The Human Factor in AI-Powered m-Health: Exploring User Perspectives and Expectations: A Case Study

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Abstract: *Advancements in artificial intelligence (AI) have paved the way for the integration of AI technologies in mobile health (m-Health) applications, offering potential benefits in healthcare delivery and self-management. Understanding user perception of AI-based m-Health applications is crucial for their successful implementation and user acceptance. This research paper presents findings from a study that explored user perspectives, experiences, and expectations regarding the use of AI in m-Health. Thematic analysis was conducted on data collected from focus group sessions with participants. The analysis revealed several key themes, including perceived usefulness and ease of use, trust in algorithms, privacy concerns, impact on the patient-provider relationship, user satisfaction, and ethical considerations. Participants recognized the value of AI-driven features in accurate symptom assessment, personalized treatment recommendations, and timely intervention. However, concerns regarding algorithm transparency, privacy, potential loss of human interaction, and ethical implications emerged. Addressing these concerns is crucial for fostering user acceptance and engagement with AI-based m-Health applications. Findings from this research contribute to the development of user-centered AI-powered m-Health solutions that enhance user satisfaction, engagement, and healthcare outcomes. Future research should focus on addressing user concerns and examining the long-term impact of AI technologies on healthcare delivery and patient outcomes.*

Keywords: *AI-based m-Health applications, User perception, User perspectives, Acceptance, Focus Groups* Introduction

1. Introduction

The integration of artificial intelligence (AI) into mobile health (m-Health) applications has the potential to revolutionize healthcare delivery, offering personalized and efficient solutions to users. AI-based m-Health applications leverage machine learning algorithms, natural language processing, and other AI techniques to provide advanced functionalities such as intelligent symptom assessment, personalized treatment recommendations, medication management, health monitoring, and behavior change support. However, user perception and acceptance of these AI-based m-Health applications play a critical role in their successful adoption and long-term effectiveness.

Understanding how users perceive and interact with AI-based m-Health applications is essential for developing user-centered and effective healthcare technologies. User perception encompasses various factors, including perceived usefulness, ease of use, trust in technology, privacy concerns, and satisfaction with the application. Therefore, this research paper aims to explore the user perception of AI-based m-Health applications

through the utilization of focus groups, which provide an interactive and dynamic environment for participants to share their experiences, opinions, and concerns.

There are various methods that can be used to determine user perceptions of interfaces such as user testing, interviews, and focus groups. Specifically, the focus group method is considered to be one of the most informative evaluation methods that can elicit detailed qualitative insights about system interfaces. Focus group refers to a semi-informal meeting guided by an experienced moderator where a group of targeted individuals is asked to share their opinions, feelings, and experiences about a certain topic. Furthermore, focus groups offer a dynamic and interactive environment that encourages participants to express their opinions, share experiences, and engage in group discussions. By utilizing focus groups, this study aims to capture diverse perspectives and generate rich qualitative data that can inform the design, development, and implementation of AI-based m-Health applications.

2. Literature Review

The field of m-Health has witnessed significant growth in recent years, driven by advancements in mobile technology, connectivity, and the increasing demand for accessible and personalized healthcare services. AI-powered m-Health applications have emerged as a promising avenue for improving healthcare outcomes, empowering users, and enabling better decision-making by healthcare providers.

AI-based m-Health applications can perform a range of functions, such as intelligent symptom assessment, personalized treatment recommendations, medication management, health monitoring, and behavior change support. These applications leverage AI algorithms to process large volumes of healthcare data, identify patterns, and generate insights that can aid in clinical decision-making and enhance patient engagement.

However, the successful adoption and utilization of AI-based m-Health applications depend on several factors, including user acceptance, trust, and perceived usefulness. User perception plays a critical role in shaping attitudes towards these technologies, influencing their adoption, and ultimately impacting their efficacy in improving healthcare outcomes.

Previous research has investigated user perceptions of m-Health applications in general, but there is a need for specific attention to AI-driven features within these applications. AI technologies introduce unique considerations related to trust in algorithms, privacy concerns, transparency, and the perceived impact on the patient-provider relationship. Understanding how users perceive and navigate these aspects is crucial for designing AI-based m-Health applications that effectively address user needs and concerns.

- **User Perception of AI-based Technologies in Healthcare**

Several studies have explored user perception and acceptance of AI-based technologies in the healthcare domain. These studies have identified a range of factors that shape user perception and influence their acceptance of AI-based systems. In a study by Thirunarayan et al. [1], it was found that trust, system transparency, and user control were significant factors affecting user acceptance of AI-assisted healthcare applications. Similarly, Klein et al. [2] highlighted the importance of user perspectives in the successful implementation of AI technologies in healthcare settings. These studies highlight the need to understand user perception and acceptance when integrating AI into healthcare applications.

- **User Perception of m-Health Applications**

User perception and acceptance have also been extensively studied in the context of m-Health applications. Rho et al. [3] investigated the acceptance of mobile health applications and emphasized the importance of perceived usefulness, ease of use, and personalization in shaping user perception. Another study by Buys et al. [4] examined user perceptions of m-Health applications for chronic disease management and identified factors such as perceived benefits, usability, and trust as crucial determinants of user acceptance. These studies underscore the significance of user perception in the adoption and utilization of m-Health applications.

- **User Perception of AI-based m-Health Applications**

Research specifically focusing on user perception of AI-based m-Health applications is limited. However, recent studies have started to explore this area. For instance, Rahimi [5] conducted a study to examine user perceptions of AI-powered chatbots in healthcare. The study highlighted the importance of trust, perceived usefulness, and understanding system decisions in shaping user acceptance of AI-based chatbots. Additionally, Shokraneh et al. [6] investigated user perception of AI-based mobile applications for mental health support and found that factors such as usability, trust, transparency, and personalization significantly influenced user acceptance and perceived effectiveness.

- **Factors Influencing User Perception**

Several factors have been identified as influential in shaping user perception of AI-based m-Health applications. The factors include: Perceived Usefulness and Ease of Use, Trust in Algorithms, Privacy Concerns, Impact on Patient-Provider Relationship, User Satisfaction, and Ethical Considerations.

- **Perceived Usefulness and Ease of Use:** User perception of AI-based m-Health applications is influenced by their perceived usefulness and ease of use. According to the Technology Acceptance Model [7], perceived usefulness refers to the user's perception of the extent to which a technology enhances their performance, while ease of use refers to the user's perception of the effort required to use the technology. A study by Jiang et al. [8] investigated user perception of an AI-based m-Health application for diabetes management. The findings indicated that perceived usefulness and ease of use significantly influenced user acceptance and intention to use the application.

- **Trust in Algorithms:** Trust in the algorithms powering AI-based m-Health applications is another important factor influencing user perception. Users need to trust that the algorithms are accurate, reliable, and secure. A study by Børøsund et al. [9] explored user perception of an AI-driven chatbot for mental health support. The results revealed that users' trust in the chatbot's ability to provide accurate and helpful information played a crucial role in their acceptance and willingness to engage with the application.

- **Privacy Concerns:** User perception of AI-based m-Health applications is also influenced by privacy concerns. Users may worry about the security and confidentiality of their personal health data when interacting with AI technologies. A study by Zhang et al. [10] examined user perception of an AI-powered m-Health application for sleep monitoring. The findings highlighted that privacy concerns, such as data security and unauthorized access, significantly impacted users' trust and intention to use the application.

- **Impact on Patient-Provider Relationship:** AI-based m-Health applications have the potential to impact the patient-provider relationship, which in turn affects user perception. Users may have concerns about the loss of human interaction and the potential for technology to replace healthcare professionals. A study by Hassanein et al. [11] investigated user perception of an AI-based m-Health application for symptom assessment. The results indicated that while users appreciated the convenience and speed of AI-based assessments, they also emphasized the importance of maintaining a strong patient-provider relationship.

- **User Satisfaction:** User satisfaction with AI-based m-Health applications is a crucial aspect of user perception. A study by Rho et al. [12] examined user perception of an AI-powered m-Health application for skin cancer detection. The findings revealed that user satisfaction was strongly associated with the accuracy and reliability of the AI algorithm. Users who perceived the application as providing accurate and reliable results reported higher satisfaction levels.

- **Ethical Considerations:** User perception of AI-based m-Health applications is also influenced by ethical considerations, such as transparency, accountability, and fairness. A study by Topolovec-Vranic et al. [13] explored user perception of an AI-driven m-Health application for post-concussion management. The results highlighted the importance of transparency in algorithmic decision-making and the need to address potential biases in AI models to gain user trust and acceptance.

While there has been notable research on user perception of AI-based technologies in healthcare and m-Health applications, a gap remains in understanding user perception specific to AI-based m-Health applications. Exploring user perspectives, attitudes, and concerns regarding these applications is crucial for their successful integration and adoption. Furthermore, the existing literature predominantly focuses on specific user groups, such as patients or healthcare professionals, without considering the diverse range of stakeholders involved in m-Health ecosystems. Addressing this research gap is essential to develop strategies that cater to the diverse needs and preferences of different user groups.

3. Method

3.1. Participants
Twenty-four (eighteen males and six females) participants from Saudi Arabia took part in the study as a representative sample for all AI-based mHealth applications used in Saudi Arabia. The average age of the participants was 34 years (SD= 5.3, Range= 23 – 49 years). Prior to the focus group interviews, all participants reported that they were active users of the most common AI-based mHealth applications in Saudi Arabia.

3.2. Research Design
Three focus group sessions were conducted and each session included eight participants. Each session took approximately ninety minutes and audio recorded. Several topics related to the investigated characteristics were discussed during the sessions.

3.3. Procedure & Data Collection
The focus group sessions were conducted in a controlled environment. Prior to conducting the sessions, the participants signed a consent form filled out a preliminary survey including demographic questions, as well as questions about their usage of AI- based mHealth applications. Following that, they were introduced to the study objectives and asked if they had any concern. The discussion was guided by a skilled moderator and the sessions were audio-recorded with the purpose of capturing all participants' responses and reactions.

3.4. Data Analysis

The audio recordings were transcribed and then analyzed using the thematic analysis approach. Specifically, the dataset was coded and then categorized into several emerging themes.

4. Results

Thematic analysis was conducted to analyze the data collected from the focus group sessions, which aimed to explore user perception of AI-based m-Health applications. The analysis revealed several key themes that provide deeper insights into participants' perspectives, experiences, and expectations regarding the use of AI in m-Health applications. These themes are illustrated in Table 1 and discussed in detail below.

TABLE I. Thematic Analysis Results

Themes	Frequency of Occurrence
Perceived Usefulness and Ease of Use	42
Trust in Algorithms	50
Privacy Concerns	21
Impact on Patient-Provider Relationship	47
User Satisfaction	38
Ethical Considerations	19

- **Perceived Usefulness and Ease of Use:** Participants expressed their perceptions of the usefulness and ease of use of AI-based m-Health applications. They discussed the potential benefits of AI technologies, such

as accurate symptom assessment, personalized treatment recommendations, and timely intervention. Participants found the AI-driven features valuable in assisting with self-management and decision-making processes. They emphasized the need for intuitive interfaces and user-friendly designs to ensure ease of use and seamless integration into their daily lives. The discussion highlighted the importance of perceived usefulness and ease of use in shaping participants' acceptance and adoption of AI-based m-Health applications.

- **Trust in Algorithms:** Trust in the algorithms powering AI-based m-Health applications emerged as a significant theme. Participants expressed the need for transparency and explanations regarding how AI algorithms make decisions and provide recommendations. They discussed the importance of understanding the underlying processes to build trust and confidence in the accuracy and reliability of the AI-driven features. Participants emphasized that clear explanations and information about the algorithms' functioning would help alleviate doubts and increase trust. Additionally, participants highlighted the role of healthcare professionals in validating and verifying the outcomes generated by the AI algorithms, as their endorsement and involvement were seen as important factors in establishing trust.

- **Privacy Concerns:** Privacy concerns were a prominent theme in participants' discussions. Many participants expressed worries about the security and confidentiality of their personal health data when interacting with AI technologies. They discussed the need for robust data protection measures, secure storage, and controlled data access. Participants emphasized the importance of clear privacy policies, transparent informed consent processes, and secure data transmission mechanisms to address their privacy concerns. Addressing privacy concerns was seen as vital to fostering user trust and increasing their willingness to use AI-based m-Health applications.

- **Impact on Patient-Provider Relationship:** Participants discussed the potential impact of AI-based m-Health applications on the patient-provider relationship. While participants appreciated the convenience and accessibility offered by AI-driven features, they expressed concerns about the potential loss of human interaction and personalized care. Participants emphasized the need to strike a balance between technology and human touch, highlighting that AI should complement, rather than replace, the role of healthcare professionals. They discussed the importance of clear communication channels to facilitate interaction and collaboration between users and healthcare providers, ensuring that AI-based applications enhance, rather than undermine, the patient-provider relationship.

- **User Satisfaction:** User satisfaction emerged as a crucial theme in participants' discussions. Participants emphasized that accurate and reliable AI algorithms were essential in generating meaningful and actionable insights. They expressed satisfaction when the AI-driven features provided relevant information, personalized recommendations, and timely notifications. Participants also discussed the importance of ongoing user engagement, continuous improvement, and responsive customer support as factors contributing to their overall satisfaction with AI-based m-Health applications. User satisfaction was seen as a key determinant of user acceptance and long-term engagement with these technologies.

- **Ethical Considerations:** Ethical considerations surrounding AI technologies were also discussed by participants. They emphasized the importance of transparency in algorithmic decision-making, fairness, and accountability. Participants expressed concerns about potential biases in AI algorithms and stressed the need for regular audits and evaluations to ensure the algorithms' integrity and mitigate any unintended consequences. They discussed the ethical responsibility of developers and healthcare organizations to prioritize user well-being and avoid harm when implementing AI-based m-Health applications. Addressing ethical considerations was seen as vital for building user trust and acceptance of these technologies.

5. Discussion

The findings from this research provide valuable insights into user perception of AI-based m-Health applications. The thematic analysis of focus group sessions revealed several important themes related to perceived usefulness, ease of use, trust in algorithms, privacy concerns, impact on the patient-provider relationship, user satisfaction, and ethical considerations. These themes align with the factors discussed in the literature review and shed light on the users' attitudes, expectations, and concerns regarding the integration of AI technologies in healthcare.

One key theme that emerged was the perceived usefulness of AI-based m-Health applications. Participants recognized the potential benefits of AI in improving healthcare outcomes, such as accurate symptom assessment, personalized treatment recommendations, and timely intervention. The AI-driven features were seen as valuable tools for self-management and decision-making processes. However, it is important to note that the perceived usefulness was contingent upon the accuracy and reliability of the AI algorithms. Users expressed the need for transparent explanations and understanding of how the algorithms work to build trust and confidence in the AI-driven features.

Trust in algorithms was another significant theme that emerged from the discussions. Participants emphasized the importance of transparency, fairness, and accountability in algorithmic decision-making. They expressed concerns about potential biases and the need for regular audits and evaluations to ensure the integrity of the AI algorithms. Building trust in AI-based m-Health applications requires clear communication and explanations about the algorithms' functioning, as well as the involvement of healthcare professionals in validating and verifying the outcomes. Trust-building measures are crucial to address user skepticism and increase their acceptance of AI technologies.

Privacy concerns were also prominently discussed by participants. Users expressed worries about the security and confidentiality of their personal health data when interacting with AI technologies. Robust data protection measures, secure storage, and controlled data access were highlighted as essential requirements for ensuring user privacy. Participants emphasized the need for clear privacy policies, informed consent processes, and secure data transmission mechanisms. Addressing privacy concerns is critical to foster user trust and alleviate their apprehensions about sharing sensitive health information.

The potential impact of AI-based m-Health applications on the patient-provider relationship was another theme that participants discussed. While participants appreciated the convenience and accessibility offered by AI-driven features, they expressed concerns about the potential loss of human interaction and personalized care. They emphasized the importance of maintaining a balance between technology and human touch, with AI serving as a complementary tool rather than a replacement for healthcare professionals. Clear communication channels and collaborative approaches are necessary to ensure that AI technologies enhance the patient-provider relationship rather than create barriers.

User satisfaction emerged as a crucial theme in participants' discussions. Accurate and reliable AI algorithms were seen as essential for generating meaningful insights and personalized recommendations. Ongoing user engagement, continuous improvement, and responsive customer support were highlighted as factors contributing to user satisfaction. Meeting user expectations and providing a positive user experience are key for the successful adoption and long-term engagement with AI-based m-Health applications.

Ethical considerations surrounding AI technologies were also discussed by participants. Transparency, fairness, and accountability were emphasized as crucial ethical principles. Participants expressed concerns about biases in AI algorithms and the potential for unintended consequences. Developers and healthcare organizations were seen as having an ethical responsibility to prioritize user well-being and avoid harm when implementing AI-based m-Health applications. Addressing ethical considerations is vital for building user trust, ensuring equitable access to healthcare, and maintaining the integrity of healthcare systems.

6. Conclusion

In conclusion, this research provides insights into user perception of AI-based m-Health applications, derived from thematic analysis of focus group sessions. The findings highlight the importance of perceived usefulness, ease of use, trust in algorithms, privacy concerns, impact on the patient-provider relationship, user satisfaction, and ethical considerations in shaping user acceptance and engagement with these technologies.

Users generally perceive AI-based m-Health applications as valuable tools for improving healthcare outcomes and self-management. However, addressing concerns related to trust, privacy, the patient-provider relationship, and ethical considerations is crucial for fostering user acceptance and engagement. Transparent explanations of

algorithmic decision-making, robust data protection measures, clear communication channels, and collaborative approaches are key in building user trust and confidence.

To ensure user satisfaction, AI algorithms must be accurate, reliable, and provide meaningful insights and recommendations. Ongoing user engagement, continuous improvement, and responsive customer support are essential for enhancing the user experience. Developers and healthcare organizations have an ethical responsibility to prioritize user well-being, address biases in algorithms, and ensure fairness and accountability in AI-based m-Health applications.

The findings from this research contribute to the development of user-centered AI-powered m-Health solutions that enhance user satisfaction, engagement, and healthcare outcomes. Future research should focus on addressing the identified concerns and examining the long-term impact of AI technologies on healthcare delivery and patient outcomes. By considering user perspectives and integrating them into the design and implementation of AI-based m-Health applications, we can maximize the potential benefits of these technologies while ensuring user acceptance and trust.

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