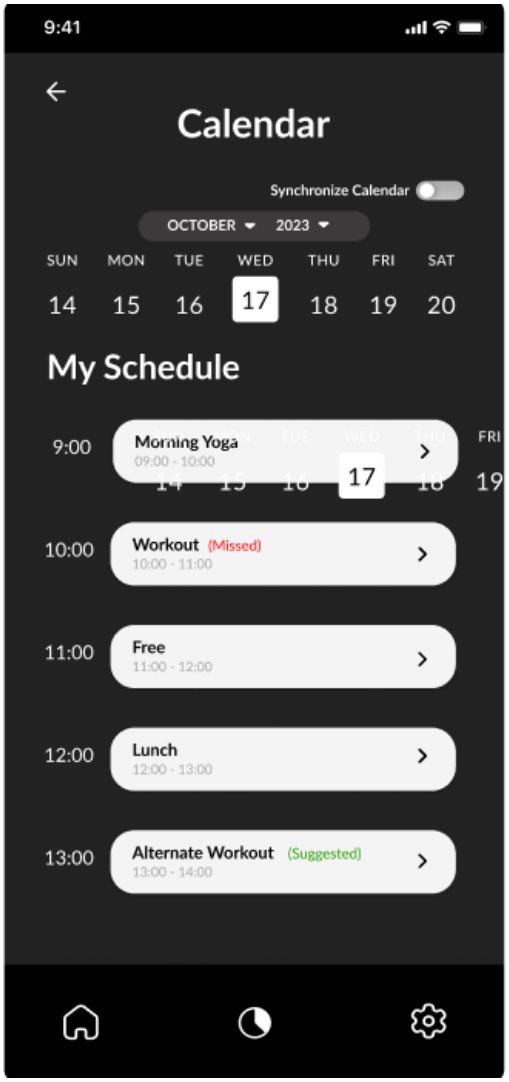


***Figure 17.*** *Calendar showing missed activity and alternate time suggestion Concept design.*

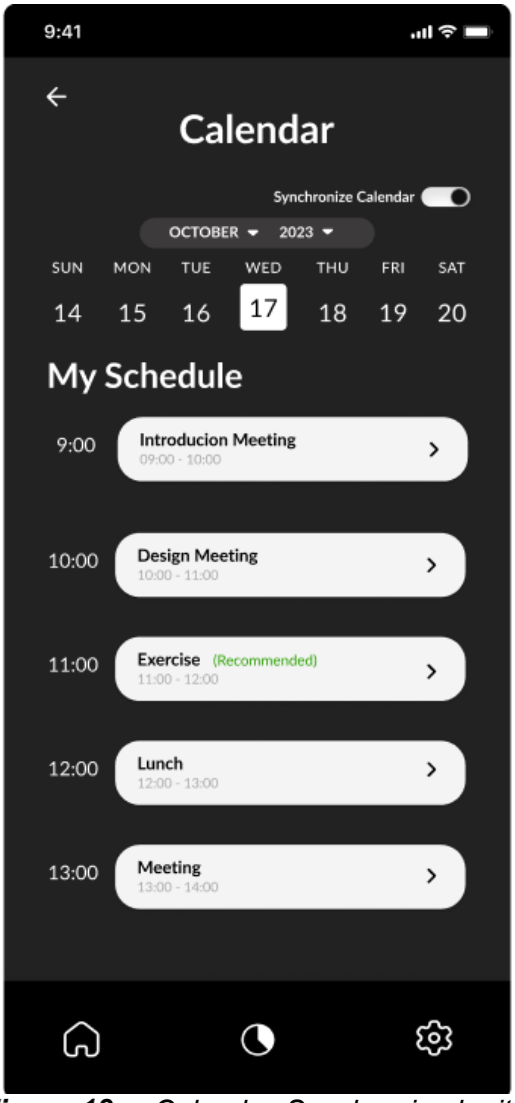


***Figure 18.*** *Calendar Synchronized with the app Concept design.*

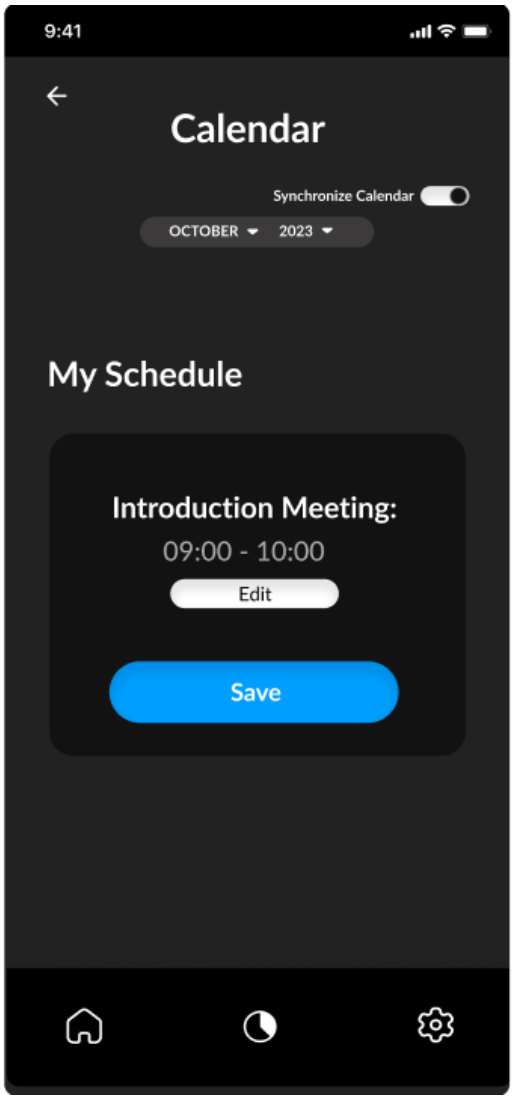


***Figure 19.*** *Editing the activities Concept design.*

The fourth feature that “Health Mentor” provides is the Fitness community **Figure 20** where users will be able to share their experiences, learn from other people and can be a part of vast fitness family. Users will be able get along with other people and see what is going on in the community. Lifestyle library with the news feed about different articles with classification based on newest, trending and most viewed. Users will also be able to search for their desired articles. Community groups will allow users to select their desired category of sports and join the related community group using the join button option. Need assistance will allow users to post their queries with the topic name and description.

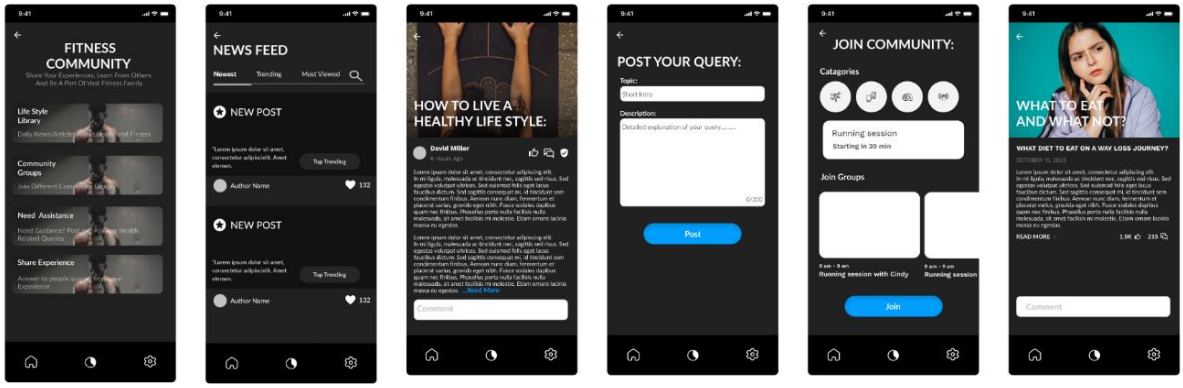


***Figure 20.*** *Fitness Community Concept design*

Another feature that “Health Mentor” provides is the rewards and achievements. The Rewards and achievements section is to motivate the use to participate in more healthy activities. The Rewards section shows the users achievements like where does the user rank in the community i.e., among the top five present or 10 percent of the community. Also, users will be able to see the points they have received after the completion of exercises and medals earned (as shown in Appendix H). Users can click on the activities option on the achievements page. It will show the users all the activities they have completed, and badges or medals earned (as shown in Appendix H).

The last two important features that “Health Mentor” provides can be seen on the bottom of the home page in the bottom navigation menu. The performance icon in the middle when clicked will take user to the performance page (as shown in Appendix I). The performance page will provide the user with the daily weekly and monthly performance e.g., for how much time the user has performed exercises or workouts, how many steps they have taken, how much water they have drunk etc. Also, there is a graph which will provide the user with information about the number of exercises the user has performed every day of the week. Lastly the settings icon will take the users to their profile (Appendix I), where the user can add their picture, change their account settings, themes, privacy settings, language, help and support etc.

# 5. EVALUATION INTERVIEWS

This chapter is dedicated to the crucial phase of evaluation interviews, where the designed mobile health application undergoes comprehensive scrutiny and garners valuable feedback from users. The primary objective is to assess the efficacy of the application in addressing the identified challenges faced by office workers and to gauge its overall usability and user experience. Evaluation interview questions are strategically designed to elicit insightful responses, shedding light on users' initial impressions, the user-friendliness of the application, perceived benefits for maintaining a healthy lifestyle, and specific features catering to office workers. The thematic focus extends to identifying areas requiring improvement, additional features for enhanced usability, and overall user preferences. Through this evaluative lens, the chapter endeavors to provide a nuanced understanding of the user's perspective, ensuring that the final iteration of the mobile health application aligns seamlessly with user expectations and effectively addresses the targeted health and fitness needs.

## 5.1 Purpose and Objectives

The purpose of the post-development interviews is to gather user feedback and insights regarding the mobile health app designed for office workers. The objectives of these interviews are as follows:

- Assess users' initial impressions of the app's design.
- Evaluate the user-friendliness of the app, including ease of navigation.
- Understand the perceived benefits of the app for office workers in maintaining a healthy lifestyle.
- Identify specific features within the app that users find helpful for individuals with busy schedules.
- Collect feedback on any aspects of the app design that users found lacking or in need of improvement.
- Gather suggestions for additional features that could enhance usability and user experience.
- Determine users' likelihood of using the app in the future.
- Encourage users to propose further improvements or enhancements for the app.

Data has been collected through one-on-one interviews with users who have interacted with the mobile health app. These interviews were conducted using open-ended questions, allowing users to express their thoughts, opinions, and suggestions freely. The interviews have been conducted in person and through online video conferencing, depending on the participants' preferences and logistical considerations.

A. Transcription and Coding: Interviews were transcribed verbatim to ensure accuracy. After transcription, the data was coded to identify recurring themes, opinions, and recommendations provided by the users.

B. Thematic Analysis: Thematic analysis was employed to categorize and interpret the data. The identified themes helped reveal patterns and insights from user feedback.

## 5.2 Evaluation Interview Questions:

These interview questions (See Appendix F) guided the conversation and facilitated the collection of comprehensive user feedback on the mobile health app. The data gathered through these interviews was invaluable in refining the app's design and features to better meet the needs of office workers and enhance their overall health and fitness experiences.

In table 2 below provides background information about the participants recruited for the evaluation phase, encompassing their age, gender, nationality, and the mode of interview. A total of six participants were recruited, with three being participants from the initial user study and the remaining three being new participants. This balanced mix was chosen to ensure a valuable blend of insights, as the "Health Mentor" application was primarily designed based on the needs and requirements identified in the initial user study.

**Table 2: Participant Information:**

| ID | Age | Gender | Nationality | Mode of Interview |
|---|---|---|---|---|
| 01 | 27 | Female | Bangladesh | Online |
| 02 | 20 | Female | Vietnam | Online |
| 03 | 25 | Female | Finland | Online |
| 04 | 29 | Male | Pakistan | Face-to-face |
| 05 | 25 | Male | Pakistan | Face-to-face |

| | | | | |
|---|---|---|---|---|
| 06 | 27 | Male | Pakistan | Face-to-face |

This diverse group of participants ensured that the evaluation interviews encompassed a broad spectrum of perspectives and experiences, contributing to the robustness of the research findings.

**Recruiting for Interviews**. Identifying Participants In the first phase of the evaluation of the mobile health application "Health Mentor," it was essential to identify suitable participants for the study. Six participants were recruited, ensuring a diverse representation to obtain a comprehensive range of insights. These participants were carefully selected to provide a well-rounded perspective on the application's usability and design.

**Crafting Interview Questions** The formulation of interview questions played a pivotal role in conducting the evaluation interviews. These questions were meticulously designed to extract in-depth information regarding the participants' perceptions and experiences with the "Health Mentor" application. The questions (attached in appendix F) were framed in a manner that encouraged participants to express their opinions and preferences openly.

**Ethical Considerations** It is paramount to acknowledge the ethical considerations surrounding the research. All participants were provided with a clear and concise overview of the thesis research topic and the interactive prototype of the "Health Mentor" application. Informed consent (as attached in appendix D below) was obtained from each participant, ensuring their willingness to participate in the evaluation interviews.

**Conducting Final Interviews** Setting the Stage The initial phase of conducting the evaluation interviews involved setting the stage for a productive and insightful interaction. Participants were given a brief introduction to the research topic, and the "Health Mentor" application was introduced to them. This introduction ensured that participants had a foundational understanding of the context and purpose of the study.

**Data Collection** The research method for evaluating the "Health Mentor" application involved the same technique of recording and transcribing interviews as the pre-development interview study. Each interview session was meticulously recorded and transcribed for a detailed analysis using thematic analysis. This method allowed for the identification of different themes and patterns in participants' responses, contributing to a comprehensive understanding of their perspectives.

Thematic analysis was used for data analysis to categorize data, identify themes, and highlight patterns.

## 5.3 Results of the Post-Development Interview

Subsequent to the evaluation interviews, the analysis phase yielded a comprehensive set of themes encapsulating the rich and varied feedback from users. These themes emerged organically from the post-development interviews, capturing the diverse perspectives and insights shared by participants regarding the designed mobile health application. The generated themes encapsulate key aspects such as users' initial impressions, the user-friendliness of the application, perceived benefits for maintaining a healthy lifestyle, and specific features tailored for office workers. Furthermore, the themes delve into areas of improvement identified by users, additional features suggested to enhance usability and user experience, and an overall assessment of user preferences. This thematic analysis serves as a robust framework for interpreting and presenting the nuanced and multifaceted findings derived from the post-development interviews, contributing to a holistic understanding of the application's effectiveness and user reception.

## Theme 1: Initial Design Impression on the Users

*Description*: The first theme, "Initial Design Impression on the Users," reflects participants' immediate reactions to the design of the mobile health application. It explores their thoughts on its simplicity, usability, and visual appeal, along with any suggestions for improvement.

Participants provided valuable insights into their initial impressions of the application:

Participant ID1 expressed optimism about the application's potential, stating, "I think it will work nicely." This response indicates a positive initial perception of the app's usability and functionality.

Participant ID2 praised the application for its features, including exercises, daily step reminders, a calendar, and customer feedback, expressing that it was impressive. This response emphasizes the importance of comprehensive features in attracting users.

Participant ID3 liked the simplicity and visual elements of the design, which suggests that aesthetics and ease of use are essential factors for users.

Participant ID4 found the design simple and minimalist, highlighting its user-friendliness. This aligns with the notion that straightforward designs are more likely to be preferred by users.

Participant ID5 appreciated the minimalistic design and its suitability for users with limited experience with health apps, emphasizing the importance of accessibility.

Participant ID6 agreed with the simplicity of the design but suggested room for improvement, indicating that while simplicity is a strength, there is still potential for enhancements such as more personalization and integration with other mobile apps.

**Implications**: These responses indicate that the initial design of the mobile health application has received positive feedback from users. Simplicity, user-friendliness, and comprehensive features are key factors that attract users to health applications. However, it is essential to recognize that there is room for improvement, which could involve refining the existing design to further enhance user experience.

**Limitations**: One limitation of this theme is that the responses are subjective, representing the opinions of a limited number of participants. To draw more comprehensive conclusions, a larger and more diverse sample would be necessary. Additionally, the interview method itself may have influenced participants to provide more positive feedback.

**Conclusion**: The findings suggest that the initial design of the mobile health application is well-received by office workers, primarily due to its simplicity, user-friendliness, and the inclusion of essential features. These insights are valuable for designing and improving health applications aimed at promoting exercise and maintaining overall health. Future research should explore the effectiveness of these design elements in promoting long-term engagement with the application and achieving positive health outcomes.

## Theme 2: User Friendliness and Navigation

*Description*: Theme 2, "User Friendliness and Navigation," explores participants' perceptions of how easy it is to use and navigate the mobile health application. This theme delves into their experiences with the application's interface, its accessibility, and the language used for different sections.

Participants' responses shed light on their experiences with user-friendliness and navigation:

Participant ID4 found the application easy to navigate, noting that understanding the charts and moving between different sections was straightforward. The information was readily accessible on the screen, reducing the need to search through multiple sections.

Participant ID5 emphasized the user-friendliness and the clarity of language used in the application's different sections. This implies that the app's interface and terminology are designed with user comprehension in mind.

Participant ID6 also commended the application's simple design, describing it as user-friendly. They found the navigation to be easy, although they acknowledged that their experience might differ from others.

**Implications**: The feedback provided by participants on this theme highlights the importance of user-friendliness and easy navigation in a mobile health application. Users value clear language and a well-organized interface that allows them to access information and features without unnecessary complexity. These aspects contribute to a positive user experience and may encourage regular engagement with the app.

**Limitations**: As with Theme 1, the limitations here include a limited number of participants and the potential for positive bias in responses. Additionally, the theme does not address potential issues or challenges that participants may have encountered while using the application.

**Conclusion**: User-friendliness and ease of navigation are critical factors in the success of a mobile health application. The positive feedback from participants suggests that the application's design and language are effective in facilitating users' understanding and interaction with the app. Future research should consider exploring potential challenges or areas for further improvement in these aspects to ensure a comprehensive user experience.

## Theme 3: Beneficial in Maintaining a Healthy Lifestyle

*Description*: Theme 3, "Beneficial in Maintaining a Healthy Lifestyle," delves into participants' perceptions of how the mobile health application can contribute to promoting a healthier lifestyle, especially for time-strapped office workers. It examines their thoughts on features such as exercise reminders, calendar integration, and community support.

Participants provided valuable insights on the potential benefits of the application:

Participant ID1 expressed the desire for reminders to encourage physical activity, emphasizing the importance of exercises and flexibility in selecting activities.

Participant ID2 acknowledged the usefulness of reminders, especially for those with busy work schedules. The integration of reminders and notifications could motivate users to go to the gym.

Participant ID3 believed that the application could benefit a broader audience, not just office workers, suggesting its versatility and appeal to a wider range of users.

Participant ID4, a software engineer who spends extended periods sitting at work, highlighted the value of an app that reminds users to take breaks and perform stretching exercises, indicating its potential in combating a sedentary lifestyle.

Participant ID5 appreciated the calendar feature, which could help users schedule exercise into their busy routines and receive recommendations for optimal times to work out.

Participant ID6 saw the application as beneficial for office workers due to its comprehensive features, including exercise plans, reminders, calendar settings, and community support, all of which could motivate and support individuals in maintaining a healthy lifestyle.

**Implications**: Theme 3 underscores the potential of the mobile health application to make a positive impact on users' lives by promoting a healthy lifestyle. Features such as exercise reminders, calendar integration, and community support are highly valued by participants and have the potential to address the specific needs of office workers.

**Limitations**: The limitations include the potential for participants to provide positive feedback, as well as the lack of discussion on potential challenges or drawbacks related to the application.

**Conclusion**: The participants' responses to this theme highlight the application's potential to benefit users, especially time-strapped office workers, in maintaining a healthier lifestyle. Features such as reminders, calendar integration, and community support are seen as valuable tools for promoting regular exercise and overall well-being. Future research could explore the actual impact of these features on users' health and exercise habits and whether they lead to sustained behavior change.

## Theme 4: Helpful Features for Office Workers

*Description*: Theme 4, "Helpful Features for Office Workers," focuses on participants' perceptions of specific features within the mobile health application that they consider beneficial for individuals working in office settings. This theme explores their preferences for features like exercise reminders, water intake reminders, stretching exercises, and calendar synchronization.

Participants shared their insights regarding these helpful features:

Participant ID1 appreciated the stretching exercises and the water intake reminder, recognizing the value of simple activities like stretching for maintaining health.

Participant ID2 emphasized the importance of the water intake reminder for office workers who often forget to drink enough water during the day.

Participant ID3 specifically liked the calendar feature, particularly the recommendations for exercise timing, which can help users plan physical activity effectively.

Participant ID4 found small exercise and water reminders, along with calendar synchronization, appealing. They also highlighted the motivational aspect of the reward feature.

Participant ID5 mentioned the usefulness of exercise or movement reminders, water reminders, and stretching exercises, considering them a comprehensive package for office workers to stay fit.

Participant ID6 personally appreciated the calendar synchronization feature and highlighted the importance of quick exercise reminders to help office workers stay active during their busy workdays.

**Implications**: This theme highlights the importance of tailoring features within the mobile health application to cater to the specific needs and challenges faced by office workers. Exercise reminders, water intake reminders, stretching exercises, and calendar synchronization are perceived as valuable tools for promoting health and well-being among this demographic.

**Limitations**: Similar to previous themes, the limitations include the potential for participants to provide positive feedback and the absence of discussion about potential challenges related to these features.

**Conclusion**: The findings within Theme 4 demonstrate that office workers find certain features of the mobile health application to be highly beneficial. These features can address common health-related issues faced by office workers, such as lack of physical activity and insufficient water intake. By incorporating these features, the application can better cater to the specific needs of this user group, potentially improving their overall health and well-being. Future research could explore the impact of these features on the health and lifestyle of office workers in real-world settings.

## Theme 5: Improvement Needed Features in the Design

*Description*: Theme 5, "Improvement Needed Features in the Design," addresses participants' suggestions for enhancing the design of the mobile health application. It encompasses recommendations related to visual elements, gender inclusivity, color schemes, and the use of animations for a more professional appearance.

Participants provided insights into areas for potential improvement in the application's design:

Participant ID1 suggested replacing human pictures with cartoons or alternative visual elements, indicating a desire for more diverse and engaging graphics.

Participant ID2 raised a concern about the application's initial visual impression, which appeared geared more toward males and featured exercises that may seem too strenuous for women. This comment underscores the importance of gender-inclusive and user-friendly design.

Participant ID5 recommended adding more colors to the application or incorporating a lighter color theme to improve the overall visual appeal. This suggestion highlights the significance of aesthetics in user engagement.

Participant ID6 proposed enhancing the application with animations rather than static images to convey a more professional appearance. This suggestion aligns with the idea of using interactive design elements to enhance user experience.

**Implications**: Theme 5 underscores the importance of visual design elements in attracting and retaining users. It highlights the need for a more gender-inclusive and visually appealing design that can cater to a broader audience. The inclusion of animations and a diverse color palette can contribute to a more engaging and professional user experience.

**Limitations**: The limitations here include the subjective nature of design preferences, as participants' opinions may vary, and not all users may share the same aesthetic preferences.

**Conclusion**: Participants' suggestions in Theme 5 indicate potential areas for improving the design of the mobile health application. These recommendations can contribute to making the application more appealing, inclusive, and professional. By addressing these suggestions, the application can better cater to a wider user base and enhance its overall user experience. Future research should explore the impact of these design changes on user engagement and satisfaction.

## Theme 6: Additional Features to Enhance Application Usability and User Experience

*Description*: Theme 6, "Additional Features to Enhance Application Usability and User Experience," addresses participants' suggestions for improving the mobile health application by introducing new features that can enhance usability and overall user experience. These recommendations touch on language options, diet recommendations, and the ability to contact fitness experts.

Participants provided insights into potential enhancements for the application:

Participant ID2 suggested adding language options to allow users to adjust the application's language. This feature could make the app more accessible to a wider range of users and enhance its global appeal.

Participant ID4 recommended incorporating diet recommendations and information about daily calorie requirements alongside fitness plans. This addition could offer users a more comprehensive approach to their health and fitness goals.

Participant ID5 proposed the inclusion of an option for users to contact fitness experts or professionals, similar to how users can contact online doctors. This feature would provide users with access to expert advice and support, further enhancing the application's value.

**Implications**: Theme 6 highlights the potential for enhancing the application's usability and user experience by introducing features that address language diversity, provide diet-related guidance, and offer access to fitness experts. These additions can make the application more user-centric, comprehensive, and supportive.

**Limitations**: The limitations include the need to consider the feasibility and scalability of implementing these features, as well as potential challenges in ensuring the quality and accuracy of advice provided by fitness experts through the app.

**Conclusion**: Participants' suggestions in Theme 6 provide valuable insights into how the mobile health application can be further improved to better serve its users. The recommendations aim to make the application more user-friendly, holistic in its approach to health and fitness, and supportive of users' needs. Future research and development should explore the feasibility and impact of these suggested features on the overall user experience.

## Theme 7: User's Likeness to Use the Application

*Description*: Theme 7, "User's Likeness to Use the Application," reflects participants' inclination and willingness to use the mobile health application. Their responses express their positive attitudes and eagerness to engage with the app for various reasons.

Participants conveyed their willingness to use the application:

Participant ID1 expressed a strong commitment to using the app daily, emphasizing its benefits for both physical and mental health.

Participant ID2 conveyed a determination to use the application regularly, as it aligns with their goal of making gym attendance a stable habit, while also appreciating the user-friendly design.

Participant ID3 expressed a likely intention to use the application, indicating their openness to adopting it if available.

Participant ID5 expressed strong affirmation, stating that they would definitely use the application and expressing a favorable attitude towards it.

Participant ID6 not only indicated a willingness to use the application but also favored it over other health apps available online, particularly praising its features.

**Implications**: Theme 7 reveals the positive reception and eagerness of participants to incorporate the mobile health application into their daily routines. Their likeliness to use the app suggests that it holds promise in addressing the health and fitness needs of its target audience.

**Limitations**: While participants' expressions of willingness are valuable, actual user behavior may vary from their stated intentions. The theme focuses on the participants' immediate responses but does not capture long-term usage patterns or barriers that might affect their usage.

**Conclusion**: The participants' enthusiastic responses in Theme 7 indicate a strong likelihood of user adoption and regular usage of the mobile health application. This positive attitude toward the app bodes well for its potential success in promoting healthier lifestyles and supporting users' health and fitness goals. Future research can explore the actual adoption and sustained usage of the application among participants and identify factors influencing their long-term engagement.

## Theme 8: Improvements in the Design

*Description*: Theme 8, "Improvements in the Design," encapsulates participants' suggestions for enhancing the design of the mobile health application. Their recommendations focus on adding motivational reminders and improving the application's food selection feature.

Participants provided insights into areas for potential design improvements:

Participant ID1 suggested incorporating motivational reminders after completing exercises, emphasizing the importance of offering positive reinforcement to encourage users without being intrusive.

Participant ID2 recommended improvements to the application's food selection feature, although the specific details of these enhancements were not outlined.

**Implications**: Theme 8 highlights the potential for design improvements to enhance user engagement and overall experience. Participants' suggestions for motivational reminders and food selection enhancements can contribute to a more user-centric and comprehensive application.

**Limitations**: The limitations include the need for more detailed information on the suggested food selection improvements to understand the scope and potential impact of these changes.

**Conclusion**: Participants' suggestions in Theme 8 offer valuable input for potential enhancements to the mobile health application's design. Motivational reminders can positively influence user behavior, and food selection improvements may contribute to a more holistic approach to health and fitness. Future research and development should explore the feasibility and effectiveness of implementing these design changes to improve the user experience further.

# 6. DISCUSSION

The development of the physical activity applications has opened new avenues for research and exploration in the realm of health and fitness. In the preceding chapters, the researcher has extensively discussed the process of creating and implementing this application. To further enhance the understanding and delve deeper into the implications and the usability of this technological intervention, the current study conducted interviews with individuals who have actively engaged with the application. The following chapter discusses the thematic analysis performed to unravel the themes that emerged from these interviews.

## 6.1 Thematic Analysis Discussion

In this discussion chapter, the findings of this thematic analysis are based on insights from the various participants involved in this study. This contribution will further contribute to the development and improvement of the application design and its implications for overall health and well-being.

### Theme 1: Initial Design Impression on the Users

The first theme of our study, "Initial Design Impression on the Users," reveals the immediate reactions of participants towards the mobile health application's design. The positive feedback indicates that simplicity, user-friendliness, and comprehensive features play a pivotal role in attracting users. Participants' optimistic responses underscore the significance of a positive initial perception, with an emphasis on usability and functionality. However, it is essential to acknowledge that room for improvement exists, suggesting that refining the current design could further enhance the user experience.

These findings align with previous research that highlights the importance of first impressions in user engagement with health applications. The positive initial design impression may be a key factor in encouraging users to explore the application further and, ultimately, adopt it as a part of their health and fitness routine. It is noteworthy that while the responses on this theme are promising, they are subjective, representing a limited number of participants. To draw more comprehensive conclusions, future studies should involve a larger and more diverse sample.

## Theme 2: User Friendliness and Navigation

"User Friendliness and Navigation," the second theme of our study, sheds light on participants' experiences with the mobile health application's ease of use and navigability. The feedback emphasizes the importance of clear language, well-organized interfaces, and accessibility. Participants found it easy to navigate, highlighting the significance of straightforward design elements that allow them to access information and features without undue complexity.

User-friendliness and ease of navigation are crucial for the success of a mobile health application, as confirmed by the positive feedback from our participants. A well-structured interface and user-friendly terminology contribute to a positive user experience, fostering regular engagement with the app. However, it's important to recognize that, similar to Theme 1, the limitations here include a limited number of participants and the potential for positive bias in responses. Future research should explore potential challenges or areas for further improvement in these aspects to ensure a comprehensive user experience.

## Theme 3: Beneficial in Maintaining a Healthy Lifestyle

The third theme, "Beneficial in Maintaining a Healthy Lifestyle," explores how the mobile health application can contribute to promoting a healthier lifestyle, particularly for time-strapped office workers. Participants' feedback highlights the potential benefits of the application, such as exercise reminders, calendar integration, and community support. These features are well-received, suggesting the application's ability to address the specific needs of office workers.

This theme underscores the importance of tailoring health applications to address the challenges and needs of their target audience. Office workers, in particular, stand to benefit from features that promote regular exercise and overall well-being. However, like the previous themes, this theme lacks discussion on potential challenges or drawbacks related to the application, an aspect that future research should consider exploring.

## Theme 4: Helpful Features for Office Workers

"Helpful Features for Office Workers," our fourth theme, focuses on participants' perceptions of specific features within the mobile health application that are considered beneficial for individuals working in office settings. The recommendations encompass exercise reminders, water intake reminders, stretching exercises, and calendar synchronization.

Participants appreciated these features for their potential to address common health-related issues faced by office workers.

The findings in this theme emphasize the importance of designing features tailored to the specific needs of office workers. These features are viewed as valuable tools for promoting health and well-being among this demographic. The positive feedback suggests that by incorporating these features, the application can better cater to the specific needs of this user group, potentially improving their overall health and well-being.

## Theme 5: Improvement Needed Features in the Design

The fifth theme, "Improvement Needed Features in the Design," addresses participants' suggestions for enhancing the design of the mobile health application. Their recommendations focus on visual elements, gender inclusivity, color schemes, and the use of animations for a more professional appearance. The feedback underscores the importance of visual design elements in attracting and retaining users.

These suggestions indicate potential areas for improving the design of the application, making it more inclusive, engaging, and professional. By addressing these recommendations, the application can better cater to a wider user base and enhance its overall user experience. It is essential to note that design preferences are subjective, and not all users may share the same aesthetic preferences.

## Theme 6: Additional Features to Enhance Application Usability and User Experience

The sixth theme, "Additional Features to Enhance Application Usability and User Experience," presents participants' suggestions for improving mobile health application. Their recommendations touch on language options, diet recommendations, and the ability to contact fitness experts. These additions can make the application more user-centric, comprehensive, and supportive.

Participants' suggestions in this theme highlight the potential for enhancing the application's usability and user experience. However, the feasibility and scalability of implementing these features should be carefully considered, along with the need to ensure the quality and accuracy of advice provided by fitness experts through the app.

### Theme 7: User's Likeness to Use the Application

"User's Likeness to Use the Application," our seventh theme, reflects participants' willingness to engage with the mobile health application. Their positive attitudes and eagerness to use the app for various reasons are promising. However, it is important to remember that stated intentions do not always align with actual behavior. Future research should explore the actual adoption and sustained usage of the application among participants and identify factors influencing their long-term engagement.

### Theme 8: Improvements in the Design

The eighth theme, "Improvements in the Design," encapsulates participants' suggestions for enhancing the design of the mobile health application, focusing on motivational reminders and food selection improvements. Motivational reminders can positively influence user behavior, and enhancements in food selection may contribute to a more holistic approach to health and fitness. Future research and development should explore the feasibility and effectiveness of implementing these design changes.

## 6.2 Limitations and Future Work

It is essential to acknowledge the limitations of this study.

- Firstly, the responses gathered in this research are subjective and represent the opinions of a limited number of participants. To enhance the generalizability of the findings, future research endeavors should aim for a more extensive and diverse participant pool.
- Additionally, the interview method employed may have introduced potential positive bias, influencing participants to provide favorable feedback. A potential alternative to mitigate this bias could involve employing a mixed-methods approach, combining interviews with quantitative measures such as surveys or usability metrics.
- Moreover, the study's limitation extends to a lack of explicit discussion on potential challenges or drawbacks associated with the mobile health application. To foster a more comprehensive understanding, future research should explicitly explore the hurdles users may encounter and areas for further improvement.

The insights gained from this study provide a solid foundation for future research in the field of mobile health applications. To further advance this area of study, future work should consider:

- **Long-Term User Behavior:** Investigating the actual adoption and sustained usage of the mobile health application among participants over an extended period.
- **User Diversity:** Expanding the participant pool to include a more diverse range of users, ensuring a comprehensive understanding of application usability.
- **Challenges and Drawbacks**: Exploring potential challenges or drawbacks users may encounter while using the application and identifying areas for improvement.
- **Feasibility of Feature Implementation**: Assessing the feasibility and scalability of implementing suggested features, such as language options, diet recommendations, and access to fitness experts.

# 7. CONCLUSION

This thesis has explored the critical aspects of user perception and feedback regarding a mobile health application designed to promote exercise and overall well-being, with a particular focus on office workers. By conducting a thematic analysis of participant responses, this research has provided valuable insights into the initial design impression, user-friendliness, potential benefits, helpful features, design improvements, and additional features that can enhance the application's usability and user experience. For instance, participants consistently emphasized the significance of a streamlined and intuitive user interface, suggesting that a clean design with easily navigable features contributes significantly to a positive user experience. In response to this, future iterations of mobile health applications could prioritize intuitive design principles, minimizing unnecessary complexity and ensuring a seamless user journey. Moreover, participants expressed a desire for personalized features that cater to the specific challenges faced by office workers. This insight suggests that customization options, such as tailored exercise plans accommodating busy schedules, could substantially enhance the application's utility for this demographic. The research also illuminated the potential benefits of incorporating real-time feedback mechanisms within the application. Users appreciated instant feedback on their exercise routines and progress, indicating a potential avenue for improvement in similar applications. Implementing features like real-time performance tracking and goal achievements could significantly contribute to sustaining user engagement and motivation.

The findings highlight the importance of a positive initial design impression, user friendliness, and tailored features to cater to specific user needs. While this study has shed light on critical aspects, there is room for further research to explore long-term user behavior, user diversity, challenges and drawbacks, and the feasibility of implementing suggested features. By continuing to study and improve mobile health applications, we can contribute to the promotion of healthier lifestyles and better support users' health and fitness goals.

# REFERENCES

Bloom, M. Building Vibrant Ecologies of Pastoral Wellbeing. Reflective Practice: Formation and Supervision in Ministry, 42.

Böhm, A.-K., Jensen, M. L., Sørensen, M. R., & Stargardt, T. (2020). Real-World Evidence of User Engagement With Mobile Health for Diabetes Management: Longitudinal Observational Study. JMIR MHealth and UHealth, 8(11), e22212. https://doi.org/10.2196/22212

Borali, S., & Caputi, S. (2023). La biblioteca come Healthy Hub. Biblioteche come Healthy Hub: la CAA per la promozione della salute, 41-72.

Carver, C. S., & Scheier, M. F. (1982). Control theory: A useful conceptual framework for personality–social, clinical, and health psychology. Psychological Bulletin, 92(1), 111–135. https://doi.org/10.1037/0033-2909.92.1.111

Clark, A. M., & Sousa, B. J. (2018). The Mental Health of People Doing Qualitative Research. International Journal of Qualitative Methods, 17(1), 160940691878724. https://doi.org/10.1177/1609406918787244

Crompton, S. (2001). Virtual hospital speeds recovery. Final, 1, 2.

Cruz, C., Bernal-Jiménez, M. Á., Vázquez-García, R., & Santi-Cano, M. J. (2022). Effectiveness of mHealth Interventions in the Control of Lifestyle and Cardiovascular Risk Factors in Patients After a Coronary Event: Systematic Review and Meta-analysis. JMIR MHealth and UHealth, 10(12), e39593. https://doi.org/10.2196/39593

Davies, A., & Mueller, J. (2020). Developing Medical Apps and mHealth Interventions. In Computers in health care. https://doi.org/10.1007/978-3-030-47499-7

DeNicola, N., Grossman, D., Marko, K., Sonalkar, S., Butler Tobah, Y. S., Ganju, N., Witkop, C. T., Henderson, J. T., Butler, J. L., & Lowery, C. (2020). Telehealth Interventions to Improve Obstetric and Gynecologic Health Outcomes. Obstetrics and Gynecology, 135(2), 371–382. https://doi.org/10.1097/AOG.0000000000003646

Dwivedi, Bali, R. K., Raouf, & Nassar, N. S. (2006). The Efficacy of the M-Health Paradigm: Incorporating Technological, Organisational and Managerial Perspectives. 15–32. https://doi.org/10.1007/0-387-26559-7_2

Fox, S., Brown, L. J. E., Antrobus, S., Brough, D., Drake, R. J., Jury, F., Leroi, I., Parry-Jones, A. R., & Machin, M. (2022). Co-design of a Smartphone App for People Living With Dementia by Applying Agile, Iterative Co-design Principles: Development and Usability Study. JMIR MHealth and UHealth, 10(1), e24483. https://doi.org/10.2196/24483

Greenberg, J. K., Javeed, S., Zhang, J. K., Benedict, B., Frumkin, M. R., Xu, Z., Zhang, J., Rodebaugh, T. L., Lu, C., Piccirillo, J. F., Steinmetz, M., Ghogawala, Z., Bydon, M., & Ray, W. Z. (2023). Current and future applications of mobile health technology for evaluating spine surgery patients: a review. Journal of Neurosurgery: Spine, 38(5), 617–626. https://doi.org/10.3171/2022.12.SPINE221302

Griffiths, F., Bryce, C., Cave, J., Dritsaki, M., Fraser, J., Hamilton, K., Huxley, C., Ignatowicz, A., Kim, S. W., Kimani, P. K., Madan, J., Slowther, A.-M., Sujan, M., & Sturt, J. (2017). Timely Digital Patient-Clinician Communication in Specialist Clinical Services for Young People: A Mixed-Methods Study (The LYNC Study). Journal of Medical Internet Research, 19(4), e102. https://doi.org/10.2196/jmir.7154

Hall, G., Laddu, D. R., Phillips, S. A., Lavie, C. J., & Arena, R. (2021). A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another. Progress in cardiovascular diseases, 64, 108.
Harper S, Mueller J, Davies A, Nicolau H, Eraslan S, Yesilada Y. The case for 'Health-induced impairments and disabilities'. In: W4A '20, 20–21 April 2020, Taipei; 2020

Harper, S., Mueller, J., Davies, A., Nicolau, H., Eraslan, S., & Yesilada, Y. (2020). The case for "health related impairments and disabilities." Proceedings of the 17th International Web for All Conference. https://doi.org/10.1145/3371300.3383335

Haug, M., Schröder, T., Heiko Gewald, & Burth, L. (2022). This Disease Scares Me! Influences on Adoption of Mobile Health Applications by Seniors. Lecture Notes in Networks and Systems, 140–149. https://doi.org/10.1007/978-3-030-96293-7_14

Helbostad, J., Vereijken, B., Becker, C., Todd, C., Taraldsen, K., Pijnappels, M., Aminian, K., & Mellone, S. (2017). Mobile Health Applications to Promote Active and Healthy Ageing. Sensors, 17(3), 622. https://doi.org/10.3390/s17030622

Hermsen, S., Moons, J., Kerkhof, P., Wiekens, C., & De Groot, M. (2017). Determinants for Sustained Use of an Activity Tracker: Observational Study. JMIR MHealth and UHealth, 5(10), e164. https://doi.org/10.2196/mhealth.7311

International Telecommunication Union. ICT Facts and Figures; (2017). https://www.itu.int/en/ ITU-D/Statistics/Pages/facts/default.aspx

Kuru, H. (2018). Behavior change techniques used in mobile applications targeting physical activity: a systematic review. *Current and Emerging mHealth Technologies: Adoption, Implementation, and Use*, 23-35.

Leeder, T. M. (2022). Behaviorism, Skinner, and Operant Conditioning: Considerations for Sport Coaching Practice. Strategies, 35(3), 27–32. https://doi.org/10.1080/08924562.2022.2052776

Lobo, E. H., Abdelrazek, M., Frølich, A., Lene Juel Rasmussen, Livingston, P. M., Shariful, M., Finn Kensing, & Grundy, J. (2023). Detecting user experience issues from mHealth apps that support stroke caregiver needs: an analysis of user reviews. Frontiers in Public Health, 11. https://doi.org/10.3389/fpubh.2023.1027667

Makri, A. (2019). Bridging the digital divide in health care. The Lancet Digital Health, 1(5), e204–e205. https://doi.org/10.1016/s2589-7500(19)30111-6

Manzano-Monfort, G., Paluzie, G., Díaz-Gegúndez, M., & Chabrera, C. (2023). Usability of a mobile application for health professionals in home care services: a user-centered approach. Scientific Reports, 13(1), 2607. https://doi.org/10.1038/s41598-023-29640-7

Marks, D. F., & Yardley, L. (Eds.). (2004). Research methods for clinical and health psychology. Sage.

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Eccles, M. P., Cane, J., & Wood, C. E. (2013). The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions. Annals of Behavioral Medicine, 46(1), 81–95. https://doi.org/10.1007/s12160-013-9486-6

Nouri, R.; Kalhori, S.R.N.; Saeedi, M.G.; Marchand, G.; Yasini, M. Criteria for assessing the quality of mHealth apps: A systematic review. J. Am. Med. Inform. Assoc. (2018), 25, 1089–1098. [CrossRef] [PubMed]

Pauwels, I., Versporten, A., Drapier, N., Vlieghe, E., Goossens, H., Koraqi, A., Hoxha, I., Tafaj, S., Cornistein, W., Quiros, R., Hojman, M., Ghazaryan, L., Horne, K., Cairns, K., Doukas, F., Gottlieb, T., Sermijn, E., Verhamme, K., Brands, C., & Van Herendael, B. (2021). Hospital antibiotic prescribing patterns in adult patients according to the WHO Access, Watch and Reserve classification (AWaRe): results from a worldwide point prevalence survey in 69 countries. Journal of Antimicrobial Chemotherapy, 76(6), 1614–1624. https://doi.org/10.1093/jac/dkab050

Peng, W.; Kanthawala, S.; Yuan, S.; Hussain, S.A. A qualitative study of user perceptions of mobile health apps. BMC Public Health (2016), 16, 1158.

Qi, M., Moyle, W., Jones, C., & Weeks, B. (2018). Physical Activity and Psychological Well-Being in Older University Office Workers: Survey Findings. Workplace Health & Safety, 67(3), 123–130. https://doi.org/10.1177/2165079918790585

Rao, M., Rao, K. D., Kumar, A. S., Chatterjee, M., & Sundararaman, T. (2011). Human resources for health in India. The Lancet, 377(9765), 587–598. https://doi.org/10.1016/s0140-6736(10)61888-0

Robinson, J., Billington, J., Gray, E., & Chapple, M. (2019). Qualitative Methodologies I: Using Established Qualitative Methods in Research on Reading and Health. Springer EBooks, 155–190. https://doi.org/10.1007/978-3-030-21762-4_9

Rodríguez-Romero, B., Smith, M. D., Quintela-del-Rio, A., & Johnston, V. (2020). What Psychosocial and Physical Characteristics Differentiate Office Workers Who Develop Standing-Induced Low Back Pain? A Cross-Sectional Study. International Journal of Environmental Research and Public Health, 17(19), 7104. https://doi.org/10.3390/ijerph17197104

Rough, D. J., & Quigley, A. (2020). End-User Development of Experience Sampling Smartphone Apps -Recommendations and Requirements. Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, 4(2), 1–19. https://doi.org/10.1145/3397307

Sezgin, E., Yildirim, S., Özkan-Yildirim, S., & Sumuer, E. (Eds.). (2018). *Current and Emerging mHealth Technologies*. Springer International Publishing. https://doi.org/10.1007/978-3-319-73135-3

Shabir, Habiba & D'Costa, Matthew & Mohiuddin, Zain & Moti, Zaeem & Rashid, Hamza & Sadowska, Daria & Alam, Benyamin & Cox, Benita. (2022). The Barriers and Facilitators to the Use of Lifestyle Apps: A Systematic Review of Qualitative Studies. European Journal of Investigation in Health, Psychology and Education. 12. 144-165. 10.3390/ejihpe12020012.

Silver, L. (2019, February 5). Smartphone Ownership Is Growing Rapidly Around the World, but Not Always Equally. Policycommons.net; Pew Research Center's Global Attitudes Project. https://policycommons.net/artifacts/616956/smartphone-ownership-is-growing-rapidly-around-the-world-but-not-always-equally/1597679/

Skinner, B. F. (1998). The experimental analysis of operant behavior: A history. Psychology: Theoretical-Historical Perspectives (2nd Ed.)., 289–299. https://doi.org/10.1037/10276-011

Stevens, W. J. M., van der Sande, R., Beijer, L. J., Gerritsen, M. G., & Assendelft, W. J. (2019). eHealth Apps Replacing or Complementing Health Care Contacts: Scoping Review on Adverse Effects. Journal of Medical Internet Research, 21(3), e10736. https://doi.org/10.2196/10736

Taki, S., Russell, C. G., Wen, L. M., Laws, R. A., Campbell, K., Xu, H., & Denney-Wilson, E. (2019). Consumer Engagement in Mobile Application (App) Interventions Focused on Supporting Infant Feeding Practices for Early Prevention of Childhood Obesity. Frontiers in Public Health, 7. https://doi.org/10.3389/fpubh.2019.00060

Vaghefi, I., & Tulu, B. (2019). The Continued Use of Mobile Health Apps: Insights From a Longitudinal Study. JMIR MHealth and UHealth, 7(8), e12983. https://doi.org/10.2196/12983

Van der Kamp, M. R., Hengeveld, V. S., Brusse-Keizer, M. G. J., Thio, B. J., & Tabak, M. (2023). eHealth Technologies for Monitoring Pediatric Asthma at Home: Scoping Review. Journal of Medical Internet Research, 25(1), e45896. https://doi.org/10.2196/45896

Wu, P., Zhang, R., Luan, J. et al. Factors affecting physicians using mobile health applications: an empirical study. BMC Health Serv Res **22**, 24 (2022). https://doi.org/10.1186/s12913-021-07339-7

Yang, Y., & Koenigstorfer, J. (2021). Determinants of Fitness App Usage and Moderating Impacts of Education-, Motivation-, and Gamification-Related App Features on Physical Activity Intentions: Cross-sectional Survey Study. Journal of Medical Internet Research, 23(7), e26063. https://doi.org/10.2196/26063

# APPENDIX A – CONSENT FROM 1

## Consent to Participate in the Interview and Permission to record it

First of all, I would like to thank you for your time to participate in this interview: "Enhancing Usability for Busy Lifestyles - Optimizing Mobile Health Application for Time- Strapped Office Workers". It is part of my Master's thesis project in the Human Technology Interaction. This interview is the initial user study which is conducted to gather information about the problems being faced by the office workers who don't have enough time to specifically go to gym or perform any exercise sessions regularly due to their tough routine. What are the frustrations that are being faced by office workers if they are using any health applications, what would be the possible solutions to tackle those problems and what would be the suggestions that can be implemented to design a better health application that would be helpful and user friendly to time strapped office workers.

In addition, by participating in this interview, your answers will provide a good base for my thesis and help us to understand the needs and expectations from a users perspective, which ultimately will help me to design an innovative and user-friendly health application which can help busy routine office workers to focus on their health.

Moreover, the interview will take approximately 40 to 60 minutes of your time, We will collect your name in this consent form and your voice recording during the interview. These data will be stored in securely in my personal drive, protected by password. The results of this interview will be reported in the thesis anonymously. In transcriptions, all identification information will be removed; recordings or your personal data will not be revealed. Identification information will be stored separately from the transcriptions and findings, and will not be connected to those. The audio recording and consent form will be destroyed as soon as the thesis is over.

You can stop participating in the workshop at any point and you do not need to explain the reasons why you are quitting.

If you have any questions, we are happy to answer.

Contact Information:
Student: Husnain Khan - Husnain.Khan@tuni.fi
Thesis Supervisor: Päivi Majaranta - paivi.majaranta@tuni.fi

# APPENDIX B- CONSENT FORM 2

1. I give my permission to audio record this interview *

- Yes
- No

2. I am comfortable to participate in this interview? *

- Online
- Face to Face

3. I have received information about this interview. I participate in this interview voluntarily.

To consent to the above terms, please enter your name (first name and surname) *

Enter your answer

# APPENDIX C- CONSENT FROM FOR EVALUATION INTERVIEW

## Consent Form To Participate In The Evaluation Interviews:

Hello and welcome to the evaluation interview of my thesis study. First of all, I would like to thank you for your time to participate in this interview for my thesis study, that is "Enhancing Usability for busy lifestyles - Optimizing Mobile Health Application for Time-Strapped Office Workers". This evaluation interview is part of my Master's thesis study in Human Technology Interaction. This interview is being conducted to evaluate the interactive prototype of the health app that I have designed for office workers and your insights and opinions will help me to analyze how well the prototype meets the user needs, preferences and how well it serves its purpose. This interview is being conducted to access how well my study has answered the research questions, which are:

1. To identify the usability challenges faced by time-strapped office workers when using mobile health applications.
2. To explore the preferences and requirements of this demographic concerning health and wellness information and features.

Moreover, the interview will take approximately 20 to 30 minutes of your time, We will collect your name in this consent form and your voice recording during the interview. These data will be stored in securely in my personal drive, protected by password. The results of this interview will be reported in the thesis anonymously. In transcriptions, all identification information will be removed; recordings or your personal data will not be revealed. Identification information will be stored separately from the transcriptions and findings, and will not be connected to those. The audio recording and consent form will be destroyed as soon as the thesis is over.

You can stop participating in the workshop at any point and you do not need to explain the reasons why you are quitting.

If you have any questions, we are happy to answer.

Contact Information:
Student: Husnain Khan - Husnain.Khan@tuni.fi
Thesis Supervisor: Päivi Majaranta - paivi.majaranta@tuni.fi

# APPENDIX D QUESTIONS FOR EVALUATION INTERVIEW

1. Age

Enter your answer

2. Gender *

- Woman
- Man
- Prefer not to say

3. Nationality *

Enter your answer

4. I give my permission to audio record this interview *

- Yes
- No

5. I have received information about the workshop. I participate in this workshop voluntarily.

To consent to the above terms, please enter your name (first name and surname) *

Enter your answer

+ Add new

# APPENDIX E – PRESTUDY QUESTIONS

**Background Questions:**

1. What is your age?
2. What is your nationality?
3. What is your Gender?

**Main Interview Questions:**

1. How comfortable are you with using mobile devices in general? Do you consider yourself to have a high level of digital literacy, or do you face any difficulties with technology?
2. Can you tell me about your experience using mobile health applications? Which specific applications have you used, and what motivated you to use them?
3. What challenges or difficulties have you encountered when using mobile health applications? Can you describe any specific frustrations or barriers you've faced?
4. Can you describe any specific features or aspects of mobile health applications that you find particularly useful or beneficial for your health and well-being?
5. Are there any specific features or functionalities in mobile health applications that you find confusing, difficult to navigate, or hard to understand? Can you explain why?
6. What factors do you consider when deciding to download or continue using a mobile health application? Are there any specific criteria or considerations that influence your decision?
7. Have you ever encountered any accessibility issues or challenges when using mobile health applications? Can you provide examples or describe any difficulties you faced in accessing or using certain features?
8. Are there any privacy or security concerns that you have when using mobile health applications? How important are these factors in your decision to use or trust a particular application?
9. Can you describe any instances where you felt that a mobile health application did not meet your needs or preferences? What improvements would you suggest enhancing the usability and user experience?
10. How do you envision an ideal mobile health application designed specifically for office workers? What features, functionalities, or design elements would you prioritize?

# APPENDIX F- POST DEVELOPMENT QUESTIONS

Q1. What is the first impression that came to your mind after seeing the design of the mobile health app that I designed for office workers?

Q2. How user friendly was this mobile health app? Is it easy to locate and navigate between different sections?

Q3. Do you think this mobile health app would be beneficial for office workers in maintaining a healthy lifestyle and achieving their fitness goals? If yes why, if not, why not?

Q4. Were there any specific features in this health app that you found particularly helpful for busy scheduled office workers?

Q5. Was there anything that you disliked about the health app design and would like to be better?

Q6. Are there any additional features that you believe would further enhance the app's usability and user experience effectiveness for office workers?

Q7. How likely are you going to use this app in the future, if available?

Q8. Do you want to suggest any further improvements for this mobile app?

# APPENDIX G – LINK FOR APP DESIGN

Link to Prototype (Valid for Two Months): https://www.figma.com/file/f2X0N6THAb-mHGE2qv5L0xr/My-Health-Companion?type=design&node-id=6%3A3&mode=design&t=avRurKeZCogapQw8-1

# APPENDIX H – USER INTERFACE

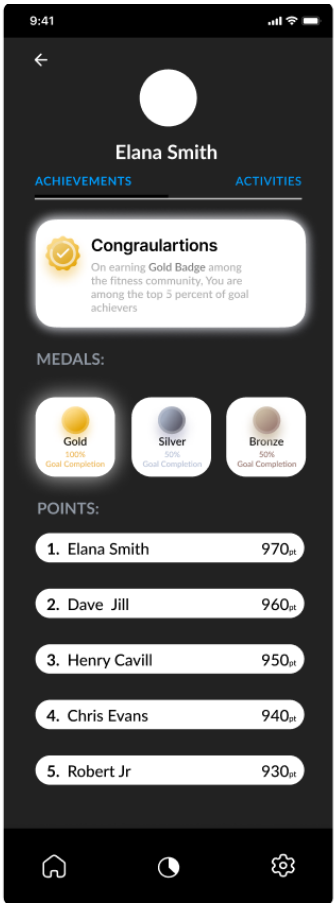


***Figure 21.*** *Achievements page concept design*

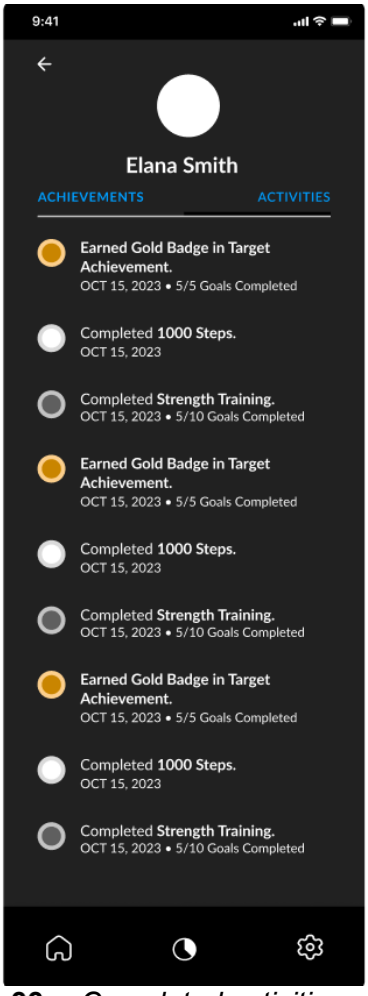


***Figure 22.*** *Completed activities page concept design.*

# APPENDIX I –APP DESIGN

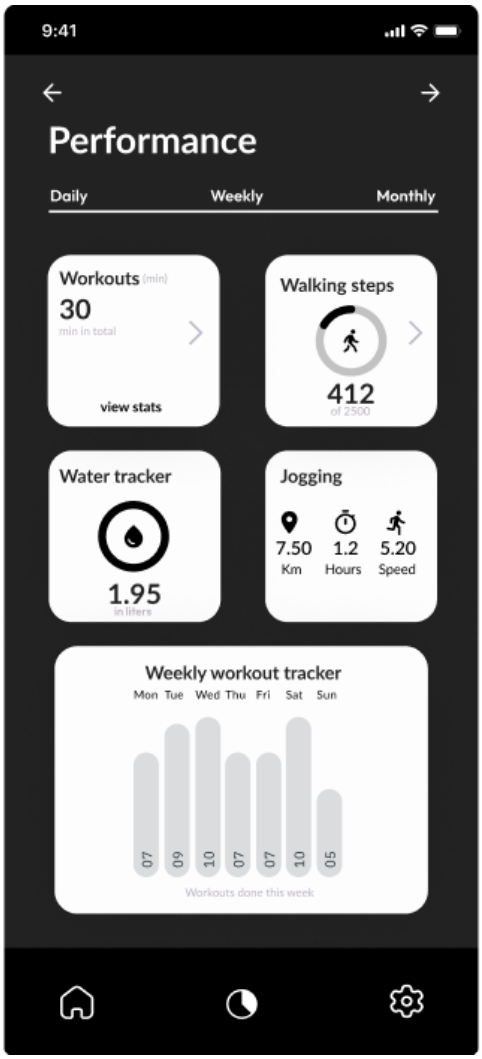


***Figure 23.*** *The Performance page which shows the no. Of steps, jogging performance including no. Of km ran, the duration and total average. This also includes the water tracking feature too.*

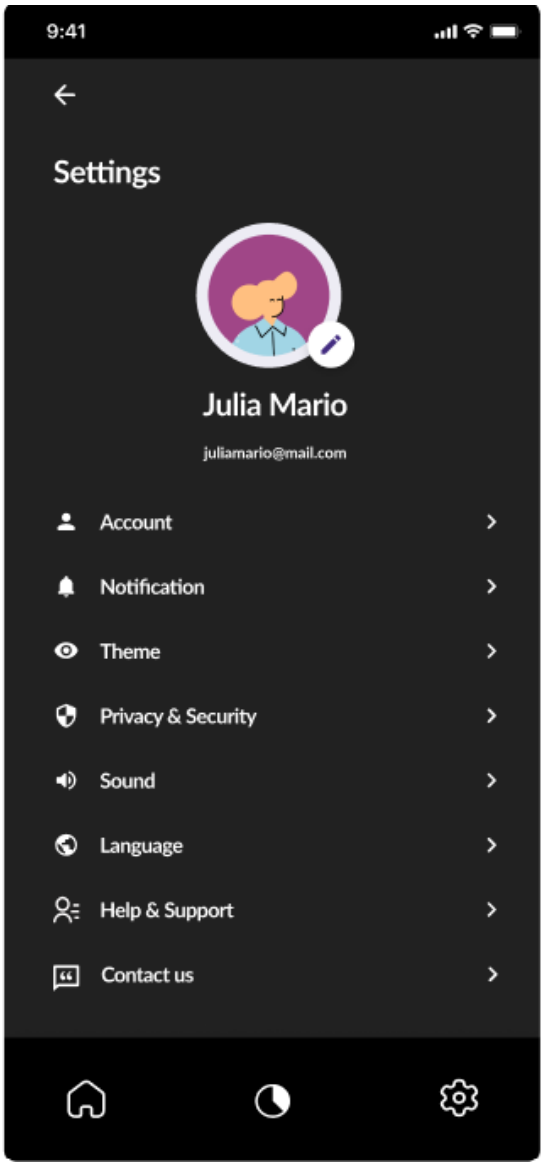


***Figure 24.*** *The figure shows the settings interface to control any notifications, language and privacy issues.*