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Faculty of Medicine & Health Sciences

**Exploring the Perceptions of Mobile Medical Devices towards
Daily Health Status Monitoring among Student's Community in
Universiti Malaysia Sarawak, UNIMAS**

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Bachelor of Nursing with Honours

2025

Exploring the Perceptions of Mobile Medical Devices towards Daily Health Status
Monitoring among Student's Community in Universiti Malaysia Sarawak, UNIMAS

Marha Madiehah binti Rusli

This project is submitted
In partial fulfilment of the requirements for the degree of
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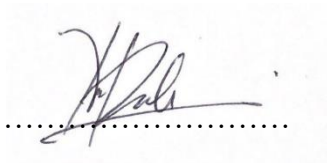
Faculty of Medical and Health Sciences
UNIVERSITI MALAYSIA SARAWAK

2025

DECLARATION

I hereby declare that the work presented in this thesis, titled “*Exploring the Perceptions of Mobile Medical Devices towards Daily Health Status Monitoring among Student’s Community in Universiti Malaysia Sarawak, UNIMAS.*” is my own original work and has been carried out under the supervision of Madam Dayang Zuraina binti Abang Haji Kashim at Faculty of Medicine and Health Sciences of Universiti Malaysia Sarawak, UNIMAS.

I confirm that this thesis has not been submitted, either in part or in full, to any other institution or university for the award of any degree, diploma, or qualification. I have ensured that all sources of information used in this thesis have been properly acknowledged and cited in accordance with the academic and ethical guidelines of Universiti Malaysia Sarawak, UNIMAS. I take full responsibility for any errors or omissions in this work.

A handwritten signature in black ink, appearing to read 'M. Rusli', is written over a horizontal dotted line. The signature is fluid and cursive.

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ABSTRACT

Background: Smart health care has become a growing innovation in the health sector, with Mobile Medical Devices (MMDs) such as smartwatches and health apps playing a vital role in daily health monitoring. These technologies support home-based care and remote monitoring, enabling students at Universiti Malaysia Sarawak (UNIMAS) to monitor their health without relying on costly healthcare visits. This qualitative study explored student perceptions and usage of MMDs, aiming to understand the factors influencing their adoption and the challenges faced.

Methods: A descriptive research design was used, and data was collected through semi-structured interviews with ten purposively selected UNIMAS students who owned MMDs. Interviews were conducted on campus, and participants came from diverse social backgrounds. They discussed their usage of smartwatches and health-related mobile apps and were shown specific features of exemplar devices to prompt deeper discussion. All interviews were audio-recorded, transcribed verbatim, and analyzed using thematic analysis.

Findings: Findings revealed that participants generally had a positive perception of MMDs and recognized their benefits for daily health monitoring. Ten key themes emerged, including perceptions of use, influencing factors, and challenges. Despite interest and awareness, students highlighted several barriers such as device complexity, affordability issues, discomfort, technical limitations, and concerns regarding data accuracy and privacy.

Conclusion: The study concludes that while MMDs are seen as useful by students, effective adoption requires addressing these obstacles. Recommendations include awareness programs, financial support strategies, and user-friendly device designs to improve MMD usage within the university student population.

Keywords: Smartwatch, Health apps, Wearable devices, Perceptions, Student, m-Health, Self-monitoring, Technologies

ABSTRAK

Latar Belakang: Penjagaan kesihatan pintar kini menjadi inovasi yang semakin berkembang dalam sektor kesihatan, di mana Peranti Perubatan Mudah Alih (Mobile Medical Devices, MMD) seperti jam tangan pintar dan aplikasi kesihatan memainkan peranan penting dalam pemantauan kesihatan harian. Teknologi ini menyokong penjagaan berasaskan rumah dan pemantauan jarak jauh, membolehkan pelajar di Universiti Malaysia Sarawak (UNIMAS) memantau kesihatan mereka tanpa perlu bergantung kepada lawatan kesihatan yang mahal. Kajian kualitatif ini dijalankan untuk meneroka persepsi dan penggunaan MMD dalam kalangan pelajar serta memahami faktor yang mempengaruhi penerimaannya dan cabaran yang dihadapi.

Kaedah: Reka bentuk kajian deskriptif digunakan, dan data dikumpul melalui temu bual separa berstruktur dengan sepuluh pelajar UNIMAS yang dipilih secara bertujuan dan memiliki MMD. Temu bual dijalankan di kampus, melibatkan peserta daripada pelbagai latar belakang sosial. Mereka membincangkan penggunaan jam tangan pintar dan aplikasi mudah alih berkaitan kesihatan serta ditunjukkan ciri-ciri peranti contoh untuk merangsang perbincangan yang lebih mendalam. Semua temu bual dirakam audio, ditranskrip secara verbatim, dan dianalisis menggunakan kaedah analisis tematik.

Dapatan: Kajian mendapati bahawa peserta secara umumnya mempunyai persepsi positif terhadap MMD dan menyedari manfaatnya dalam pemantauan kesihatan harian. Sepuluh tema utama dikenal pasti, termasuk persepsi penggunaan, faktor pengaruh, dan cabaran. Walaupun terdapat minat dan kesedaran, pelajar turut menyatakan beberapa halangan seperti kerumitan peranti, isu kemampuan kewangan, ketidakselesaian, kekangan teknikal, dan kebimbangan terhadap ketepatan serta privasi data.

Kesimpulan: *Kajian ini merumuskan bahawa walaupun MMD dilihat berguna oleh pelajar, penerimaan yang berkesan memerlukan penyelesaian terhadap halangan tersebut. Cadangan termasuk pelaksanaan program kesedaran, strategi sokongan kewangan, dan reka bentuk peranti yang mesra pengguna bagi meningkatkan penggunaan MMD dalam kalangan pelajar universiti.*

Kata kunci: *Jam tangan pintar, Aplikasi kesihatan, Peranti boleh pakai, Persepsi, Pelajar, m-Kesihatan, Pemantauan sendiri, Teknologi*

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LIST OF ABBREVIATION

COVID-19	Coronavirus Disease 2019
UNIMAS	Universiti Malaysia Sarawak
MMD	Mobile Medical Devices
APPS	Applications
IT	Information Technology
HR	Heart rate
BP	Blood Pressure
FDA	Food and Drug Administration
RR	Respiratory Rate
E-health	Electronic health
m-health	Mobile health
FMHS	Faculty on Medicine and Health Sciences
ICT	Information Communication Technology
SMS	Short Messages Services

CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter consist of the background of the study, problem statement, research questions, research aim and objectives, the significance of the study and definition of terms.

1.2 Background of study

In today's digital age, smart health care has emerged as a significant improvement in the health profession. Smart healthcare is a comprehensive, multifaceted shift rather than only a technical development (Tian et al., 2019). Shifts in medical practices include transitioning from general to personalized management, evolving from a disease-focused model to a patient-centered care approach, and redefining prevention and treatment by prioritizing preventive healthcare over solely treating diseases. The key concepts driving this (centripetal) counter-revolution are home testing, portable or wearable devices, and remote patient monitoring (Lippi et al., 2024).

Mobile Medical Devices (MMDs) encompass mobile health apps on smartphones, wearable devices and artificial intelligence. Mobile devices for home-based monitoring can assist in creating a remote health monitoring, which leverages non-invasive wearable sensors and advanced communication and information technologies, allows the UNIMAS community especially students to remain in the comfort of their own homes or college or even their current location.

These days, mobile health applications (apps) have become increasingly popular, providing innovative tools to influence health-related behaviors and manage chronic conditions effectively. In addition to finding solutions for health issues, fitness and exercise

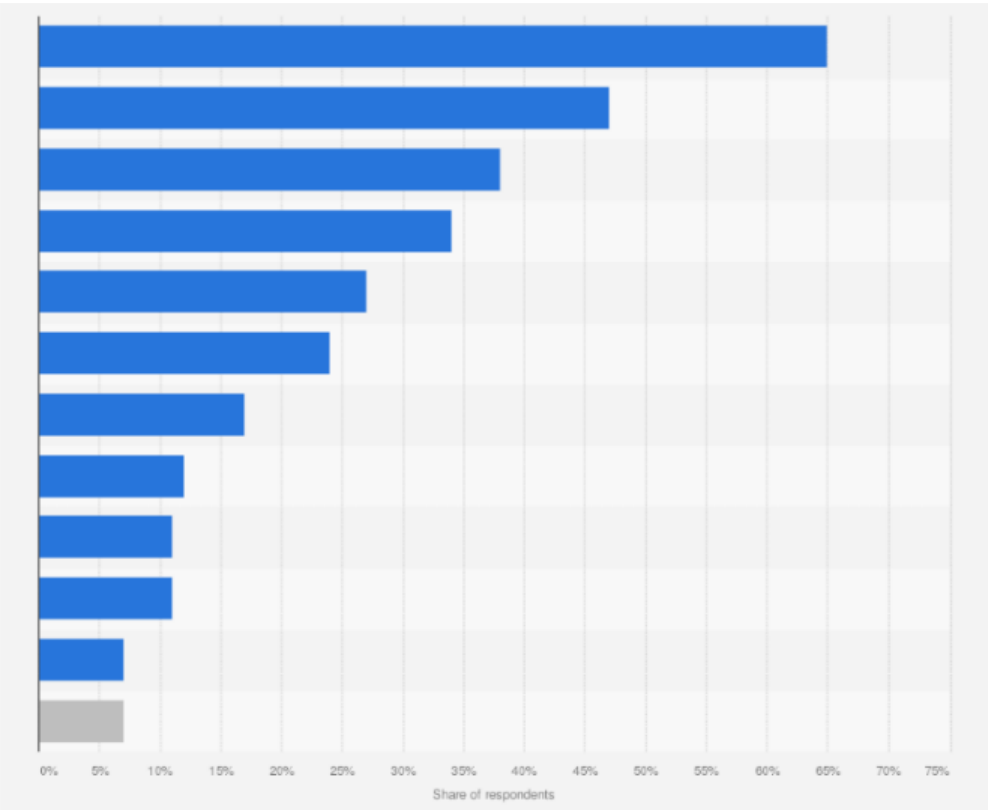
programs, health management tools, and other related features at anytime and anywhere. In an international survey by Tong et.al (2022), 60% of people stated use a smartphone apps for medical reasons. As mobile internet technology rapidly advances and smart mobile devices become more widely adopted, mobile health apps have emerged as the most direct tools for managing individual public health (Wang & Qi, 2021). In one study, 47.7% of smartphone owners used at least one health app, with the most common being wellness, prevention, and fitness apps (Paradis et al., 2021). Due to these, more and more individuals are using smartphones for health-related purposes.

The increasing popularity of mobile devices has fuelled the development of smart wearable technology. Smartwatches, and other wearable gadgets enable users to keep tabs on their sleeping patterns, diet, physical activity, and health information (Farivar et al., 2020). Smartwatches especially, have becoming increasingly popular. The smartwatch represents the meeting point of information technology (IT) innovation and fashion (Misra et al., 2023). Wearables as digital health technologies might fulfil a personal need and be used as fashion objects (Canali et al., 2022). These devices are part of a growing category of wearable technologies that allow people to take control of their health and well-being at any time. The capacity of smartwatches to track many health metrics, including heart rate (HR), sleep patterns, and physical activity, has led to their current surge in popularity (Masoumian Hosseini et al., 2023).

According to Siddharta (2022), Malaysians are more inclined towards wearable technology compared to other Southeast Asian populations, with 65% of Malaysian users adopting wearable devices for fitness and healthcare purposes (*Figure 1.2*). Wearable gadgets remain in their early stages of market dispersion. There is a deep awareness of contemporary consumer expectations, especially in Malaysia; therefore, it is vital to

determine the aspects that influence the behavioral intention and MMDs adoption of Malaysian users (Hayat et al., 2023). However, among students, there is a tendency to use devices such as smartwatches primarily as a lifestyle or fashion trend rather than for actual health monitoring purposes. This trend-driven usage may undermine the true potential of such technologies in promoting health awareness and self-management.

Figure 1.1
Malaysia: Most Common Uses for Wearable Tech 2022



1.3 Problem statement

1.3.1 Gap in knowledge

There is limited research that specifically explores how university students, a young, tech-savvy population perceive these devices in the context of daily health monitoring for general well-being and prevention. Moreover, in the Malaysian context, especially within local university environments like Universiti Malaysia Sarawak (UNIMAS), there is a lack of contextualized, qualitative data on the causes that shape students' awareness, attitudes, and acceptance of MMDs. Without this understanding, efforts to encourage healthy lifestyle behaviors using technology may not align with students' actual needs, beliefs, or usage barriers. This gap in knowledge makes it difficult for healthcare promoters, university health services, and tech developers to effectively target or support this population in adopting digital health tools. Hence, exploring students' lived experiences and perceptions is essential to bridging this gap and informing future health and technology integration strategies.

1.3.2 Acceptance and willingness

Although mobile medical devices (MMDs) are becoming more common for daily health monitoring, there is still limited understanding of how students at UNIMAS view and use these technologies. Their acceptance and willingness to use MMDs can depend on personal experiences, comfort with technology, financial concerns, and cultural views on health tracking. People often judge the usefulness of a product based on how well it works for them (Singh et al., 2022). Without knowing how students feel about MMDs, it's difficult to tell if these devices meet their needs or if certain challenges are stopping them from being widely used. This lack of

knowledge can lead to doubts about how accurate or reliable the devices are. Without efforts to raise awareness and understanding, confusion and mistrust may continue to slow down the use of these helpful health tools.

1.3.3 Efficacy and reliability

A further limitation of this research is the potential for variations in how individuals perceive the efficacy and reliability of mobile medical devices. Maintaining the data integrity and reliability is an ongoing task. Some users may question whether these devices provide accurate, timely, and reliable health data. Fears and lack of confidence in digital platforms have been highlighted (Kaihlanen et al., 2022). Doubts about the devices' ability to detect serious health issues or provide adequate monitoring without the involvement of healthcare professionals may lead to skepticism about their usefulness, thereby influencing perceptions toward their adoption.

1.4 Research questions

This study will answer the following questions:

1. What are the perceptions of the UNIMAS students regarding the use of Mobile Medical Devices (MMDs) for daily health status monitoring?
2. What are the causes that influence student's perceptions and acceptance of Mobile Medical Devices (MMDs)?
3. What challenges do students from UNIMAS community perceive in adopting and using Mobile Medical Devices (MMDs) for personal health monitoring?

1.5 Research aim

The aim of this research is to explore and understand the perceptions, influencing factors and challenges perceived by UNIMAS students in using Mobile Medical Devices (MMDs) for daily health status monitoring.

1.6 Research objectives

The objectives of this research are:

1. To explore the perceptions of the UNIMAS students regarding the use of Mobile Medical Devices (MMDs) for daily health status monitoring.
2. To identify the causes that influence student's perceptions and acceptance of Mobile Medical Devices (MMDs).
3. To identify the challenges, do students from UNIMAS community perceive in adopting and using Mobile Medical Devices (MMDs) for personal health monitoring.

1.7 Significance of the Research

This research on the perceptions of Mobile Medical Devices (MMD) for daily health status monitoring among students' communities in UNIMAS is significant for several key reasons:

1.7.1 Attitudes towards use of MMDs

Firstly, we look into the attitudes and behaviour behind using mobile medical devices, especially among university students. Some people use devices like smartwatches mainly for fashion or because they are trendy, especially younger users. As a result, not everyone fully understands or uses the health features these devices offer. Trust in the device and being health-conscious have a strong influence on whether someone wants to use MMDs (Cao et al., 2024). However, even those who see the benefits often just track their health data and wait to see trends, rather than acting immediately.

Many university students, because of their busy schedules, prefer to adjust their habits on their own rather than seek medical help. Even if their condition worsens, they may wait to see if it improves on its own before reaching out for help. This approach helps them avoid overreacting to one unusual reading and gives them time to see if things improve with lifestyle changes. Reactions to the data also vary some students may feel discouraged if the numbers do not improve, while others feel motivated to stay healthy by keeping track of their progress. These different attitudes show that how people use and respond to MMDs depends on their lifestyle, priorities, and personal health goals.

1.7.2 Limitation of awareness and education

This study aims to improve health awareness by exploring how individuals perceive and use mobile medical devices (MMDs) in their daily lives. Many people may not fully understand the benefits of these devices for tracking vital signs such as heart rate (HR), blood pressure (BP), and physical activity. By highlighting these advantages, the research can help encourage a more proactive approach to personal health management among university students. Greater awareness could promote healthier lifestyles and better self-monitoring habits, ultimately supporting overall well-being.

However, a lack of awareness and education remains a major barrier. According to participants, using digital health tools often requires advanced digital skills, which not everyone possesses (Kaihlanen et al., 2022). Misunderstanding or lack of information about how MMDs work, or how they improve health outcomes, can lead to hesitation or negative perceptions. Some students may believe that they do not need these tools because they already maintain healthy habits, or they may think that health apps are only useful for patients or those needing extra motivation (Maaß et al., 2022).

In today's world, where daily routines are closely linked with health goals, people who live wellness-focused lifestyles are more likely to use health technologies, exercise regularly, and follow healthy diets (Hokroh et al., 2020). To close the awareness gap and improve perceptions, it's important to provide clear educational materials and simple guidance on how to use MMDs effectively. This

will help dispel misconceptions and make these technologies more accessible and appealing to a wider range of users.

1.7.3 Identifying challenges and causes to adoption

The study can help identify challenges to adoption that may prevent individuals from effectively using mobile medical devices. Despite their availability, challenges such as technical issues, lack of trust in device accuracy, concerns about data privacy, and limited technological knowledge may discourage users from integrating these tools into their daily lives. Many individuals may hesitate to use mobile medical devices due to concerns about accuracy, reliability, and security. This study can help identify trust-related issues and suggest ways to improve confidence in these devices, such as better data accuracy, security measures, and user education. Also, by pinpointing these challenges, the research can provide insights into how developers, healthcare providers, and institutions can address these concerns and improve user experience, making mobile health technology more accessible and reliable.

Overall, this study is significant because it provides a deeper understanding of how people especially students perceive mobile medical devices for home-based monitoring, identifies key challenges, and offers recommendations for improving healthcare accessibility, usability, and trust in digital health solutions. Ultimately, this research aligns with Malaysia's national health goals and the country's efforts to modernize its healthcare system, making it more equitable, efficient, and preventive-focused through the use of mobile medical devices for home-based care (Vankrunkelsven, 2024).

1.8 Definition of terms

In this subheading, the researcher defines the conceptual and operational definition for every word from the title of the study.

1. Mobile Medical Devices (MMD)

Conceptual definition:

The Food and Drug Administration (FDA) defines a mobile medical device as "a mobile app that includes device software functionality meeting the definition of a device under section 201(h) of the FD&C Act, and is either designed to function either to convert a mobile platform into a regulated medical device or as an add-on to an existing medical device." (Hilliard, 2021).

Operational definition:

Mobile medical devices include smartphones and wearable health trackers (e.g., smartwatches and FitBits). In the context of this research, the focus is on devices that facilitate daily health status monitoring by offering real-time health data and empowering users to engage in proactive health management anywhere and anytime.

2. Perceptions

Conceptual definition:

According to Merriam-Webster (2019), perception is defined as the result of perceiving or observing something. Perception involves awareness of environmental elements through physical sensation and it is shaped by one's experiences.

Operational definition:

In this research, perceptions will be measured through surveys and interviews, focusing on the student's understanding of the devices, their satisfaction with their usage, concerns about accuracy, data privacy, and overall willingness to integrate these devices into their healthcare routines.

3. Community

Conceptual definition:

The Cambridge Dictionary (2019) defines "community" as a group of individuals who share common interests, a social group, or a nationality. This definition emphasizes that a community can be based on geographic location or shared social and cultural ties.

Operational definition:

In the context of this research, the term "community" refers to the population groups of students in UNIMAS, a region in Sarawak, Malaysia, which coming from different cultural, socioeconomic, and geographic backgrounds, who may use or be affected by mobile medical devices and experience with health status monitoring.

1.9 Summary

In conclusion, this chapter introduces the study by outlining its background, problem statement, research questions, aim and objectives, significance, and key definitions. It highlights the growing role of smart healthcare technologies, particularly Mobile Medical Devices (MMDs) which include wearable devices and mobile health apps, in enabling individuals to monitor their health remotely and conveniently. While global adoption is increasing, especially among young, tech-savvy populations, there is limited research on how university students in Malaysia, particularly at UNIMAS, perceive and use these devices. The study identifies a gap in knowledge regarding students' acceptance, trust, and understanding of MMDs, as well as the challenges they face such as concerns about accuracy, data privacy, and usability. Research questions aim to explore perceptions, influencing causes, and challenges to adoption. The study is significant for promoting health awareness, guiding the development of more user-friendly digital health tools, and informing strategies for broader MMD adoption in line with Malaysia's healthcare modernization goals.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter discusses the literature review and theoretical framework for this study. The literature search was conducted using the databases such as JMIR, Scisearch and Google Scholar, focusing on keywords such as "mobile medical devices," "wearable devices," "remote health monitoring," "smartphones," "smartwatches," "m-Health technologies," and "mobile health apps." To ensure relevance, the search was limited to papers released between 2018 and 2024. Selection criteria included peer-reviewed articles published within the last seven years that were relevant to the research question and had full-text availability. Papers not in English, unless translations were accessible, and low-quality or irrelevant studies, such as opinion pieces without data, were excluded from consideration.

This discussion explores the dynamics at play for the community context, focusing on three topics including: (i) perceptions of MMDs in supporting daily well-being, (ii) causes influence the adoption and usage, (iii) challenges perceived:

2.2 Perceptions of MMDs in Supporting Daily Well-being

Perceptions play a crucial role in shaping individuals' awareness and behaviors toward Mobile Medical Devices (MMDs), which include health tracking apps, wearable devices, and portable monitoring tools. Studies have shown that positive perceptions are strongly linked to higher engagement with digital health tools, while skepticism or uncertainty can limit usage (Masoumian Hosseini et al., 2023).

Globally, users tend to perceive MMDs positively when they see tangible benefits such as improved health awareness, convenience, and control over personal well-being (Paradis et al., 2021). However, perceptions can vary significantly by demographic,

especially among younger populations such as university students. While students are often more tech-savvy and open to innovation, their perceptions of MMDs are influenced by factors such as prior experience, peer influence, health consciousness, and exposure to health education (Canali et al., 2022). For many, these devices are viewed not just as health tools but also as fashion accessories, which may overshadow their medical functions (Misra et al., 2023).

A cross-sectional study by Jembai et al. (2022), aimed at assessing awareness, attitudes, practices, and factors associated with mHealth app usage among medical students discovered that the majority of respondents (82.7%) were aware of the existence and function of COVID-19 apps, followed by personal health and fitness apps (76.3%) and medical education apps (61.8%). Health applications frequently tracked health metrics, health information, and physical activity. Notably, based on research by Jones et al. (2024), the use of health apps to track calories or meals for weight loss is less common. Self-monitoring of dietary intake, which is a systematic observation and recording to raise individuals' awareness of eating habits and food ingested, is an important component of behavioral weight management treatments.

When people believe their health is in danger, they are more inclined to employ information technology to enhance it. In the qualitative study by Wu et al. (2024), sought to determine opportunities for development by learning about patients' experiences with wearable technology and mobile apps. From the interview conducted by Wu et al. (2024), patients stated that they were inspired to get well after viewing summaries of their daily physical activities. While exercising, seeing their heart rate gave them comfort (Wu et al., 2024).

Additionally, emotional responses to health data such as anxiety from abnormal readings or motivation from positive trends can influence how students perceive and use MMDs (Cao et al., 2024). Some students may find MMDs empowering, while others may feel discouraged if their progress is not aligned with personal expectations. Moreover, a lack of trust in the technology or doubts about privacy and data sharing can negatively affect overall perception and willingness to use these tools consistently (Zhou et al., 2019).

In the Malaysian context, Siddharta (2022) reported that Malaysians are among the most inclined in Southeast Asia to adopt wearable technologies, yet perceptions remain mixed. While many acknowledge the benefits of fitness tracking and health data visibility, concerns about data accuracy, device reliability, and the need for professional medical interpretation persist (Kaihlanen et al., 2022). Among university students, perceptions are further shaped by lifestyle habits, affordability, and understanding of the devices' health-monitoring capabilities (Hayat et al., 2023).

2.3 Causes Influence the Adoption and Usage

Although different mobile health devices may offer comparable functions, they also offer unique features that address different aims and target different demographics, which may influence utilization. Due to inadequate health literacy, persons in low-income or rural areas, the elderly, and members of minority groups may find it difficult to comprehend and utilize digital health solutions (Kaihlainen et al., 2022). An individual's goal and health needs, social influences, demographic pattern, devices usability and potential benefits are all factors linked to the use of mobile medical devices, though their influence may vary when predicting the use of specific types of devices.

2.3.1 Individual goals and health needs

A survey done by Shandhi et al. (2024), found a primary reason for owning a wearable device was fitness and workout monitoring. Same goes to study by Chandrasekaran et al. (2020), wearable technology is expected to be helpful for people who establish health-related objectives like losing weight and increasing their physical activity levels in order to track their progress. Acceptance and usage of mobile health apps may indicate a user's motivation to modify or sustain healthy behavior (Wang & Qi, 2021). Health motivation is increasingly intertwined with people's daily activities (Misra et al., 2023). Thus, the more acute the health threat to individuals, the higher the probability they will show positive attitudes to take steps to change their condition (Singh et al., 2022).

Similarly, a survey by Hokroh et al. (2020) aims to investigate the variables influencing the acceptance and usage of wearable health technology in the Kingdom of Saudi Arabia, using an expanded version of the Technology Acceptance Model (TAM). This study found that 'wellness-oriented' consumers are more inclined to

participate in health technology use (Hokroh et al., 2020). Wellness-oriented individuals engage in regular exercise, healthy diets, and use of health technologies indicating personal health goals.

An overview by Canali et al. (2022), present an epistemic (knowledge-related) summary of wearable technology's primary tasks for health: monitoring, screening, detection, and prediction. The findings found that wearable devices may satisfy a user's personal requirement (e.g., tracking fitness activities and exercise). For example, Milward et al. (2018) discovered that abstainers' desire to cut back on alcohol usage drove them to utilize an alcohol harm reduction app.

2.3.2 Social influences

Cao et al. (2024), investigated the impact of social influence on young individuals' behavioral intentions to adopt mobile health (mHealth) reported that social influence positively affects behavioral intention through trust. Recommendations from others to utilize m-Health assist young individuals build confidence in m-Health-related information, improving their behavioral intention to use MMDs. Furthermore, social influence had a favorable impact on MMD behavioral intentions by raising persons' health awareness.

Social media platforms facilitate the design of user experiences that fulfill the user's demands (Mirzaei & Esmailzadeh, 2020). As they use the channel, they become more familiar with the environment, and they learn more about the app's services, culture, and dynamics among members. Patients may now contact with care providers and each other through a variety of channels because to developments in information and communication technology (ICT). For example, WhatsApp,

Instagram, Facebook and TikTok where they can easily share their activity status. The more social presence there is, the more social support the members have for one another.

For phone applications, the sharing or social network feature is essential. It is important to note that fitness applications leverage the sharing/social network feature to transform individual exercise activity into social behavior, add excitement to routines, and boost users' sense of accomplishment, all of which eventually increase users' endurance. This feature makes it easier to study healthy lives and insist on health activities by allowing users to speak with one another and exchange information and accomplishments (Tran et al., 2018). Creating a personally-tailored exercise program reflects users' goal for self-improvement and health management (Timurtas et al., 2021).

Furthermore, a research by Goodyear et al. (2018) stated that family members and friends encouraged young people to use gadgets and apps by spreading the idea that they were "cool." For young people, peer recommendations and usage of health-related applications and gadgets was a significant and intimate source of assessment data. There was evidence that using health-related applications to interact with peers about diets and/or physical activity was a valuable source of inspiration and support for some of the young people. The applications made by young people also showed a lack of perceived peer effect on longer-term app usage.

2.3.3 Devices usability

User expectations depend more on how easy a device is to use than its usefulness (Misra et al., 2023). App design should be attractive and meet user needs

to ensure acceptance (Wang & Qi, 2021). The main feature of the smartwatch interventions was the delivery of notifications or reminders and alerts to the user. Following that, users' interest in mobile health applications is influenced by other fundamental functionalities (e.g., reminders, alerts, incentives, follow-up, and goal setting) and how they are delivered. Users expect wearable devices to support their personal wellness and self-tracking (Misra et al., 2023). Push notifications with tailored health information are associated with mobile health app engagement. A study by Timurtas et al. (2021) show that participants relied mostly smartwatch notifications to push exercise reminders.

Another element that most participants enjoyed was the reminder. Reminders were particularly beneficial for busy people who were prone to forgetting things or who needed to remember many medications in a single day. Li et al. (2023) employed medication SMS reminders when the wristwatch identified a lack of medication compliance. Although other options include reminders, people rated mobile applications to be the handiest.

A survey by Bischoff et al., (2021) emphasized how crucial goal-specific apps on smart devices are for recognizing individual differences, such as personality traits, vulnerability levels, and typical health behaviors, and for offering appropriate goal-setting and management techniques along with pertinent features for adopting healthy lifestyle choices. In addition, goal-setting features promote self-discipline and gradual behavior change (Wang & Qi, 2021).

The primary goal of mobile health applications is to give users with medical and health information, hence the quality of the information is an important aspect

in consumers' adoption and use of applications. Information quality may be judged in three ways: accuracy, timeliness, and relevancy. Applications built by non-medical institutions raise issues regarding information accuracy, impacting application use (Biviji et al., 2020). The study revealed that these devices may detect differences in vital signs such as heart rate and blood pressure, alerting medical personnel to potential problems (Pope et al., 2019). This might be especially beneficial for those who are unable to communicate effectively with their healthcare professionals or are prone to sudden changes in health.

2.3.4 Potential benefits

The emergence of smartphones, smartwatches, provides a new method for this type of monitoring. It focuses on real-time patient self-monitoring, immediate health data feedback, and timely medical behavior adjustment. Real-time feedback implies accuracy is essential for functionality (Timurtas et al., 2021). To support this statement, a study by Triantafyllidis et al. (2024) encompasses quantitative methods aims to identify research study incorporating smartwatches interventions. The paper highlights that using smartwatches for healthcare offers a promising solution for enhancing patient self-management and enabling remote medical monitoring. Their ability to track various health metrics and detect health issues in real time, even during daily activities, makes them particularly valuable. Self-tracking is increasingly helping people establish a sense of self while also delivering health and wellness services (Misra et al., 2023).

A research by Tian et al. (2019), focuses on introducing the concept of smart healthcare leverages a new generation of information technologies. In this approach, smartphones might become a feasible and cost-effective instrument for continuous

health monitoring. By enhancing portability, users can leverage high-performance smartphones to more efficiently monitor their environment and health, saving both time and effort. As a result, it provides an efficient and cost-effective alternative to in-person clinical monitoring, which is more favored by communities.

Wearable devices monitor users' everyday actions in order to understand and improve their habits. For example, if the user has been sitting for longer than normal, the gadget will alert the user to get up and exercise, or they can assist the user in improving their breathing pattern. In addition, these devices may send messages to remind you to take your meds or attend appointments. Thus, they can assist elders live independent and healthy lives (Farivar et al., 2020).

2.4 Challenges Perceived

Although many participants acknowledged the benefits of Mobile Medical Devices (MMDs), several challenges were identified that hinder their use or limit their long-term adoption. These challenges emerged from both personal experiences and broader concerns related to technology, affordability, and user confidence.

2.4.1 Device complexity

Participants' perceptions of the complexity involved in using Mobile Medical Devices (MMDs), particularly smartwatches and health-related applications. Perceived complexity has been defined as relatively difficult to understand and use (Farivar et al., 2020). The learning curve and user-friendliness were identified as significant factors influencing user experience and sustained use (Wu et al., 2024). Also, telemonitoring equipment were used more frequently due to their comfort and convenience of use. It is critical that gadgets may be modified to meet individual needs, so that users can conduct their everyday duties freely.

Perceived ease of use in mobile health applications is mostly determined by the user interface design and usage efficiency. When the user interface is packed with text or information, it is difficult for users to interact with the program; nevertheless, a clean and straightforward design may assist consumers navigate it (Vaghefi & Tulu, 2019). Furthermore, some user-specific requirements, such button size and data presentation for elderly (Morey et al., 2019), are also factors to assess the friendliness and usability of the mobile health application interface. It may be shown that requiring a significant time and energy investment prevents consumers from accepting and using it. Thus, participants will face difficulties interpreting measurements.

2.4.2 Cost

Cost, a typical reason for consumers to reject mobile health applications, comprises the requirement of terminal devices, the cost of purchasing applications, and data traffic expenses when using the applications. Cost was the driving force behind not owning a wearable (Shandhi et al., 2024). Additionally, in the study by Zhou et al. (2019), claimed about the cost was a major challenge for participants, with a significant proportion (78/117, 66.7%) stating they would not purchase for a health app. Applications that are free are more prone to inspire users to take part in health management (Zhou et al., 2019). High-income individuals may find affordability more appealing given the high prices of the many wearable technology available on the market (Lee & Lee, 2018). Thus, young adults or students particularly may face challenges in affording these devices due to financial constraints. Cost-related hurdles and expenditures that would prevent the cessation or effective use of telemonitoring equipment.

2.4.3 Feeling of discomfort

Comfort and bulkiness affected usage during sleep. Following that, device wear during sleep is less common due to factors like comfort and charging (Shandhi et al., 2024). Similarly, a study by Wu et al. (2024), reported that patients had concerns about the watch's size and the comfort of the strap. Most of the time, malfunctions and bulky design seen as barriers.

While many people are motivated to engage in healthy activities, they may not always know how to go about it. Some of the information in the health applications directed individuals to areas with healthier food options or gave guidance on how to be healthy. Participants felt uncomfortable or feared something

irreversible would happen, mistakes were believed to lead to potentially major errors (Kaihlanen et al., 2022). Participants disliked the concept of having to receive commands or ideas from a machine. In some cases, such as when users are unable to complete a specific task or fail to meet their specified objective, having the app continue to provide negative feedback might demotivate and backfire.

2.4.4 Technical concerns

Several studies have reported challenges with the use of smartwatch interventions, which might have affected patient engagement and study outcomes. A research by Triantafyllidis et al. (2024), found that technical concerns like as synchronization with the app, regular wristwatch charging and internet availability. The need for daily charging, availability of a WiFi connection, and privacy protection for personal data gathered by the wristwatch were mentioned as issues in the study by Li et al (2023). More specifically, Abbott et al (2019) reported that charging the smartwatch every two days and connecting with the smartphone app could be potential barriers. Charging needs and wear-time differences influence usage patterns (Shandhi et al., 2024).

Additionally, it was discovered that most of the time, a smartphone app was utilized in conjunction with the wristwatch to help with patient monitoring and direction. The lack of synchronization with a mobile app has been documented in the literature as a troubling technological problem, typically resulting from smartwatch operating system changes or limited battery life (Triantafyllidis et al., 2024).

Technical problems, bulky wearable and carrying two phones was reported by Wu et al. (2024) as barrier to sustain use of the devices. Wrist movement captured

by smartwatches is subtle and noisy (Chen et al., 2021). When a user wears a watch loosely, it is difficult to capture respiration signals. Furthermore, overestimated measurements are potentially dangerous if a person decides not to seek care (Jiang et al., 2023).

2.4.5 Data accuracy

The primary goal of mobile health apps is to offer users medical and health information, making the quality of that information a crucial factor in users' acceptance and use of the apps. Providing accurate health information contributes to trust and adoption (Cao et al., 2024). Three criteria may be used to assess information quality: accuracy, timeliness, and relevance. Biviji et al. (2020) conducted a quantitative study to explore the connection between the features of mobile health applications and users' perceived satisfaction and intention to use them. According to the research, applications developed by non-medical companies might raise concerns about information accuracy, impacting application usage.

The reliability of smartwatches is a subject of concern due to lack of transparency surrounding the algorithms used to identify and analyze users' health data. These algorithms are kept from the general public, which raises concerns about their accuracy and reliability. Due to that, users question the authenticity of health information and face difficulty verifying its accuracy (Wang & Qi, 2021). Coordination and quality assessment are challenging due to sensor variability and inconsistent performance (Canali et al., 2022). Health information accuracy refers to customers' perceptions of the trustworthiness and credibility of data supplied by gadgets. Similarly, Singh reported that the accuracy of health wearable devices' information increases the likelihood that people will rely on it (Singh et al., 2022).

Consumer smartwatches cannot be utilized in research or clinical settings since the data quality is unclear. For example, device inaccuracy in calculating steps caused frustration (Farivar et al., 2020). Wrist movement captured by smartwatches is subtle and noisy (Chen et al., 2021). Align with this context, sensor placement and loose wearing could potentially affect accuracy. When a user wears a watch loosely, it is difficult to capture respiration signals. Furthermore, overestimated measurements can be dangerous if a chooses not to seek care (Jiang et al., 2023).

2.4.6 Privacy

Users' perception of security and privacy may determine their willingness to use applications (Wang and Qi, 2021). Privacy concerns limiting wearable ownership vary across race, age, education, and employment (Shandhi et al., 2024). Because information provision, collecting, and transmission rely heavily on online networks, mobile health apps are extremely legally dangerous. A research by Wang and Qi (2021), employing quantitative methods seeks to identify and summarize the influencing factors on user acceptance and use behaviour for mHealth apps. This study stated that users face challenges in evaluating the credibility of experts' personal or health information within applications, and determining legal accountability for medical or medication safety issues is often complex.

In addition, certain mobile health applications may gather more sensitive health data than others, thus raising privacy concerns. Ethical reflections about security, privacy, intrusiveness this can loosely tie to discomfort due to invasiveness (Canali et al., 2022). People could be more reluctant to give their personal information to mobile health apps since health data is sensitive (Bol et al., 2018).

When it comes to patient health data, security and privacy are tightly intertwined since any illegal access to the data (security breach) jeopardizes patient privacy.

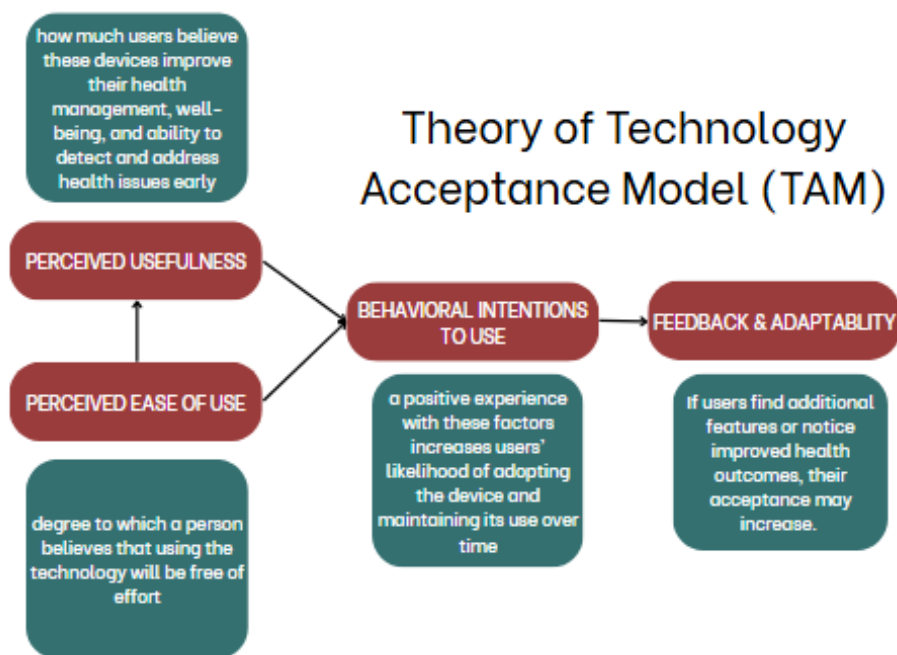
In contrast, although privacy concerns do not determine whether people use mobile health apps in general, they do predict use of certain types of health apps. Bol et al. (2018) discovered that while those who were more concerned about perceived surveillance were more likely to use reproductive health apps than those who were less concerned about privacy, those who were less concerned about secondary use of information were more likely to use health dashboards. According to these findings, consumers view some forms of health-related data as more sensitive than others, and certain kinds of health applications cause greater privacy issues than others.

2.5 Theoretical framework

This study adopts the Technology Acceptance Model (TAM) as its theoretical framework to explore the perceptions and acceptance of mobile medical devices among students' community at Universiti Malaysia Sarawak (UNIMAS). Originally developed by Davis (1989), TAM provides a robust foundation for examining the adoption of emerging technologies by identifying key determinants such as perceived usefulness and perceived ease of use. Here's how TAM relates to mobile medical devices:

Figure 2.1

Theory of Technology Acceptance Model (TAM)



2.5.1 Perceived Usefulness

Perceived usefulness refers to the degree to which students believe that using mobile medical devices improves their daily health management. Among the student population at UNIMAS, these devices may be perceived as valuable for tracking steps, heart rate, sleep patterns, or calorie intake, thus enabling informed decisions about lifestyle habits. Previous studies have found that perceived usefulness

significantly predicts the adoption of mobile health applications, particularly when users believe these tools contribute to improved academic performance through better physical and mental well-being (Chen et al., 2018; Vaghefi & Tulu, 2019). Increased access to real-time health data may also reduce students' reliance on clinical visits, making self-monitoring a convenient option for managing minor health concerns.

2.5.2 Perceived Ease of Use

Perceived ease of use reflects how effortlessly students can operate and interact with mobile health technologies. Devices that offer intuitive navigation, clear health metrics, seamless app integration, and minimal setup requirements are more likely to be embraced. For students at UNIMAS who balance academic responsibilities, part-time work, and personal life, simplicity and convenience are crucial. Moreover, user interfaces that are engaging, visually clear, and tailored to student needs such as goal tracking or gamified health features further enhance ease of use and encourage daily engagement.

2.5.3 Behavioral Intention of Use

Behavioral intention refers to a student's willingness to adopt and consistently use mobile medical devices. According to TAM, this intention is shaped by perceived usefulness, ease of use, and social influence (Kao, 2019). When students recognize tangible health benefits, find the device user-friendly, and receive positive reinforcement from peers or instructors, their intention to incorporate the technology into their daily routine increases. For example, a student who uses a smartwatch to improve sleep hygiene and receives positive academic outcomes may

continue using the device long-term. This repeated usage creates a feedback loop that strengthens motivation and habit formation.

2.5.4 Feedback and Adaptability of Use Based on Experience

Students' perceptions may evolve over time based on their personal experiences with mobile medical devices. As they become more familiar with the technology, discover new features, or observe health improvements, their acceptance may deepen. Conversely, negative experiences such as technical malfunctions or data inaccuracies, may lead to reduced engagement. Therefore, adaptability is key. Mobile medical devices that offer regular updates, responsive customer support, and customizable features are more likely to maintain relevance among student users whose health needs and academic routines may change throughout the semester.

2.6 Summary

To sum up, this literature review discusses the community context surrounding the use of Mobile Medical Devices (MMDs) among students, organized into three key themes: perceptions, adoption factors, and perceived challenges. It highlights how students' perceptions shaped by health goals, peer influence, and technological familiarity affect their engagement with MMDs for daily well-being monitoring. Causes such as individual motivation, social support, device usability, and perceived benefits significantly influence adoption and usage. At the same time, various challenges including device complexity, cost, discomfort, technical issues, data accuracy, and privacy concerns hinder sustained use. The chapter also integrates the Technology Acceptance Model (TAM) by Davis (1989), explaining how perceived usefulness, ease of use, and behavioral intention impact students' acceptance of MMDs. Ultimately, the discussion provides insights into how student experiences, preferences, and trust shape their engagement with health technologies in a university setting.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter outlines the research design, research setting, inclusion and exclusion criteria for participants, sampling method and sample size, study instruments, ethical considerations, data collection methods, data analysis techniques, and provides a summary.

3.2 Research design

Qualitative research design aims to explore and understand complex events and the meanings individuals or groups attach to them (Jain, 2023). It captures the insight of human experiences, beliefs, attitudes, and behaviors, uncovering insights that quantitative research might miss. A descriptive qualitative research design is ideal for this study, as it provides a thorough understanding of the community's perceptions and attitudes toward mobile medical devices. It is often exploratory, utilizing triangulation of data from various sources like interviews, focus groups, and documents, which gather detailed data on participants' perspectives and environments (DeMarco, 2023). It contextualizes quantitative data and explores the social and cognitive processes behind research components (Farivar et al., 2020).

This approach uncovers rich insights into the unique perceptions and causes that influences the student's community at UNIMAS, revealing how cultural, socio-economic, or environmental influences shape views on healthcare technology. As experiences, emotions, and actions are difficult to quantify (Tenny et al., 2022), this method uncovers perceptions that may not emerge from quantitative methods, offering a deeper understanding of why people adopt or resist mobile medical devices for home monitoring.

Another advantage of this design is its flexibility, allowing researchers to probe participants for deeper responses. If users express concerns about usability or reliability, researchers can ask follow-up questions to explore how these concerns influence adoption. These findings can lead to recommendations for better device design or educational programs to enhance usability (Doyle et al., 2020).

Finally, this approach ensures diverse perspectives are included. In a community like UNIMAS, where experiences with mobile devices vary by socio-economic status, education, or health status, it ensures all voices are heard, providing a holistic and actionable view of the community's perceptions for healthcare providers.

3.3 Research setting

The study was conducted within the UNIMAS compound. Interview take place in any suitable and conducive environment in area like college or cafeteria, depends on participants availability and suggestions.

3.4 Inclusion and Exclusion criteria

3.4.1 Inclusion:

- i. Any UNIMAS students age 20-30 years old who own Mobile Medical Devices (MMDs)

3.4.2 Exclusion:

- i. Students who are below 20 or above 30 years old.
- ii. Participant who does not own Mobile Medical Devices (MMD)
- iii. Participant that unwilling to join.
- iv. Participants who joined the pilot study

3.5 Sampling method and sample size

3.5.1 Sampling method

In this study, a purposive sampling method was used. Purposive sampling is a non-probability approach that selects units depending on the sample's intended features (Nikolopoulou, 2022). It involves the intentional selection of units. Unlike probability sampling, which seeks representativeness, purposive sampling aims to select cases that provide in-depth insights into the phenomenon of interest. This method is particularly effective for focusing on relatively small, targeted samples (Obilor, 2023). The objective of purposive sampling is to choose individuals or groups that will best help answer the research question. It works best when researchers have extensive prior knowledge of the topic, as the quality of the sample improves with more data (Nikolopoulou, 2022).

3.5.2 Sample size

The sample size for this study was determined by data saturation, meaning interviews continued until no new ideas emerged during data collection (Squires & Dorsen, 2023). Data saturation is an important concept in qualitative research, as it signals when no further interviews are necessary and data collection can conclude. It occurs when enough interviews have been conducted and no new information is obtained, although it is often underreported (Squires & Dorsen, 2023). The study included ten participants, all from UNIMAS students aged 20-30 years who own Mobile Medical Devices (MMDs). Data collection was stopped when saturation is reached, meaning no new themes arise.

3.6 Study instruments

This study employed four instruments: (1) the researcher; (2) a notepad and pen; (3) a smartphone; and (4) semi-structured interview rules. The researcher itself taking roles of interviewer, observer, and scribe during the participant interviews made the researcher indispensable to the study. The semi-structured interview guideline (refer to Appendix V) is adopted from George (2022) and changes were done to ensure it answers the objectives of this research. Throughout the interview, participants' comments and observations were jot using the notebook and pen. The interview was recorded using an app on the researcher's phone that records audio. A semi-structured interview guideline comprising both scheduled and unstructured questions that underwent a pilot study to assess its rigour.

3.7 Ethical consideration

Ethical approval for the research study has been obtained by the Medical Research Ethics Committee, Universiti Malaysia Sarawak (UNIMAS). Because doing research typically necessitates considerable collaboration and coordination among multiple persons from diverse areas and organizations, ethical norms sustain the ideals of trust, accountability, mutual respect, and equity that are vital to teamwork (Resnik, 2020). The procedure known as "informed consent" guarantees that study participants are fully informed about the specifics of the investigation and voluntarily decide to take part. Participants were guaranteed anonymity and confidentiality, with access to relevant information restricted solely to those essential for the research comprehension.

Prior to commencing the study, written consent and permission were prepared before having a one-to-one interview session. Consent given and explained to the participants prior to interview session and all data recording from the interview were kept safely in phone storage with backup in online OneDrive storage. The data has limited access only to

researcher and researcher's supervisor for data translation. Participants have rights to withdraw or leave the study at any moment where the study were conducted with prior notice.

3.8 Rigour and Trustworthiness

Specific rigor criteria are essential to assure the reliability and integrity of data analysis in qualitative research, using computer software, peer review, audit trails, triangulation, and negative case analysis (Johnson et al., 2020). Ensuring trustworthiness is vital to establish the credibility and dependability of qualitative findings. This includes credibility, transferability, dependability, and confirmability (Ahmed, 2024).

To ensure rigor and trustworthiness in this qualitative study, several strategies aligned with established criteria were employed. Credibility was enhanced through the use of triangulation, peer review, and pilot testing, which allowed the researcher to refine the interview protocol based on direct participant feedback regarding question clarity, language, and relevance. The pilot study, involving student participant, ensured that data collection tools were accurate and appropriate, contributing to prolonged engagement and consistent monitoring key aspects of credible research. Transferability was supported by providing detailed contextual descriptions and clear inclusion and exclusion criteria, enabling others to determine whether the findings could apply to similar settings or populations. Dependability was addressed through careful documentation of research procedures, including audit trails of decision-making during the instrument refinement and analysis process, which ensures the study can be replicated or followed by other researchers. Lastly, confirmability was strengthened by incorporating peer debriefing and reflective journaling, allowing for transparency in the interpretation of findings and reducing researcher bias. These combined approaches demonstrate methodological rigor and help build trust in the

study's outcomes, contributing to a more reliable and meaningful understanding of students' perceptions toward mobile medical devices.

A pilot study was conducted prior to the actual study to evaluate the research approach in data collection. A well-conducted pilot study guarantees methodological rigor, which may result in good research and scientifically sound work that may be published and benefit the community at large. The findings from a pilot study help researchers design and execution of their primary study, as well as provide a chance to learn or upgrade the relevant skills prior to commencing the larger investigation (Shakir & Rahman, 2022).

3.9 Data collection

Figure 3.1

Data collection Flow Chart



The researchers acquired ethical approval prior to commencing the study from the Medical Research Ethics Committee, Universiti Malaysia Sarawak (UNIMAS). A written consent and permission were prepared before having a one-to-one interview session. Upon receiving ethical permission, a compilation of names of students who expressed their willingness to involve in the study was gathered. The interview session was conducted utilising semi-structured interview guidelines and questions that were authorised and analysed based on pilot research. This was done to assure the rigour and reliability of the interview questions. The time and location for interview take place based on researcher and

participants choice. The interview setting done in comfortable place and free from disruption which can affect the interview.

3.9.1 Pilot study

Pilot studies serve an important role in research. A pilot or preliminary study is a small-scale test of a particular research tool, such as an interview guide or questionnaire (Shakir & Rahman, 2022). It helps the researcher anticipate and address potential challenges before conducting the main study. The pilot study included with selection of two students who met the specific inclusion and exclusion criteria established for this research. They were requested to provide feedback on the questions' language, meaning, and connotation. In addition to being asked for their opinions on the methods being employed, pilot participants were requested to ask questions if anything seemed unclear. As a result, the researcher was able to improve the instrument's accuracy and consistency. The participants in the pilot project were explicitly notified that their involvement would be keep the confidentiality and anonymity. The data obtained from the pilot project was securely stored, with access limited to the researcher and their supervisor.

3.9.2 Actual study

The participants were personally contacted in class on campus. A total of ten students, was selected purposively. The researcher would brief the purpose of the study and provide an information sheet along with a consent form. Follow-up would be necessary to confirm the participants' agreement to take part in the study. The interview schedule was arranged based on the availability of the participants and the researcher.

During the data collection process, a semi-structured interview approach was conducted in both English and Malay. Participants would answer predetermined open-ended questions, a method frequently used by healthcare practitioners in research. The interviews would be audio-recorded to make sure that data is captured accurately, allowing the researcher to focus on the content of the interview and provide verbal cues for a "verbatim transcript." Each interview would last between 20 to 30 minutes. Data collection stopped when saturation is reached, meaning no new themes arise.

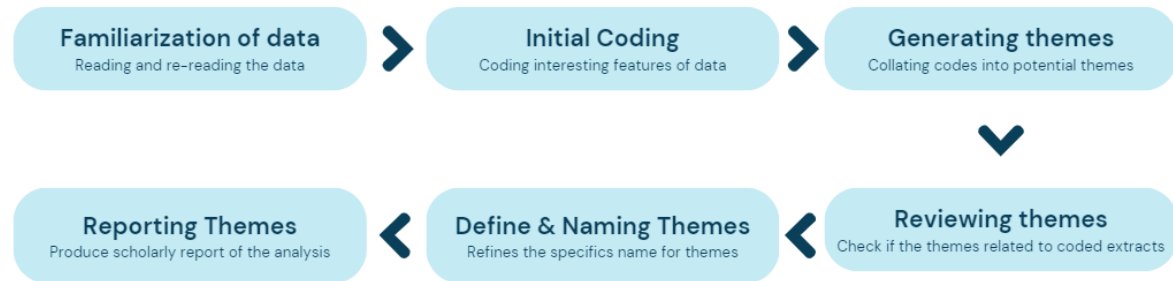
3.10 Data analysis

Data collection for this study involved recording audio from interviews with participants. The collected data was transcribed and analyzed using thematic analysis. Thematic analysis is a qualitative research method that identifies and presents recurring patterns or themes within the data. It entails carefully reading and evaluating the information to extract meaning and comprehend numerous subjects and interpretations (Chawla & Wood, 2021). The audio recordings were manually transcribed word by word into Microsoft Word immediately to prevent data loss, and the transcripts saved on OneDrive and specialized hardware to ensure the security of the collected information. Thematic analysis was chosen because it is well-suited for novice researchers using a phenomenological approach, as it allows for extracting detailed insights from participants.

Braun and Clarke (2012) define thematic analysis as a technique that identifies, examines, and summarizes patterns within data. The six-phase approach in thematic analysis was applied to this study.

Figure 3.2

6 Phases for Braun & Clarke's thematic analysis



The process of data familiarization begins when the researcher actively listens to the audio recordings, transcribes the data, and engages in repeated readings to become familiar with the information provided by the participants. To have a thorough knowledge of the data, the researcher then generates initial codes by identifying and coding noteworthy and relevant data characteristics throughout the entire dataset. Once coding is complete, the researcher organizes the codes into potential themes. The researcher then gathers all relevant data associated with each potential theme and sub-theme. The themes are evaluated by checking the relevance of the codes to each respective theme. This is followed by refining the themes, establishing clear definitions, and naming each one appropriately. Finally, the themes are finalized, and the report generation process is completed.

3.11 Summary

This chapter outlines the qualitative research design used to explore UNIMAS students' perceptions of Mobile Medical Devices (MMDs). A descriptive approach with semi-structured interviews was employed, targeting ten purposively selected students aged 20–30 who own MMDs. Ethical approval was obtained, and informed consent ensured confidentiality and voluntary participation. A pilot study refined the interview guide, improving clarity and validity. Data were collected through audio-recorded interviews, transcribed, and analyzed using Braun and Clarke's (2012) thematic analysis. Trustworthiness was ensured through strategies addressing credibility, transferability, dependability, and confirmability, enhancing the study's rigor and reliability.

CHAPTER 4: FINDINGS

4.1 Introduction

This chapter presents the findings of the data collected through interviews, observation, and reflective journals through four sections (1) Socio-demographic data (2) Overview of the themes (3) Research questions and (4) Summary. The chapter includes the sociodemographic data of the participants, as well as the themes that arose from the data collection. Additionally, it will explore how the dialogue among participants contributed to the findings and themes. This chapter provided a detailed explanation of the ten themes that arose from the data collection, as well as the opinions expressed by the participants.

4.2 Socio-demographic of the Participants

A sample size of 10 students from UNIMAS were selected using the purposive sampling. The selection of participants was based on the inclusion and exclusion criteria outlined in section 3.4. The point of data saturation was reached when conducting interviews with the tenth participant. All participants were assigned with a code name of a random alphabet throughout the interview process to maintain anonymity.

Table 4.1*Socio-demographic Data of Participants*

Participants	Gender	Age	Race	Religion	Course of study	Type of MMDs
Mr. A	Male	23	Dusun	Christian	Nursing Student	Smartwatch, Fitbits
Mr. J	Male	21	Bisaya	Islam	Nursing Student	Smartwatch
Mr. K	Male	23	Indian	Hindu	Economics Student	Smartwatch
Ms. I	Female	23	Malay	Islam	Intern (Psychology Student)	Smartwatch
Ms. N	Female	23	Iban	Christian	Nursing Student	Health apps (Strava)
Ms. S	Female	25	Bidayuh	Islam	Counselling Student	Smartwatch
Ms. L	Female	22	Bajau	Islam	Psychology Student	Smartwatch
Ms. H	Female	23	Malay	Islam	Communication Student	Health apps (Apple Fitness)
Ms. K	Female	22	Chinese	Buddha	Medical Student	Health apps (Apple Fitness)
Ms. M	Female	23	Indian	Hindu	Medical Student	Health apps (Jovi Sport)

4.3 Overview of the themes

The findings of this study are arranged according to the research objectives. A total of ten themes were revealed in this study, as shown in Table 5.2

Table 4.2

Themes of Thematic Analysis

Research Question	Themes
1) What are the perceptions of UNIMAS students regarding the use of Mobile Medical Devices (MMDs) for daily health status monitoring?	Theme 1: Awareness and understanding towards MMDs
	Theme 2: Behavioral response towards MMDs
2) What are the causes that influence student's perceptions and acceptance of Mobile Medical Devices (MMDs)?	Theme 3: Individual health needs and wellness goals
	Theme 4: Social influences
	Theme 5: Devices usability and real-time monitoring
3) What challenges do students from UNIMAS community perceive in adopting and using Mobile Medical Devices (MMDs) for personal health monitoring?	Theme 6: Device complexity
	Theme 7: Cost
	Theme 8: Discomfort
	Theme 9: Technical problems
	Theme 10: Data accuracy and privacy

4.4 Research Question 1:

What are the perceptions of the UNIMAS students regarding the use of Mobile Medical Devices (MMDs) for daily health status monitoring?

4.4.1 Theme 1: Awareness and understanding towards MMDs

Most participants demonstrated a functional understanding of MMDs, especially in relation to smartwatches and fitness tracking apps. They aware and recognized features like heart rate monitoring, step tracking, sleep analysis, and calorie counts. However, the depth of understanding varied, some participants only knew the basic features they personally used, while others could articulate broader health monitoring functions.

"I'm aware that the apps on my smartphone can only track steps. They don't offer more advanced features like heart rate or sleep monitoring." (Ms.H)

"My smartwatch... heart rate and sleep data give me insight into my physical condition... the noise alerts make me more conscious of my environment, especially in loud places." (Mr.J)

"For individuals who don't have any heart problems... smartwatch isn't essential, but still beneficial for monitoring general health and staying informed." (Ms.K)

4.4.2 Theme 2: Behavioral response towards MMDs

Participants generally held positive behaviour toward MMDs, appreciating their role in tracking physical activity, sleep, and overall fitness. Many saw them as supportive tools for health awareness, though some viewed them as non-essential, especially without chronic health concerns. Engagement varied, while some participants used a range of features, others focused mainly on step tracking. Most used MMDs to set

goals such as steps, jogging distances, or calories burned, which helped motivate regular activity. However, maintaining consistency was a challenge for some, as initial motivation often declined over time.

"I use the health app 4–5 times per week, mainly for step tracking. When I go for a jog... track of how far I've gone and how many calories I've burned...I can see if I'm improving over time." (Ms.N)

"I use a smartwatch for daily health tracking... I use a period calendar to track my menstrual cycle... helps me stay aware of any changes in my body." (Ms.I)

"I use my smartwatch while sleeping too... helps me understand the quality of my rest, including how long I sleep and how often I wake up during the night." (Mr.A)

"If I notice any abnormality in my heart rate, I'll track it for a few days... If it seems concerning, I'll seek medical advice to ensure everything is okay." (Ms.S)

"I use Apple Watch daily, except while sleeping. I can track and even check notifications without having to pull out my phone. It's become part of my routine... even while I'm busy with classes." (Ms.L)

4.5 Research Question 2:

What are the causes that influence student's perceptions and acceptance of Mobile Medical Devices (MMDs)?

4.5.1 Theme 3: Motivated by personal health needs and goals

Many participants adopted MMDs out of self-driven interest in fitness or due to specific health concerns. Devices were seen as useful tools to monitor recovery, track progress, and build healthier habits. For some, health scares (e.g., asthma) triggered the decision to use MMDs as a preventive or monitoring tool. Two out of ten participants started using the devices due to health conditions as an initial reason in using the devices. While the others use it initially for an accessory and slowly adapts for health tracking.

"I started using the Apple Watch because of my asthma, as it helps me keep track of my health more effectively." (Ms.L)

"I was motivated by my own interest in exercise and martial arts... enhance my training and monitor my progress more effectively." (Mr.K)

"I set my target to achieve 4 kilometers per jog... helps me stay consistent with my fitness routine." (Ms.I)

"I set and follow daily calorie burn goals, like 350 calories per day, which are often suggested by the app." (Mr.J)

4.5.2 Theme 4: Social influences

Peer groups, family, and social media played a significant role in influencing adoption. Seeing friends use MMDs or share fitness achievements (e.g., Strava updates) generated curiosity and interest. Some participants were introduced to

MMDs through school health programs or family members, creating a ripple effect of adoption within social circles. Most of the participants were influenced by their friends, but some of them also influenced by their family and community activity.

"My friend often posts about her daily... seeing that regularly made me want to try."

(Ms.K)

"A colleague encouraged me to exercise and use a smartwatch to track my runs. She shared how helpful... and staying motivated." (Ms.S)

"My college was holding a campaign to encourage jogging using the Strava app... it felt motivating to be part of a larger community working towards the same goal."

(Ms.M)

"I was introduced... initially through a school activity that promoted reaching 10,000 daily steps. The activity sparked my interest and led me to explore for my health."

(Mr.J)

"Most of my family members use smartwatches, and it has become something common in our household... easier for us to track our health together... compare our daily steps, monitor heart rates, and even encourage each other to stay active."

(Mr.K)

4.5.3 Themes 5: Devices usability and real-time monitoring

Participants preferred Mobile Medical Devices that were portable, user-friendly, and easily integrated into their daily routines. Smartwatches were favored over mobile apps due to their hands-free functionality and wearability. Features such as notifications and reminders supported consistent use. However, occasional compatibility issues, such as pairing smartwatches with smartphones sometimes

hindered the user experience. Despite this, overall ease of use encouraged regular engagement with the devices.

"I prefer smartwatches over apps because of their portability, especially when I'm not carrying my phone. It's convenient to have everything on my wrist... without needing to pull out my phone." (Mr.J)

"I find health monitoring technology on smartphone's apps easy to use... simple, real-time data that helps me stay on track with my fitness goals... user-friendly interfaces make it more convenient." (Ms.K)

"The smartwatch will automatically show a notification if my heart rate increases ... alerts me when my heart rate exceeds a certain threshold, allowing me to take action if needed." (Mr.K)

4.6 Research Question 3:

What challenges do students from UNIMAS community perceive in adopting and using Mobile Medical Devices (MMDs) for personal health monitoring?

4.6.1 Theme 6: Device complexity

Although many participants found MMDs easy to use, some reported difficulties especially when using advanced features or complex user interfaces. Participants were concerned that elderly users would struggle more due to smaller screens, unlabelled icons, or dense menu structures.

"It felt uncomfortable when I first started using the smartwatch... a bit complicated to figure out... wasn't used to the features and settings, so it took some time to learn how everything worked." (Mr.J)

"A smartwatch can't measure blood pressure directly... it requires additional equipment or sensors, like a blood pressure cuff, to provide accurate blood pressure readings." (Mr.A)

4.6.2 Theme 7: Cost

Affordability was a key barrier. Many students considered MMDs, especially branded smartwatches, to be too expensive. The high upfront cost and the need for compatible phones deterred some students from purchasing or upgrading devices.

"It is a bit costly, especially for us as students. With limited budgets, it can be challenging to justify the expense, even though the smartwatch offers many features." (Ms.L)

"The smartwatch really cost me quite a bit. Ultimately, I felt it was worth the investment for the convenience and benefits it brings." (Ms.K)

"Pricing is a significant barrier, especially for students. While the features may be appealing, it's difficult for many students to prioritize such an investment." (Ms.S)

4.6.3 Theme 8: Discomfort

Wearing MMDs for long hours caused discomfort for some participants. Issues included wrist pain, tight straps, or feeling numb after sleeping with the device. These physical discomforts affected usage consistency.

"The weight or tightness of the smartwatch can start to feel... particularly when I'm active or sweating... it can be distracting." (Mr.J)

"Because of the vibrations, there's a chance the smartwatch might over-count certain activities, like steps or movements... vibrations could trigger false readings,

especially during when there's a lot of motion or if the watch is not positioned perfectly." (Ms.L)

"I felt tightness and numbness after sleeping with the watch on. The pressure from wearing it overnight seemed to restrict circulation." (Ms.S)

"The smartwatch is kind of heavy and larger compared to a normal watch. It feels bulkier on the wrist, which can be uncomfortable at times." (Ms.I)

4.6.4 Theme 9: Technical problems

Participants reported technical glitches such as lagging apps, poor syncing, battery issues, and inaccurate readings. Forgetting to charge the device also disrupted data tracking. Compatibility problems between smartwatches and smartphones (e.g., Samsung watches not syncing with non-Samsung phones) further complicated usage.

"The apps sometimes glitch... this inconsistency can be frustrating... makes me question whether the readings are reliable, and I end up rechecking the measurements multiple times." (Ms.M)

"You have to bring your smartphone everywhere... a bit inconvenient, especially when you just want to go out with minimal stuff, but still need access to calls, messages, or apps." (Ms.N)

"The Samsung smartwatch is not fully compatible with other devices... can only save my data to a smartphone from the same brand." (Ms.I)

"I sometimes forget to charge my smartwatch... it won't be able to record my calorie burning or activity. It's frustrating, especially when I realize the watch wasn't tracking my progress." (Mr.K)

4.6.5 Theme 10: Data accuracy and privacy

While participants found MMDs helpful, many doubted the accuracy of features like BMI, oxygen saturation, or sleep monitoring. Trust in data accuracy was often partial, especially when readings varied or seemed inconsistent with physical symptoms. Despite the sensitive nature of health data, most participants expressed minimal concern over data privacy. Trusted brands like Apple or Samsung inspired confidence. However, a few participants were cautious about apps that required personal information, particularly lesser-known or non-official health apps. Ethical concerns were not a primary deterrent but were acknowledged as important, especially in terms of data sharing or surveillance.

"Sometimes, I notice potential inaccuracies in step counting, especially due to arm movement when sitting." (Ms.I)

"It has to be in direct contact with the skin for accurate readings; otherwise, the measurements may be inaccurate...especially for heart rate or activity tracking."
(Ms.L)

"I have doubts about the accuracy of certain features, like BMI and sleep tracking... not entirely convinced they're precise." (Ms.N)

"I tend to trust brands like Samsung and Apple more... feel more comfortable with these well-established companies handling my data... have stronger security measures in place compared to lesser-known brands." (Ms.I)

"As long as my information remains private and secure, I'm comfortable using it... I've read about companies having strict privacy policies... helps ease my concerns."
(Ms.S)

4.7 Summary

In summary, the study's data collection involved interviews with ten students from UNIMAS, continuing until data saturation was achieved. Analysis of the three research questions led to the identification of ten key themes. These themes include awareness and behavioral responses of students towards MMDs. Individual goals, social influences, device usability could potentially affect the adoption and usage. Challenges faced by the students were noted, particularly regarding cost, feeling of discomfort and complexity of devices and data accuracy. Regarding resources, those findings giving insights how their perceptions towards the use of Mobile Medical Devices (MMDs) for daily health monitoring.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter will discuss the results and findings of the study which were presented in Chapter 4 from data collected through the interviews, observations, and reflective journals. The results and findings will be discussed in line with the research questions presented in Chapter 1. The research was guided by the following research questions:

5.1 How do UNIMAS students perceive use of Mobile Medical Devices (MMDs) for daily health status monitoring?

5.2 What are the causes that influence student's perceptions and acceptance of Mobile Medical Devices (MMDs)?

5.3 What challenges do students from UNIMAS community perceive in adopting and using Mobile Medical Devices (MMDs) for personal health monitoring?

This chapter end with certain recommendations proposed by the researcher, together with the conclusion of this study by presenting a statement of identification from the findings of the research. Along with that, the implications and limitations of this study are provided at the end of this chapter.

5.2 **Research Question 1:**

How do UNIMAS students perceive use of Mobile Medical Devices (MMDs) for daily health status monitoring?

This research question aimed to explore the perceptions of UNIMAS students concerning the use of Mobile Medical Devices (MMDs) for monitoring their health status anywhere and anytime on a daily basis. This section presents a detailed discussion of students'; 1) Awareness and understanding towards MMDs, 2) Behavioral responses towards MMDs

5.2.1 Theme 1: Awareness and understanding towards MMDs

This theme explores participants' awareness and understanding of Mobile Medical Devices, including smartwatches, fitness bands, and health-tracking apps. It shows the participants' familiarity with smartwatches, FitBits, and various health-related mobile applications as tools for daily health monitoring. It highlights how participants perceive the purpose, functions, and potential benefits of these devices in daily life. The findings indicate that most participants have a basic to moderate understanding of Mobile Medical Devices (MMDs), primarily through their everyday use of consumer-grade devices such as smartwatches and smartphone health apps. Awareness is largely feature-driven, with users commonly citing functionalities like heart rate monitoring, step tracking, sleep analysis, and calorie counting as their primary points of reference. This aligns with previous studies showing that self-monitoring through digital tools can foster greater health awareness and proactive behavior (Paradis et al., 2021).

A cross-sectional study by Jembai et al. (2022), discovered that the majority of respondents (82.7%) were aware of the existence and function of COVID-19 apps,

followed by personal health and fitness apps (76.3%) and medical education apps (61.8%). Some participants show a more informed and reflective use, understanding not only what the device does but also how the data benefits their health monitoring. For instance, a participant highlights less obvious features like noise alerts, showing an appreciation of environmental health tracking a sign of deeper engagement with the device's capabilities. To support this statement, a study by Triantafyllidis et al. (2024) highlights that using smartwatches for healthcare offers a promising solution for enhancing patient self-management and enabling remote medical monitoring.

On the other hand, some participants also reflect a more limited awareness, restricted to only the features they personally use or are familiar with. This suggests that while MMDs are accessible, not all users explore their full potential, possibly due to lack of interest, knowledge, or perceived relevance. Moreover, there appears to be a pragmatic attitude towards the necessity of MMDs. Some of the participants view reflects this: while they don't consider a smartwatch essential for healthy individuals, they acknowledge its preventive and informative value. This highlights an emerging awareness that MMDs can play a supportive role in personal health management, even among those without existing medical conditions. Self-tracking is increasingly helping people establish a sense of self while also delivering health and wellness services (Misra et al., 2023).

Overall, responses show varying levels of awareness shaped by personal use and perceived needs. While some actively engage with their health, others may need more education or motivation. This highlights the need for targeted awareness and education to improve understanding and use of MMDs for better health outcomes.

5.2.2 Theme 2: *Behavioral responses towards MMDs*

The findings suggest that participants recognized MMDs as supportive in tracking physical activity, sleep quality, and menstrual cycles, thereby contributing to their overall health awareness and well-being.

Some participants highlighted how MMDs aid in setting and achieving fitness goals, such as steps taken, calories burned, or jogging distances. These functions appear to be motivational, helping users engage in regular physical activity by providing measurable benchmarks. While most participants in this study reported using both the step tracker and calorie burn tracker simultaneously to achieve multiple health goals with a single app intervention, this finding contrasts with previous research. For instance, Jones et al. (2024) found that the use of health apps specifically for tracking calories or meals for weight loss was relatively uncommon. This discrepancy could be attributed to several factors. For example, participants may be more inclined to use calorie burn data rather than manually inputting meals, which can be time-consuming. Therefore, while calorie tracking for dietary purposes may be less prevalent in general, the automatic tracking of calorie expenditure through steps may serve as a more appealing alternative.

For some, MMDs served not only fitness purposes but also health monitoring roles. For instance, a female participant stated that she used her smartwatch to track her menstrual cycle, enhancing bodily awareness, while other participant showed their behaviour of using heart rate tracking to observe abnormalities and decide when to seek medical advice, showing a proactive and informed health behavior. Thus, this behaviour will enhance use of MMDs as seeing their heart rate provided reassurance while exercising (Wu et al., 2024). This indicates that beyond fitness, some users are

beginning to engage with MMDs as preventive health tools, which aligns with public health goals of early detection and self-care. Similarly, Misra et al. (2023) highlights that self-tracking is increasingly assisting people in growing their sense of self and providing health and wellness services.

Emotional responses also played a role in shaping behaviors. Positive trends in tracked data, such as improvements in sleep or fitness levels, often led to feelings of motivation, while abnormal readings sometimes triggered worry or anxiety. These findings align with Cao et al. (2024), who argued that users' emotional reactions to health feedback can influence how consistently they use such devices.

Interestingly, several participants who initially used MMDs as fashionable accessories or for general convenience reported gradually transitioning to health-related use. This highlights how exposure to health features over time can shift user behavior from passive to active health monitoring, reinforcing the idea that habit formation and feature discovery are key in deepening engagement. For some students, smartwatches were not just functional tools but also status symbols or fashion accessories, which could shift their focus from medical to aesthetic value, as suggested by Misra et al. (2023). This dual perception underscores the complex motivations behind adoption, where appearance and lifestyle compatibility may carry as much weight as health functionality.

Although participants in this study expressed a generally positive outlook, a few hinted at uncertainty regarding the interpretation of data or the long-term value of their device suggesting that greater digital health literacy and assurance of data security could enhance overall trust and sustained use.

5.3 Research Question 2:

What are the causes that influence student's perceptions and acceptance of Mobile Medical Devices (MMDs)?

The data collected through the interviews revealed that the participants responded to their views on three main factors that influence the behavioural response on MMDs, (1) Motivated by personal health needs and goals (2) Social influences (3) Device usability and real-time monitoring

5.3.1 Theme 3: Motivated by personal health needs and goals

This theme underscores how personal health motivations and wellness objectives play a significant role in driving the adoption and use of Mobile Medical Devices (MMDs) such as smartwatches and health apps. Participants' engagement with MMDs was primarily influenced by two key factors: pre-existing health conditions and a proactive interest in fitness and self-care.

A subset of participants began using MMDs due to specific health-related concerns, such as asthma or lung conditions. For example, some participants described using their devices to monitor vital health metrics like heart rate and oxygen levels, enabling them to adjust their daily routines and even engage in more informed discussions with healthcare professionals. Health motivation is increasingly intertwined with people's daily activities (Misra et al., 2023). Thus, the more acute the health threat to individuals, the higher the probability they will show positive attitudes to take steps to change their condition (Singh et al., 2022). This reflects the value of MMDs as preventive and management tools for individuals dealing with chronic or acute health issues. Same goes to study by Chandrasekaran

et al. (2020), individuals who set health-related goals such as weight loss and increased physical activity are likely to find wearables useful to monitor their progress.

In contrast, the majority of participants adopted MMDs out of personal interest in fitness or general wellness. Creating a personally-tailored exercise program reflects users' goal for self-improvement and health management (Timurtas et al., 2021). For instance, some other participants also indicated that their motivation stemmed from a desire to enhance physical performance and maintain healthy habits. Same goes to a survey done by Shandhi et al. (2024), found a primary reason for owning a wearable device was fitness and workout monitoring.

Their usage extended to tracking workout metrics (e.g., distance, calories, pace) and setting personalized goals, which helped them feel more in control and motivated. Similarly, a survey by Hokroh et al. (2020) found that 'wellness-oriented' consumers are more inclined to participate in health technology use. In addition, a survey by Bischoff et al., (2021) emphasized how crucial goal-specific apps on smart devices are for recognizing individual differences, such as personality traits, vulnerability levels, and typical health behaviors, and for offering appropriate goal-setting and management techniques along with pertinent features for adopting healthy lifestyle choices. Thus, goal-setting features promote self-discipline and gradual behavior change (Wang & Qi, 2021).

5.3.2 Theme 4: Social influences

This theme highlights the significant role of social context in shaping individuals' decisions to adopt and engage with Mobile Medical Devices (MMDs).

The findings show that peer influence, familial exposure, and community-based programs or campaigns serve as powerful catalysts for MMD uptake, especially among young adults in academic environments.

Peer influence emerged as the most common social driver, with several participants reporting that observing friends share fitness updates or use smartwatches piqued their interest. This discovery was supported by previous study by Cao et al. (2024) where social influence positively affects behavioral intention through trust. Via the interview, a participant stated that frequent exposure to a friend's fitness posts made her curious and eventually motivated her to try using a smartwatch. Similarly, some other participants also were encouraged by a colleague who shared the practical benefits of tracking runs and staying motivated through wearable technology. This suggests that observational learning and informal peer modelling can strongly impact health-related behavior, consistent with social cognitive theory.

Family influence also played a significant role, particularly in fostering a supportive environment that encouraged the sustained use of MMDs. In some cases, a ripple effect was observed where one individual's adoption of an MMD inspired other family members to begin using similar devices. This collective uptake suggests that social dynamics within the family can reinforce health-related behaviors. Furthermore, Goodyear et al. (2018) found that both peers and family members influenced young people's use of health apps and devices by framing them as socially desirable or “cool,” thereby enhancing their appeal and acceptance among younger users.

Some of the participants shared that using smartwatches had become a shared family activity, with members comparing step counts and encouraging each other. The sharing and networking features integrated into smartwatches and health apps have emerged as key factors that enhance the use of Mobile Medical Devices (MMDs). This feature makes it easier to study healthy lives and insist on health activities by allowing users to speak with one another and exchange information and accomplishments (Tran et al., 2018). This reflects how familial norms and shared routines can normalize technology use and encourage long-term behavioral change.

Participants also described being influenced by structured community initiatives, such as health promotion campaigns or school programs. These experiences show that organized health promotion efforts can effectively foster initial exposure and trial use, particularly when they create a sense of shared purpose or community participation. Social media platforms facilitate the design of user experiences that fulfill the user's demands (Mirzaei & Esmaeilzadeh, 2020). The greater the social presence, the greater the social support that the members have on each other's behavior.

These social dynamics peer visibility, community involvement, and familial adoption collectively create a network effect that reinforces MMD engagement. They not only influence the decision to adopt a device but also help maintain motivation through social accountability and collective goal setting.

5.3.3 Theme 5: Device usability and real-time monitoring

This section discusses participants' experiences with the ease of use and compatibility of Mobile Medical Devices (MMDs). Participants' preferences and

experiences highlight the importance of usability and real-time feedback as critical factors that influence the consistent use of MMDs. The findings indicate a clear user inclination toward devices that are portable, accessible, and seamlessly integrated into daily routines, with smartwatches being especially favoured over smartphone apps. Overall, many participants found smartwatches and health applications user-friendly and convenient for daily health monitoring. The reminder and sharing features were likely mentioned by most of participants during the interview. However, device compatibility emerged as a concern, with several participants highlighting limitations when syncing data across different brands or operating systems.

Smartwatches were praised for their wearability and convenience, particularly in situations where carrying a smartphone is impractical. User expectations depend more on how easy a device is to use than its usefulness (Misra et al., 2023). For instance, two out of ten participants emphasized the hands-free, always-available nature of smartwatches, which made them ideal for continuous tracking and quick access to health-related data. This suggests that form factor and design simplicity significantly enhance user experience and adoption rates.

While smartphone apps were still acknowledged for their user-friendly interfaces and accessible health data, they were often considered secondary to smartwatches in terms of convenience and continuity of use. The appeal of receiving instant feedback without needing to open an app or handle a device contributes to higher levels of engagement with smartwatch users. Some of participants also highlighted that wearing a smartwatch makes them look ‘cool’ and presentable with

those different design and colour. App design should be attractive and meet user needs to ensure acceptance (Wang & Qi, 2021).

Real-time features such as automatic notifications and alerts were also seen as highly beneficial. Via the interview, the participants highlighted about the experience with heart rate alerts illustrates how real-time monitoring can support proactive health management, empowering users to respond promptly to potential health concerns. For example, if the user has been sitting for longer than normal, the gadget will alert the user to get up and exercise, or they can assist the user in improving their breathing pattern. Users expect wearable devices to support their personal wellness and self-tracking (Misra et al., 2023). Similarly, findings from a study by Timurtas et al. (2021) show that participants relied mostly smartwatch notifications to push exercise reminders. These features add a layer of preventive functionality that increases the perceived value of MMDs beyond basic fitness tracking. Push notifications with tailored health information are associated with mobile health app engagement. For instance, when the smartwatch recognized a lack of medication compliance, it sent out SMS reminders (Li et al. 2023).

Despite the overall positive impressions, some participants encountered technical issues, such as compatibility issues between smartwatches and smartphones. These frustrations, though not widespread, highlight the importance of device interoperability and technical support in maintaining positive user experiences.

5.4 Research Question 3:

What challenges do students from UNIMAS community perceive in adopting and using Mobile Medical Devices (MMDs) for personal health monitoring?

The data collected through the interview revealed five main barriers that hinder participants in using the MMDs for daily health monitoring, (1) Device complexity (2) Cost (3) Feeling of discomfort (4) Technical concerns (5) Data accuracy and privacy

5.4.1 Theme 6: Device complexity

This section examines participants' perceptions of the complexity associated with using Mobile Medical Devices (MMDs) such as smartwatches and health apps. As previously stated by Farivar et al. (2020), perceived complexity has been defined as relatively difficult to understand and use. While many participants appreciated the general usability of MMDs, several expressed concerns about the complexity involved in using advanced features and navigating certain device interfaces. This complexity emerged as a notable challenge to adoption and sustained engagement, especially among individuals with limited technological familiarity or specific physical constraints.

Several participants described their initial difficulty in adjusting to smartwatches, particularly in understanding settings, navigating menus, or recognizing icons. For example, some participants admitted that it took time to get used to the smartwatch interface, highlighting the learning curve even for younger users. The learning curve and user-friendliness were identified as significant factors influencing user experience and sustained use (Wu et al., 2024).

Participants also raised concerns regarding the limitations and dependencies of certain devices. Interview findings indicated that some Mobile Medical Devices (MMDs) are unable to independently measure health metrics such as blood pressure without the use of external equipment. This limitation may diminish users' perceived usefulness of the devices or cause confusion among those expecting a more comprehensive, all-in-one health monitoring solution. Specifically, not all smartwatches are equipped with blood pressure monitoring capabilities, and those that do often rely on technologies whose accuracy remains under investigation.

5.4.2 Theme 7: Cost

Cost was the driving force for not owning a wearable (Shandhi et al., 2024). Affordability emerged as a significant financial barrier limiting students' access to Mobile Medical Devices (MMDs), particularly branded smartwatches. While many participants recognized the health and lifestyle benefits these devices could offer, the high cost of purchase combined with students' generally limited financial means often discouraged adoption. Participants also noted that while basic models are available at lower prices, concerns about their quality and reliability sometimes discourage purchase.

Participants explicitly mentioned that the initial cost of acquiring a smartwatch was difficult to justify given their tight budgets as a student. Even basic models were perceived as not budget-friendly, creating a gap between interest and actual purchasing behavior. The majority of them were hesitant to pay for mobile health applications, and nearly half quit using them due to hidden fees. Additionally, in the study by Zhou et al. (2019), claimed about the cost was a major challenge for participants, with a significant proportion (78/117, 66.7%) stating they would not

purchase for a health app. This aligns with broader trends observed in digital health technology adoption, where price sensitivity is especially high among students and young adults, who may lack a stable income.

Besides, some participants acknowledged the device's high cost but framed it as a long-term investment, reflecting a subgroup of users who were willing to bear the expense for the perceived convenience and health benefits. Additionally, applications that are free are more prone to inspire users to take part in health management (Zhou et al., 2019). However, this issue will not be a major challenge if their family background with a high salary as high-income individuals may find affordability more appealing given the high prices of the many wearable technology available on the market (Lee & Lee, 2018). Thus, this perspective was not widely shared, as most students weighed the price against competing financial priorities, such as tuition, books, and daily living costs. Additionally, the need for a compatible smartphone to use some smartwatch features added another layer of indirect cost, making the total investment even more prohibitive for some.

The cost barrier not only affects initial adoption but also impacts continued usage and upgrades, as many MMDs undergo frequent updates and newer models with enhanced features are regularly released. Students may be reluctant to upgrade due to financial constraints, potentially limiting their long-term engagement with the technology.

5.4.3 Theme 8: Discomfort

The feelings of physical discomfort experienced by participants when using Mobile Medical Devices (MMDs), particularly smartwatches. Physical and sensory

discomfort emerged as a notable factor that negatively influenced the consistency and duration of MMD usage among student participants. While these devices are designed to be use regularly, often 24/7 for accurate tracking extended wear posed various challenges related to physical comfort, sensory fatigue, and user annoyance.

Several participants reported physical discomfort from prolonged usage, particularly with smartwatches. Some participants noted that tight straps, device weight, or bulkiness could lead to irritation, wrist pain, or distraction, especially during physical activity or workouts. Similarly, a study by Wu et al. (2024), reported that patients had concerns about the watch's size and the comfort of the strap. Specifically, numbness and circulation issues when wearing the device overnight, an unintended but important side effect that may discourage long-term overnight wear, particularly for sleep tracking. Comfort and bulkiness affected usage during sleep. Following that, device wear during sleep is less prevalent due to factors like comfort and charging (Shandhi et al., 2024).

In addition to physical discomfort, some participants experienced functional inconveniences that further diminished their experience. For example, concerns about over-counting movements due to vibrations or improper positioning of the device, potentially reducing trust in data accuracy. This speaks to a broader issue of sensor sensitivity and the need for more reliable tracking algorithms that account for unintentional movements. Participants felt uncomfortable or feared something irreversible would happen, mistakes were believed to lead to potentially major errors (Kaihlanen et al., 2022).

Participants also highlighted experiencing notification fatigue, describing app reminders as repetitive, intrusive, or overwhelming. While such reminders are intended to promote healthy behaviors, their lack of customization led to annoyance, especially when they clashed with users' routines. This points to the need for personalized engagement strategies that respect user preferences and reduce alert fatigue.

Together, these findings reveal that comfort and usability are deeply interconnected. If a device causes physical discomfort or psychological annoyance, users are less likely to wear it consistently ultimately limiting the device's effectiveness and impact on health behavior change.

5.4.4 Theme 9: Technical problems

Technical issues were a recurrent challenge affecting both the reliability and usability of Mobile Medical Devices (MMDs), according to several participants. Despite the overall usefulness of these tools, reliability concerns, maintenance demands, and technological limitations significantly impacted user experience and satisfaction. These challenges disrupted tracking accuracy, user satisfaction, and overall trust in the device were factors that are critical for long-term engagement and behavior change. The need for daily charging, the availability of a WiFi connection, and privacy protection for personal data gathered by the smartwatch were identified as issues in the research by Li et al (2023).

Participants described various technical glitches, including lagging apps, syncing failures, and sensor inconsistencies. A common frustration, when app data appears unreliable or inconsistent, users may doubt the credibility of health metrics

and feel compelled to verify results manually undermining the device's convenience and purpose. Some participants account of having to double-check data due to inconsistencies suggests a lack of trust in the system's reliability, which undermines the primary purpose of MMDs convenient and accurate health monitoring. These perceived inaccuracies erode user confidence and may lead to reduced usage over time. Wrist movement captured by smartwatches is subtle and noisy (Chen et al., 2021).

Battery life and charging habits were also frequently mentioned. While some participants found a two-week battery life convenient, others expressed concern about power limitations, especially when forgetting to charge the device before workouts. More precisely, Abbott et al (2019) reported that connecting to the smartphone app and charging the wristwatch every two days could be potential challenges. In such cases, missing data or interrupted tracking was particularly demotivating, as it invalidated users' efforts and progress. Participants emphasized the need to plan charging in advance, highlighting how technical logistics can affect even routine physical activity planning. Thus, charging needs and wear-time differences influence usage patterns (Shandhi et al., 2024).

Another source of frustration related to smartwatch–smartphone interdependence. It really inconveniences of having to carry a phone for the smartwatch to work properly. Some smartwatches often rely on nearby smartphones for full functionality, such as receiving calls or accessing apps. Similarly, findings by Wu et al. (2024) also stated that technical problems, bulky wearable and carrying two phones as barrier to sustain use of the devices. This limited autonomy of devices can

diminish their practicality, especially for users seeking minimalism or on-the-go independence.

Another critical issue was device compatibility, particularly for students using smartwatches and smartphones from different brands. Noted that cross-brand syncing limitations, like those seen between Samsung watches and non-Samsung phones, restrict access to full features and hinder data integration. This presents a major usability issue, especially in a student demographic where users often combine different brands due to financial constraints or availability. No synchronization with a mobile app has been reported in the literature as a concerning technical issue which often emerges as a result of smartwatch low battery or smartwatch operating system support (Triantafyllidis et al., 2024).

Together, these technical problems reveal a mismatch between user expectations and actual device performance, which diminishes the perceived reliability and utility of MMDs. Even highly motivated users may struggle to maintain engagement when faced with repeated glitches or incompatibility issues.

5.4.5 Theme 10: Data accuracy and privacy

Concerns over data accuracy and privacy emerged as challenges that the student perceived in acceptance of Mobile Medical Devices (MMDs). While participants generally appreciated the health-monitoring capabilities of Mobile Medical Devices (MMDs), doubts about the accuracy of certain features such as BMI, sleep tracking, and oxygen saturation were common. Reports of inaccuracies such as step miscounts caused by simple arm movements could lead some participants to question the reliability of these devices in reflecting their true health status. Singh

reported that the accuracy of health wearable devices' health information increases the likelihood that people will rely on it (Singh et al., 2022). This skepticism often stemmed from observed inconsistencies in readings, particularly when they did not align with physical symptoms or expected outcomes. The trustworthiness of smartwatches is questioned because their health-monitoring algorithms are not publicly disclosed, creating uncertainty about their accuracy and reliability. As a result, users struggle to verify the authenticity of the health information provided (Wang & Qi, 2021).

Providing accurate health information contributes to trust and adoption (Cao et al., 2024). For instance, a participant expressed concerns about the precision of BMI and sleep tracking, while others observed possible step-count inflation due to arm movements during sedentary activity. Same with findings by Farivar where device inaccuracy in calculating steps caused frustration (Farivar et al., 2020). According to the research by Biviji et al. (2020), applications developed by non-medical companies might raise concerns about information accuracy, impacting application usage. These examples highlight a broader trend: while MMD data is seen as useful, it is not always regarded as fully reliable.

Furthermore, physical placement as such, direct skin contact is necessary for accurate health monitoring, adding another layer of data inaccuracy and potential inconvenience. When a user wears a watch loosely, it is difficult to capture respiration signals. The variability of sensors and lack of consistency make it difficult to coordinate and assess quality (Canali et al., 2022). Additionally, wrist movement captured by smartwatches is subtle and noisy (Chen et al., 2021) as overestimated

measurements can be dangerous if a person chooses not to seek care (Jiang et al., 2023).

Despite handling sensitive health data, participants did not express major concerns over data privacy. According to Wang & Qi (2021), users' perception of security and privacy may determine their willingness to use applications. In fact, most were comfortable sharing data, especially when using devices from reputable brands like Apple or Samsung. They felt reassured by the perceived security standards of these companies, suggesting that brand trust plays a critical role in shaping attitudes toward privacy.

While ethical concerns such as data surveillance and information sharing were acknowledged by participants, they were not considered primary deterrents to the use of Mobile Medical Devices (MMDs). This contrasts with findings by Canali et al. (2022), who reported that ethical considerations particularly around security, privacy, and intrusiveness, often contributed to users' discomfort and hesitancy toward such technologies. In the present study, participants appeared generally content with privacy protections, provided that basic information, such as email addresses, was safeguarded and the platforms followed transparent data policies.

5.5 Implications

The findings from this study provide valuable insights into how Mobile Medical Devices (MMDs), particularly smartwatches and health apps, are perceived and utilized by students within the UNIMAS community for daily health monitoring. These insights carry several important implications for both nursing practice and the promotion of student health and wellness.

Firstly, the study highlights the growing interest and engagement of UNIMAS students in self-monitoring their health using digital tools. This supports the nursing role in health promotion and preventive care, as nurses are well-positioned to educate and empower individuals to understand their health data, recognize early warning signs, and seek appropriate care. As such, nursing students and educators should integrate digital health literacy into teaching and practice, preparing future nurses to support patients who use wearable technology in both community and clinical settings.

Secondly, the study identified gaps in awareness and understanding among students. Some participants used devices only for basic functions such as step tracking, while others were unaware of advanced features like sleep or heart rate monitoring. This implies a need for targeted health education programs within the UNIMAS community, led by nursing students or health educators, to promote effective and informed use of MMDs for daily health management.

Additionally, emotional responses to health data, such as anxiety from abnormal readings or motivation from progress suggest the importance of psychosocial support in health monitoring. Nursing students can play a key role in developing peer support systems

or workshops that help students understand and emotionally manage their health data, thus fostering a more positive engagement with their well-being.

Lastly, this study contributes to the broader goal of promoting a healthier, more informed student population at UNIMAS. By understanding how students perceive and use MMDs, nursing students can tailor interventions, awareness campaigns, or collaboration with student health services to improve health outcomes, encourage proactive health behavior, and enhance the overall quality of student life on campus.

In conclusion, this research empowers the UNIMAS student community to take greater control of their health through technology, while also contributing to the integration of nursing knowledge with digital health innovation.

5.6 Recommendations

Based on the study's findings, several recommendations are proposed to improve the awareness, accessibility, and adoption of Mobile Medical Devices (MMDs) among university students.

5.6.1 Community-based recommendations

To foster a supportive environment for Mobile Medical Devices (MMDs) adoption, peer-led health initiatives and campus-wide awareness campaigns should be implemented. As many students are unaware of the full capabilities of their devices, workshops or health campaigns, possibly led by nursing students should be organized to educate the UNIMAS community about how to effectively use smartwatches and health apps. Topics can include interpreting health data (e.g., heart rate, sleep cycles), setting realistic fitness goals, and responding appropriately to irregular readings. With the development of mobile devices and social networks, health authorities should encourage app adoption through education and promotions (Wang & Qi, 2021). Such community-driven approaches not only enhance engagement but also reduce the stigma or uncertainty associated with technology-based health practices.

5.6.2 Policy recommendations

At the institutional and governmental levels, policies should be developed to support equitable access and informed use of MMDs. According to Cao et al. (2024), the government can enhance public trust in mobile medical care. Given the identified barriers such as cost and limited knowledge, universities and health authorities should consider subsidizing MMDs for students, especially those in low-income groups. Collaboration between UNIMAS and technology providers (e.g., student

discounts or loan programs for wearables) can help address affordability issues. Making MMDs more accessible would support equitable student engagement in self-monitoring and preventive health care.

5.6.3 Future Research Recommendations

While this study offers valuable insights into UNIMAS students' perceptions and experiences, future research should aim to expand the demographic and institutional scope. Broader studies involving multiple universities, faculties, and cultural contexts across Malaysia can help generalize findings and reveal regional or educational disparities in MMD adoption. Additionally, longitudinal studies are recommended to assess the long-term impact of MMD use on students' health behaviors and outcomes. Research could also explore the effectiveness of specific interventions such as peer support groups or curriculum integration on improving digital health engagement among youth.

5.7 Limitations

One limitation of this study is its limited generalizability. Since the research is conducted solely among students at Universiti Malaysia Sarawak (UNIMAS), the findings may not be applicable to students from other universities, individuals from different age groups, or the general population. This makes it difficult to draw broader conclusions from the results.

Furthermore, given the fast pace of innovation in mobile health technology, the findings from this study may quickly become outdated. Newer devices or features could address some of the concerns raised by participants in this research, meaning that the barriers identified may no longer be as relevant in the near future. As a result, the study's conclusions may not fully reflect the latest advancements or trends in MMD usage.

Finally, a further limitation is that the study captures only a snapshot of students' perceptions and usage behaviors at one point in time. Without a longitudinal perspective, it is difficult to track how these perceptions or behaviors evolve over time. A longer-term study could provide more insights into whether students' attitudes or usage patterns change after prolonged use of MMDs, offering a deeper understanding of long-term engagement and challenges.

5.8 Summary

In conclusion, this study has provided valuable insights into UNIMAS students' perceptions, various factors affecting the awareness and behavioral responses and barriers in using (MMDs) for home-based health monitoring. While students generally understand and aware of the potential benefits of MMDs in promoting personal daily health monitoring, their actual usage remains limited due to barriers such as technical concerns, financial constraints, feeling of discomfort, concern regarding data accuracy and privacy and perceived complexity. It is evident that while MMDs have the capacity to enhance healthcare accessibility and empower students to take charge of their well-being, more targeted efforts are required to support their widespread adoption. By addressing the identified challenges through peer-led educational initiatives, awareness campaigns, and subsidized access to MMDs can become a more integral part of the student health ecosystem. Ultimately, fostering a digitally empowered health culture within the university setting is essential for preparing students to navigate and thrive in an increasingly health-conscious and technology-driven world. Despite its insights, the study is limited by its small, localized sample and the fast-changing nature of health technology, requiring broader, ongoing research to stay relevant.

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APPENDIX I: RESEARCH APPROVAL

Deputy Vice Chancellor's Office
(Research and Innovation)
Medical Research Ethics Committee
Tel: 082 581999/1994
Fax: 082 665115

**UNIVERSITI MALAYSIA
SARAWAK**
94300 Kota Samarahan

MEMORANDUM

Reference : UNIMAS/TNC(PI)/09 – 65/01 Jld.4 (41)

To : Dayang Zuraina binti Abang Haji Kashim
Faculty of Medicine & Health Sciences

From : Chair
Medical Research Ethics Committee

Date : 10 February 2025

Subject : **Research Ethics Approval:**
Exploring the Perceptions of Mobile Medical Devices towards
Home-Based Point-of-Care Monitoring among Community in
Universiti Malaysia Sarawak, UNIMAS.
Ethics Reference Number: FME/25/25

The above matter is referred.

Medical Research Ethics Committee, Universiti Malaysia Sarawak (UNIMAS) has provided ethical **APPROVAL** for this study on 31 January 2025 by Administrative. The investigators involved in this study are:

- 1) Dayang Zuraina binti Abang Haji Kashim (Principal Researcher)
Universiti Malaysia Sarawak
- 2) Marha Madiehah binti Rusli
Universiti Malaysia Sarawak

All records and data are to be kept strictly **CONFIDENTIAL** and can only be used for the purpose of this study. All precautions are to be taken to maintain data confidentiality. Permission from all relevant heads of departments/units where the study will be carried out must be obtained prior to the study.

Please note that the approval is valid from **February 2025** to **February 2026** only. The reference number for this letter must be stated in all correspondence related to this study to facilitate the process.

Thank you with regards and well wishes.

Yours sincerely,



Professor Dr. Mohammad Zulkarnaen bin Ahmad Narihan
Chairman
Medical Research Ethics Committee

e.e: Deputy Vice Chancellor (Research & Innovation)
Director, UNIMAS Publisher

APPENDIX II: COVER LETTER FOR ETHICAL APPLICATION

Marha Madiehah binti Rusli,

Faculty Medicine and Health Sciences,

Universiti Malaysia Sarawak,

94300 Kota Samarahan,

Sarawak.

The Chairman,

Medical Research Ethics Committee,

Faculty Medicine and Health Sciences,

Universiti Malaysia Sarawak,

94300 Kota Samarahan,

Sarawak.

16th December 2024

Professor/Associate Professor/Dr/Sir/Madam,

REQUEST FOR APPROVAL TO CONDUCT RESEARCH PROJECT

I am a final-year student pursuing a Bachelor of Nursing with Honours at the Faculty of Medicine and Health Sciences, UNIMAS. I enrolled in MDJ 4653 Final Year Project I, in which the course is coordinated by Madam Shalin Lee Wan Fei. Please find my details as follows:

Full name: Marha Madiehah binti Rusli

Matrix number: 78125

IC No.: 020102-03-0146

I would like to request for the kind approval from the Faculty of Medicine and Health Sciences Medical Research Ethics Committee to conduct the following study:

Research title: Exploring the Perceptions of Mobile Medical Devices towards HomeBased Point-of-Care Monitoring among community in Universiti Malaysia Sarawak, UNIMAS.

Supervisor's name: Dayang Zuraina binti Abang Haji Kashim

Email address: ahkdzuraina@unimas.my

Supervisor's HP number: 016-8675575

Please find the required documents as appended for your kind consideration and approval.

Thank you.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'M. Rusli', is written on a light-colored rectangular background.

(Marha Madiehah binti Rusli)

APPENDIX III: PARTICIPANT INFORMATION SHEET



PARTICIPANT INFORMATION SHEET

1. **Title of the study:** Exploring the Perceptions of Mobile Medical Devices towards Daily Health Status Monitoring among Student's Community in Universiti Malaysia Sarawak, UNIMAS
2. **Main researcher:** Marha Madiehah binti Rusli
3. **Supervisor:** a) **Course coordinator:** Miss Feryante Rintika Belansai

b) **Main research supervisor:** Dayang Zuraina binti Abang Haji Kashim
4. **Institution:** Department of Nursing Exploring Faculty of Medicine & Health Sciences Universiti Malaysia Sarawak
5. **Name of Sponsor:** No external funding

PARTICIPANT INFORMATION SHEET AND INFORMED CONSENT FORM

(for adult subjects)

1. Introduction:

It is important that you understand why the research is being done and what it will involve. Please take your time to read through and consider this information carefully before you decide if you are willing to participate. Ask the study staff if anything is unclear or if you would like more information. After you are properly satisfied that you understand this study, and that you wish to participate, you must sign this informed consent form.

Your participation in this study is voluntary. You do not have to be in this study if you do not want to. You may also refuse to answer any questions you do not want to answer. If you volunteer to be in this study, you may withdraw from it at any time. If you withdraw, any data collected from you up to your withdrawal will still be used for the study. Your refusal to participate or withdrawal will not affect any medical or health benefits to which you are otherwise entitled.

This study has been approved by the Medical Research and Ethics Committee, Ministry of Health Malaysia.

2. What is the purpose of the study?

The purpose of this study is to explore the perceptions of Mobile Medical Devices (MMD) for daily wellness among student's community in Universiti Malaysia Sarawak, UNIMAS. specifically, this study seeks to investigate and understand the perceptions, factors and barriers affecting the adoption of mobile medical

devices (MMDs) for daily health monitoring among the UNIMAS student's community.

This research will be conducted for duration of 6 months (25/01/2025 till 30/06/2025). The expected number of participants is eight to ten individuals until reaches data saturation.

3. What are my responsibilities when taking part in this study?

It is important that you answer all the questions asked by the researcher. The interview will be conducted by the researcher, Marha Madiehah binti Rusli. During the data collection process, a semi-structured interview format will be used, conducted in both English and Malay. Participants will respond to predetermined open-ended questions. To ensure the data is adequately captured, the interview will be audio recorded. The interview duration is expected to range from 30 to 40 minutes, depending on the depth of the discussion.

4. What are the potential risks and side effects of being in this study?

Participation to this study will not affect your treatment, and the risk is minimal. You are free to decline to answer any of the questions that you feel uncomfortable with.

5. What are the benefits of being in this study?

Findings can be used to provides valuable insights into how students perceive mobile medical devices, including their benefits, challenges, and concerns. Also, helps students understand how to effectively use mobile medical devices for managing and monitoring their health.

6. Who is funding the research?

This study does not receive any external funding.

7. Will my medical information be kept private?

All your information obtained in this study will be kept and handled in a confidential manner, in accordance with applicable laws and/or regulations. When publishing or presenting the study results, your identity will not be revealed without your expressed consent. Individuals involved in this study, qualified monitors and auditors, and governmental or regulatory authorities may inspect the study data, where appropriate and necessary.

8. Who should I call if I have questions?

If you have any questions about the study or if you think you have a study related injury and you want information about this study, please contact the study doctor, Dayang Zuraina binti Abang Haji Kashim at telephone number [016-8675575].

If you have any questions about your rights as a participant in this study, please contact: The Secretary, Medical Research & Ethics Committee, Ministry of Health Malaysia, at telephone number 03-3362 8407/8205/8888.

APPENDIX IV: INFORMED CONSENT FORM

Title of Study: **Exploring the Perceptions of Mobile Medical Devices towards Daily Health Status Monitoring among Student's Community in Universiti Malaysia Sarawak, UNIMAS**

By signing below, I confirm the following:

- I have been given oral and written information for the above study and have read and understood the information given.
- I have had sufficient time to consider participation in the study and have had the opportunity to ask questions and all my questions have been answered satisfactorily.
- I understand that my participation is voluntary and I can at any time free withdraw from the study without giving a reason and this will in no way affect my future treatment. I am not taking part in any other research study at this time. I understand the risks and benefits, and I freely give my informed consent to participate under the conditions stated. I understand that I must follow the study doctor's (investigator's) instructions related to my participation in the study.
- I understand that study staff, qualified monitors and auditors, the sponsor or its affiliates, and governmental or regulatory authorities, have direct access to my medical record in order to make sure that the study is conducted correctly and the data are recorded correctly. All personal details will be treated as STRICTLY

CONFIDENTIAL

- I will receive a copy of this subject information/informed consent form signed and dated to bring home.
- I agree/disagree* for my family doctor to be informed of my participation in this study. (**delete which is not applicable*)

Subject:

Signature:

I/C number:

Name:

Date:

Investigator conducting informed consent:

Signature:

I/C number:

Name:

Date:

Impartial witness:

Signature:

I/C number:

Name:

Date:

APPENDIX V: SEMI-STRUCTURED INTERVIEW GUIDELINES

INTERVIEW GUIDELINE

Exploring the Perceptions of Mobile Medical Devices towards Daily Health Status

Monitoring among Student's Community in Universiti Malaysia Sarawak,

UNIMAS

Beginning:

- Opening – A brief of Mobile Medical Devices (MMDs) information
- Informed consent

Sociodemographic data:

1. Name:
2. Gender:
3. Age:
4. Race:
5. Religion:
6. Profession:
7. Type of Mobile Medical Devices (MMDs)? (Eg; Fitness tracker, mobile health apps, Smartwatches, Fitbit, etc.)

1.0 Introduction:

1. How satisfied are you with your health?
2. Do you suffer from any chronic conditions?
3. Do you go for check-up or appointment for your current illness?
4. Does anyone in your family know about your current health and condition?

2.0 The use of smartphones and smartwatches for daily use:

1. Do you own a smartphone, that is, an Internet-compatible cell phone?
2. Do you own smartwatches or any wearable devices?
3. How often do you use the devices?

4. When or where are you basically going to use the medical devices for?

3.0 The perception of smartwatches or mobile apps for health management:

1. Do you own any portable medical devices at home?
2. What are the most medical apps or devices you use for monitoring your health?
3. How comfortable are you to use in using the MMDs for daily health monitoring?
4. Can you share some situation where you particularly felt comfortable and uncomfortable in using the MMDs?

4.0 Factors that influence the adoption:

1. Did you use the MMDs to improve one of the following behaviors?
 - (1) to quit smoking
 - (2) to be regularly physically active
 - (3) to maintain a healthy diet
 - (4) to reduce weight
 - (5) to take medications regularly
 - (6) to improve blood pressure control
2. Did the MMDs you used to contain one of the following characteristics?
 - (1) motivational messages
 - (2) goal setting and action planning
 - (3) reminder
 - (4) information on the current status and individual progress
3. In what way were you introduced to MMDs?
4. How did you first learn about Mobile Medical Devices (MMDs)?
5. How do you think using MMDs will benefit you?

5.0 Challenges face by communities in using MMDs for daily life:

1. What barriers that you foresee, and you have experienced in using MMDs for daily life?
2. How do you think the barrier can be addressed?
3. How do you feel along when using the MMDs?

6.0 Resources in improving MMDs for better use:

1. How do you think MMDs can be improved for a convenient use?
2. In your opinion, how to motivate people in using MMDs for daily life?
3. What additional or support would enhance people in using MMDs for daily life?

Conclusion:

Is there something else would you like to add? Or you don't understand? Or you want to ask?

Probing questions

- Why do you think of that?
- Can you elaborate more on that point?

What do you mean by....?

APPENDIX VI: PROPOSED BUDGET

Budget			
Project Title	Exploring the Perceptions of Mobile Medical Devices towards Daily Health Status Monitoring among Students' Community in Universiti Malaysia Sarawak, UNIMAS.		
Duration Project	November 2024 – July 2025		
Nature of Expenditure/Item	Unit Price (RM)	Quantity	Amount (RM)
Materials and supply			
Notebook	1.50	1 notebook	1.50
Pen	1.00	2 pens	2.00
Participants token	5.00	10 tokens	50.00
Publications/Reports			
Printing of FYP project book	0.10/page	130 pages	13.00
Binding	2.00	1	2.00
Internet Plan			
Unifi Mobile	35.00/30gb	6 months	35.00
Transportation			
E-ride hailing (Grab, Maxim) from Rafflesia College to UNIMAS back-and-forth.	10.00/ride	10 rides	100.00
<i>GRAND TOTAL (RM)</i>	203.50		

APPENDIX VII: GANTT CHART

ACTIVITY					MONTH						
	2024				2025						
	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY
Determination of research title											
Literature Review											
Meeting with supervisor											
Submit oral defence slides											
Ethical approval											
Submission of first draft											
FYP 1: Submission of research proposal											
Data collection											
Data analysis											
Writing up Report											
Submit Final Draft											
FYP 2: Submission of final project											

APPENDIX VIII: TURNITIN SIMILARITY INDEX REPORT

FYPII_78125_MarhaMadiehahBintiRusli			
ORIGINALITY REPORT			
9%	7%	5%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
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