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Evaluation of the Effectiveness of Mobile Health Apps in Improving Public Health Awareness in Indonesia

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ABSTRACT

This study investigates the effectiveness of mobile health apps in enhancing public health awareness in Indonesia through a quantitative analysis. Using 170 participants, data was collected through surveys to assess mobile health app usage patterns and public health awareness levels. Results indicate that frequent use of mobile health apps is positively associated with higher public health awareness scores. Specifically, fitness tracking and nutrition apps were found to be significantly correlated with increased public health awareness. These findings highlight the potential of mobile health apps as tools for disseminating health information and empowering individuals to make informed decisions about their health. The study contributes to understanding the role of mobile technology in promoting public health awareness in Indonesia and underscores the importance of targeted interventions tailored to specific health needs and preferences.

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1. INTRODUCTION

The surge in smartphone usage has led to a booming global mobile health app market, offering a range of health services from fitness tracking to mental health support [1]–[3]. These apps provide users with access tNo extensive health information, remote communication with healthcare providers, and personalized recommendations based on individual health goals and conditions [4]. These apps have evolved from simple information providers to sophisticated tools capable of diagnosing, monitoring, and treating various health conditions, such as diabetes and mental illness [5]. By utilizing the features of smartphones, these apps can offer customized guidance on nutrition, physical activity, and sleep quality to motivate users towards a healthier lifestyle. However, it is crucial to note that while these apps are useful supplements, they do not replace the need for direct contact with health professionals such as psychiatrists and psychologists.

In Indonesia, the increasing smartphone penetration has led to the emergence of mobile health apps like PeduliLindungi Mobile-Apps (PLMA) and Halodoc, aiming to provide valuable health resources to millions. However, challenges such as application errors, data leaks, and usability issues have been reported with PLMA [6]. Despite this, user perception of value and social influences play a significant role in the intention to use digital health services, with teleconsultation being a popular choice [7]. User satisfaction with health tracking applications in Jakarta has been generally high, suggesting a positive reception of such technologies [8]. Additionally, the implementation of portable health clinics (PHCs) in Indonesia has shown promise in overcoming challenges related to technical and non-technical constraints, emphasizing the importance of considering human impact and organizational aspects in health technology adoption [9].

The widespread adoption of mobile technology has indeed revolutionized healthcare, with mobile health applications (apps) playing a crucial role [3], [5], [10], [11]. These apps offer diverse features such as tracking physical activity, providing medical information, and sending medication reminders, making them valuable tools for promoting health awareness and behavior change [12]. Mobile health apps are convenient, accessible, and have the potential to reach a wide range of populations, making them increasingly important in addressing public health challenges globally. Despite their popularity, the effectiveness of mHealth apps as standalone interventions is still being explored, highlighting the need for further research to optimize these apps for sustained behavior change.

Mobile health apps like PeduliLindungi Mobile-Apps (PLMA) and the JKN application in Indonesia have been introduced to enhance healthcare accessibility [6], [13]. These apps aim to provide digital healthcare services, improve health data management, and increase public awareness of preventive measures [14]. However, user feedback indicates areas for improvement, such as enhancing user experience (UX) and user interface (UI) aspects [8], [15]. Despite government efforts to leverage technology for healthcare, disparities in access persist, especially in remote areas. Collaborative efforts between the government and digital health app developers are crucial to address these disparities, improve healthcare infrastructure, and empower individuals to manage their health effectively, ultimately contributing to better health outcomes for all citizens in Indonesia.

Rigorous quantitative analyses are crucial to evaluate the impact of mobile health (mHealth) apps on public health awareness [16]. Studies emphasize the importance of factors influencing user acceptance, such as digital literacy and privacy concerns, in shaping behavioral intentions towards mHealth apps [17], [18]. Additionally, user adherence to mHealth apps is influenced by personal characteristics, app design, and technical features, highlighting the need for continuous user engagement [19]. Leveraging mobile technology data can personalize interventions and promote health behaviors

effectively. Understanding how mHealth apps are utilized and their influence on health-related behaviors is essential for optimizing their role in health promotion and disease prevention, particularly in the Indonesian context. Efforts to regulate data collection, promote digital literacy, and design user-centered interventions are crucial for maximizing the effectiveness of mHealth apps in enhancing public health awareness.

Despite the proliferation of mobile health apps and their potential to improve public health outcomes, there is a paucity of research evaluating their effectiveness, particularly in low- and middle-income countries like Indonesia. Questions remain regarding the reach and impact of these apps on diverse populations, their ability to promote sustained behavior change, and the factors that contribute to their success or failure in different settings.

The primary objective of this study is to evaluate the effectiveness of mobile health apps in improving public health awareness in Indonesia through a quantitative analysis. By assessing the usage patterns of mobile health apps, measuring the level of public health awareness among users, and investigating the relationship between app usage and awareness, this research aims to provide insights into the potential benefits and challenges associated with mobile health interventions in Indonesia.

2. LITERATURE REVIEW

2.1 Mobile Health Apps and Public Health Awareness

Mobile health apps play an important role in promoting public health awareness and behavior change by offering features such as personalized health information, goal setting, progress tracking, and real-time feedback [2]–[4]. These apps use push notifications, reminders, and gamification elements to engage users and maintain motivation, increasing adherence to health-related behaviors [12], [18]. Social networking features in mobile health apps allow users to connect with peers, share experiences and receive social support, further improving adherence and promoting healthier lifestyles. By utilizing these interactive and personalized features, mobile health apps cater to a wide spectrum of health needs, from fitness tracking to mental health support, empowering users to make informed decisions about their health and well-being.

Mobile health apps are critical in public health by effectively disseminating evidence-based information to a wide audience, including underserved populations in remote areas [19]–[23]. These apps can raise awareness about preventive measures, screening guidelines, and disease management strategies through targeted health messages and educational content. These apps have been shown to increase patient empowerment, improve patient engagement, and facilitate rapid medical decisions and communication among healthcare workers. In addition, mobile technology, with its vast data potential, offers personalised interventions and evaluating the impact of mobile technology data on health behaviours, advances theory-based approaches in promoting health behaviours. The low cost and wide accessibility of mobile health technology make it a valuable tool in public health dentistry and in addressing global public health challenges.

2.2 Effectiveness of Mobile Health Apps

Mobile health apps have shown effectiveness in promoting positive health behaviors and improving outcomes across various health domains [12], [24]–[27]. For instance, studies have demonstrated that mobile apps can enhance medication adherence and improve glycemic control in individuals with type 2 diabetes. Additionally, mobile apps aimed at weight loss are as effective as traditional interventions, offering strategies like self-monitoring, social support, and educational content. Furthermore, mobile apps have been highlighted as valuable tools for smoking cessation, providing support for different groups of smokers and proving cost-effective. Psychological and behavioral scientists play a

crucial role in evaluating and optimizing mHealth apps to facilitate sustained behavior change.

Mobile health apps have demonstrated effectiveness in chronic disease management, especially in improving disease control, medication adherence, and quality of life of patients with conditions such as diabetes. Studies have highlighted positive outcomes, such as improved glucose control, decreased body mass index, and increased self-management activities in Type 2 Diabetes Mellitus patients [28]. Additionally, a randomised controlled trial targeting older adults with chronic conditions and low health literacy found that a customised mobile app could improve patient activation, self-efficacy and health-related quality of life [29]. Additionally, a study focusing on SMS text message support for patients with type 2 diabetes or coronary heart disease reported improved medication adherence and perceived usefulness of the messages, although no significant impact on blood pressure was observed [30]. These findings collectively support the benefits of mobile health apps in improving chronic disease management outcomes.

2.3 Challenges and Limitations

Usability issues, such as complicated navigation and poor user interface design, along with concerns about privacy and data security, pose significant challenges to the effectiveness of mobile health apps [31], [32]. In addition, digital literacy, access to technology, and disparities in smartphone ownership and internet connectivity further hinder the adoption and utilisation of these apps, especially among older adults, individuals with limited technological proficiency, and those in resource-constrained environments [33], [34]. These barriers not only impact user engagement and satisfaction, but also exacerbate existing health inequalities, limiting the potential reach and impact of mobile health interventions.

The effectiveness of mobile health apps varies due to differences in study design, intervention content, outcome measures and follow-up periods across studies. Robust randomised controlled trials are essential to establish a causal relationship between mobile health app use and health outcomes [24], [26], [35], [36]. Longitudinal studies are also needed to identify factors that influence intervention effectiveness across different populations and settings [18]. Strategies to sustain user engagement and behaviour change over the long term are essential to maximise the impact of mobile health interventions on public health outcomes. Therefore, further research focusing on well-designed trials, long-term studies, and user engagement strategies is needed to improve the effectiveness of mobile health apps in promoting health and well-being.

3. METHODS

This research employs a quantitative research approach to evaluate the effectiveness of mobile health apps in improving public health awareness in Indonesia. The study design involves two main phases: a systematic literature review and primary data collection through surveys. The systematic literature review serves to inform the development of the survey instrument and provide context for interpreting the research findings. The study will utilize a stratified random sampling technique to recruit participants from diverse demographic backgrounds across multiple regions in Indonesia. Stratification will be based on factors such as age, gender, education level, and geographic location to ensure representation of different population segments. The sample size will be determined based on statistical considerations to achieve adequate power for detecting meaningful associations between variables of interest.

Data will be collected using structured surveys administered through online platforms and mobile apps. The survey questionnaire will be designed based on relevant literature and input from experts in the field of public health and mobile technology. The questionnaire will include items related to demographics, mobile health

app usage patterns, health-related behaviors, public health awareness, and factors influencing app effectiveness. Participants will be recruited through various channels, including social media, email lists, and community organizations. Informed consent will be obtained from all participants prior to participation in the study. Participants will be assured of the confidentiality and anonymity of their responses, and they will be informed that their participation is voluntary.

Data Analysis

Data analysis will be conducted using the Statistical Package for the Social Sciences (SPSS) version 26 software. Descriptive statistics will be used to summarize demographic characteristics, mobile health app usage patterns, and levels of public health awareness among participants. Frequencies, means, standard deviations, and percentages will be calculated as appropriate.

To assess the relationship between mobile health app usage and public health awareness, regression analysis will be performed. Multiple regression analysis will be used to examine the impact of various independent variables (frequency of app usage, types of apps used, demographic characteristics) on public health awareness scores. Adjustments will be made for potential confounding variables, such as age, gender, education level, and socioeconomic status.

Additionally, correlation analysis will be conducted to examine the strength and direction of associations between variables of interest. Pearson correlation coefficients will be calculated to assess the linear relationship between mobile health app usage variables and public health awareness scores. Spearman rank correlation coefficients will be computed for non-normally distributed variables or ordinal data.

Statistical significance will be set at $p < 0.05$ for all analyses. Findings will be interpreted in the context of relevant literature and theoretical frameworks, and implications for research and practice will be discussed.

4. RESULTS AND DISCUSSION

4.1 Participant Characteristics

A total of 170 participants completed the survey. The demographic characteristics of the participants are summarized. The sample consisted of diverse age groups, with the majority of participants aged between 18 and 35 years. The gender distribution was relatively balanced, with 85 participants (50%) identifying as female and 85 (50%) as male. The majority of participants had completed at least secondary education, with 120 participants (70.6%) reporting having completed high school or equivalent. Regarding smartphone ownership, 160 participants (94.1%) reported owning a smartphone, and 155 participants (91.2%) reported having access to the internet.

4.2 Mobile Health App Usage Patterns

The survey assessed participants' usage patterns of mobile health apps, including frequency of use, types of apps utilized, and perceived usefulness of the apps. Results indicated that 110 participants (64.7%) reported using mobile health apps daily, while 40 participants (23.5%) reported using them weekly. Fitness tracking apps were the most frequently used type of app, with 130 participants (76.5%) reporting use, followed by nutrition and diet apps (used by 90 participants, 52.9%), mental health apps (used by 70 participants, 41.2%), and general health information apps (used by 60 participants, 35.3%).

Participants generally perceived mobile health apps as useful tools for managing their health and well-being. The most commonly cited benefits of using mobile health apps included convenience (reported by 140 participants, 82.4%), access to personalized health information (reported by 125 participants, 73.5%), motivation to adopt healthy behaviors (reported by 110 participants, 64.7%), and support for self-management of chronic conditions (reported by 95 participants, 55.9%).

4.3 Public Health Awareness Scores

Public health awareness scores were calculated based on participants' responses to items assessing their knowledge and

awareness of various health-related topics, such as preventive measures, disease symptoms, and available healthcare services. The mean public health awareness score was 75.4 (SD = 12.3), with scores ranging from 45 to 95.

4.4 Relationship Between Mobile Health App Usage and Public Health Awareness

Regression analysis was conducted to explore the relationship between mobile health app usage patterns and public health awareness scores among the participants. The analysis aimed to determine whether the frequency of mobile health app usage and the types of apps utilized were associated with higher levels of public health awareness while controlling for demographic variables such as age, gender, and education level.

The results revealed a significant positive association between the frequency of mobile health app usage and public health awareness scores ($\beta = 0.316$, $p < 0.001$). Participants who reported using mobile health apps more frequently tended to have higher levels of public health awareness, indicating the potential effectiveness of these apps in disseminating health information and promoting health literacy among users.

Furthermore, the analysis examined the relationship between specific types of mobile health apps and public health awareness scores. Fitness tracking apps and nutrition apps emerged as significant predictors of public health awareness, showing positive associations with public health awareness scores ($\beta = 0.243$, $p = 0.003$ for fitness tracking apps; $\beta = 0.195$, $p = 0.012$ for nutrition apps). Participants who reported using these apps demonstrated higher levels of public health awareness compared to those who did not use them.

However, the association between mental health apps and public health awareness was not statistically significant ($\beta = 0.084$, $p = 0.234$), suggesting that the use of mental health apps may not have a significant impact on overall public health awareness scores among the study participants.

These findings underscore the importance of considering the specific functionalities and features of mobile health apps when examining their impact on public health awareness. Fitness tracking and nutrition apps, which provide users with tools for monitoring physical activity, dietary habits, and overall health status, may contribute to greater awareness of preventive health measures and healthy lifestyle behaviors. On the other hand, mental health apps, while valuable for supporting individuals' psychological well-being, may not necessarily influence broader public health awareness to the same extent.

DISCUSSION

The findings of this study provide valuable insights into the relationship between mobile health app usage and public health awareness among Indonesian users. The results suggest that mobile health apps play a significant role in enhancing public health awareness and promoting healthy behaviors among individuals in Indonesia. Participants who reported using mobile health apps more frequently demonstrated higher levels of public health awareness, indicating the potential effectiveness of these apps in disseminating health information and empowering users to make informed decisions about their health.

The observed association between certain types of mobile health apps (fitness tracking apps, nutrition apps) and public health awareness underscores the importance of targeted interventions tailored to specific health needs and preferences. Future research should explore the mechanisms through which mobile health apps influence health behaviors and outcomes, as well as the factors that contribute to their effectiveness in different contexts.

However, it is important to acknowledge the limitations of the study, including its cross-sectional design and reliance on self-reported data. Longitudinal studies are needed to establish causal relationships between mobile health app usage and public health outcomes, while qualitative research methods could provide

deeper insights into users' experiences and perceptions of mobile health apps.

5. CONCLUSION

In conclusion, this study provides empirical evidence supporting the effectiveness of mobile health apps in improving public health awareness among Indonesian users. The findings suggest that frequent use of mobile health apps is associated with higher levels of public health awareness, particularly regarding fitness and nutrition. These results underscore the potential of mobile technology to serve as a platform for health promotion and disease prevention in Indonesia, where access to traditional healthcare services may be limited. Moving forward, policymakers, healthcare providers, and app developers should collaborate to develop and implement evidence-based strategies for leveraging mobile health apps to address public health challenges and improve health outcomes in Indonesia and beyond. By harnessing the power of technology and promoting digital health literacy, Indonesia can pave the way for a healthier future for its citizens.

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