

Dynamics of Computer-Mediated Communication in Digital Health Services: A Qualitative Study on the Alodokter and Halodoc Applications

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Abstract

This study examined the dynamics of computer-mediated communication in digital health services through a comparative analysis of the Alodokter and Halodoc applications in Indonesia. Conceptually, the study is anchored in Computer-Mediated Communication (CMC) and User-Centered Design (UCD) to interpret how interaction patterns and interface choices shape doctor-patient sense-making on mHealth platforms. A qualitative design was employed, using non-participant observation, in-depth interviews, and document analysis. Data were analyzed through open, axial, and selective coding, followed by thematic interpretation. We conducted in-depth interviews with two doctors and two patients, providing an on-the-ground view of how clinicians and users communicate and coordinate care across the two platforms. The findings cluster into three themes: (1) doctors' flexibility and constraints, including diagnostic limits in the absence of physical examination and work/incentive trade-offs; (2) patients' communication experiences, emphasizing accessibility, trust, and privacy; and (3) the role of mobile-AI in facilitating adaptive interactions. Overall, Alodokter and Halodoc enhanced efficiency, reduced time and cost, and expanded access, while face-to-face interaction remained important for complex cases. We conclude that these applications function not only as digital service providers but also as communication ecosystems that shape emerging relationships between healthcare providers and users.

Keywords

mHealth, computer mediated communication, user centered design, mobile AI, digital healthcare

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INTRODUCTION

As the demand for healthcare services increases and resources remain limited, mobile health (mHealth) has emerged as a disruptive intervention that provides positive impacts on public health through more affordable, efficient, and transparent access (Hoque et al., 2020). Mobile health is defined by the World Health Organization (WHO) as the practice of medical and public-health services supported by mobile devices (Kaman & Yi, 2022). Rapid advances in mHealth have transformed healthcare in developing countries through their capacity to facilitate high-quality medical information exchange, support coordination among health workers in remote areas, and allow individuals to self-monitor and share their health data (Chib & Li, 2022). Through collaborative engagement and the use of mHealth, efforts toward Sustainable Development Goals 3 have been advanced by expanding access to services, improving resource efficiency, and strengthening patient autonomy (Asi & Williams, 2018). In Indonesia, the COVID-19 pandemic and technological progress prompted the Ministry of Health to implement a digital transformation that marked a pivotal step toward a stronger and more equitable health sector (Kemenkes RI, 2021).

Within digital health communication, Computer-Mediated Communication (CMC) and User-Centered Design (UCD) jointly frame the analysis. Computer-Mediated Communication highlights how reduced-cue, often text-centric channels, and the degree of synchronicity and social presence, shape turn-taking, message clarity, and trust in clinician–patient exchanges, explaining why mediated encounters can feel less, or sometimes more, interpersonal than face-to-face interactions (Walther, 1996). User-Centered Design complements this lens by centering users' goals, contexts, and constraints, and by scrutinizing how interface decisions (e.g., triage prompts, chat flows, e-prescription and medication-delivery integration) support safe, comprehensible mHealth care across the product life-cycle (ISO, 2019). In global guidance, WHO similarly urges digital health implementations to be grounded in evidence and user needs to maximize acceptability, feasibility, equity, and system benefits, principles that align closely with User-Centered Design practice in health (WHO, 2019). Taken together, Computer-Mediated Communication and User-Centered Design motivate a communication-focused examination of mHealth interactions and clarify how platform affordances may translate into perceived care quality and patient trust (Melles et al., 2021).

In communication terms, mHealth functions as a mediated channel between healthcare professionals and the public (Krishnan et al., 2024). Mobile Health applications enable not only one-way but also two-way interactions, allowing more effective information exchange between patients and healthcare providers (Aytekin et al., 2025). This approach creates opportunities for two-way communication between patients and clinicians, as well as between patients and AI-based digital systems, providing more personalized and dialogic interaction experiences

(Puspitasari et al., 2022). Communication in mHealth also involves negotiating meaning among multiple actors, encompassing patients, healthcare professionals, and the mediating role of technology (Schöpfer et al., 2022). Taken together, these processes indicate that mHealth is not merely a conduit for health messages, it is also a space that enables mediated communication aligned with patients' needs and contexts (del Río-Lanza et al., 2020).

From a technological perspective, mHealth illustrates how digital innovation can integrate diverse components to deliver healthcare that is more efficient, adaptive, and personalized (Alsahli & Hor, 2024). Mobile technologies underpin mHealth applications because they allow easy and rapid access to services via portable devices (Pereira et al., 2025). The use of artificial intelligence in mHealth further enhances service quality by leveraging big data, predictive analytics, and machine learning to provide more accurate medical recommendations (Kreitmair, 2021). The connectivity and flexibility afforded by mobile technologies across networks have also been crucial for improving access to healthcare in remote area (Anstey Watkins et al., 2018). In parallel, mobile technologies and artificial intelligence enable more dynamic two-way communication among patients, providers, and information systems, thereby contributing to progress on health-related Sustainable Development Goals (Amosun et al., 2024).

At the societal level, the use of mHealth has become integral to an information society that relies on digital technologies to obtain and distribute health information (Luo et al., 2024). This information society, shaped by rapid advances in digital and communication technologies, facilitates interaction between users and providers, making health information exchange faster and more efficient through digital health applications (Sousa & Kalju, 2022). Within these communication patterns, the public acts both as information recipients and as active agents who can shape how the technology is used (Nogueira-Leite et al., 2023). As digital literacy increases, people are increasingly capable of using mHealth applications for everyday health needs, including self-monitoring and interactive communication with healthcare providers (Cao et al., 2024).

In 2009, Vital Wave Consulting for the United Nations Foundation and Vodafone Foundation, outlined seven principal categories of mHealth intended to leverage mobile technology to improve healthcare, particularly in developing countries. These categories comprised: (1) health education and promotion, (2) help lines, (3) diagnostic and treatment support, (4) communication and training for health workers, (5) disease surveillance and remote data collection, (6) remote monitoring and medication adherence, and (7) health information collection. These categories were designed to address systemic challenges such as limited access, shortages of medical personnel, and the need for accurate and timely health information.

The internet has been a major driver of advances in telemedicine and telehealth, which have become integral to many modern healthcare organizations (Mariani & Pêgo-Fernandes,

2012). According to the 2025 We Are Social report, 47.8% of internet users in Indonesia used the internet to search for health information (Kemp, 2025). Details on the reasons for internet use among Indonesians aged 16 and above are presented in Figure 1 below.

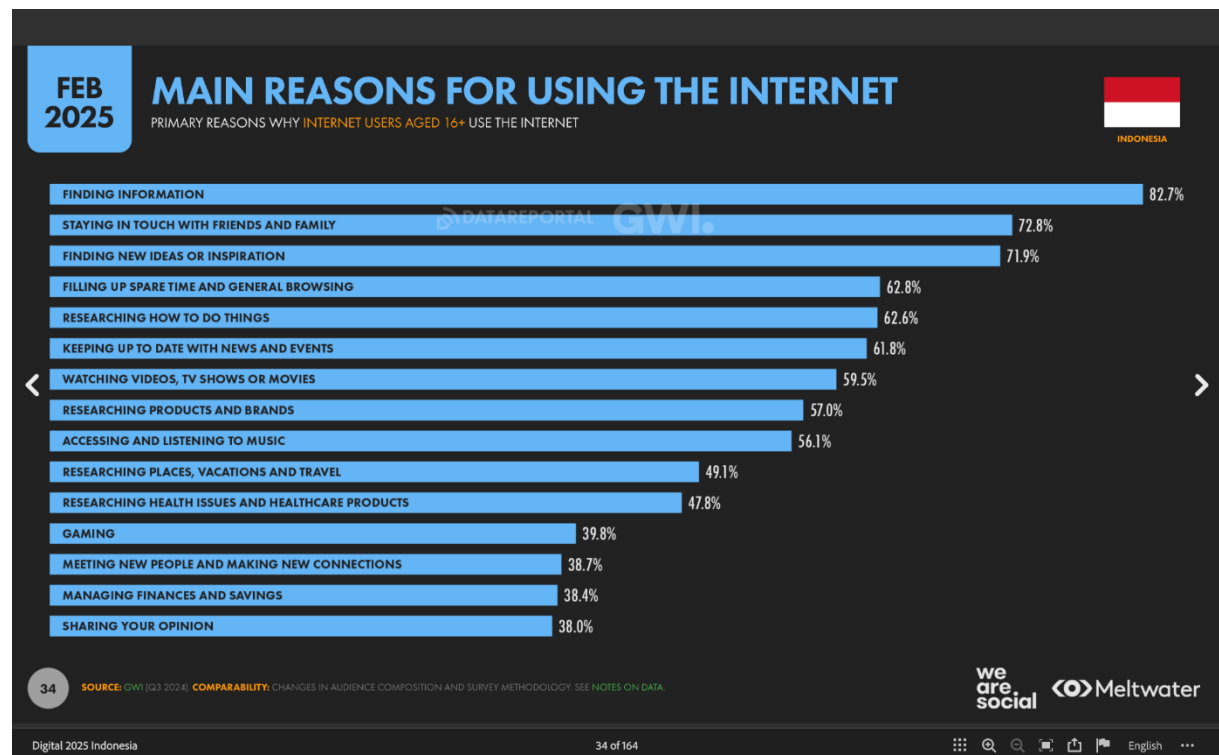


Figure 1. Statistics on Internet Usage Purposes among Indonesian Society
Source: We Are Social (2025)

As technology has advanced and internet and smartphone penetration has increased, digital health applications such as Alodokter and Halodoc in Indonesia have adopted and implemented the mHealth categories within their services. For health education and promotion, for example, both applications provide articles and medical information that are readily accessible to users. For help-line services, they offer online medical consultations via chat, voice, and video calls. Consequently, Alodokter and Halodokter exemplify the practical implementation of the mHealth categories formulated by the UN Foundation and Vodafone Foundation (2009), particularly in health education and promotion, help-line services, and diagnostic and treatment support, demonstrating how mobile technologies can effectively enhance access, quality, and efficiency in contemporary digital healthcare.

A growing body of research has examined the transformation of health communication alongside rapid technological digitalization. Globally, the adoption of mobile technologies for health communication has risen. DeSouza et al. (2014), in a study in rural India, showed that mobile phones as media for receiving health information and supporting mHealth interventions were well accepted by local communities. Implementation of mHealth applications has also been

explored in maternal and child health. Irawan et al. (2016) described “Sahabat Bundaku,” an integrated web- and mobile-based application that connects parents, particularly mothers, with midwives throughout pregnancy to ensure continuity of maternal health services through digital communication, illustrating how digital technologies can mediate communication between patients and healthcare workers, improve service efficiency, and extend the reach of health information.

In Indonesia, the digitalization of health communication has become increasingly salient, especially as the COVID-19 pandemic accelerated the use of online platforms. Aisyah et al. (2024) reported that Indonesia rapidly adopted digital health, with more than 15 million daily users of health applications during the pandemic, which prompted the government to integrate data and applications into a unified health technology ecosystem. Changes in public behavior when seeking health information and services online have also been observed. Tsabita & Sugandi (2022) found that ease of use was the primary consideration in using health websites, surpassing the quality of information provided. At the community healthcare level, Puspitasari et al. (2022) reported three years of action research developing an Android-based Posyandu application for recording maternal and child health data, which accelerated reporting and significantly improved the knowledge and skills of health cadres after implementation. Despite extensive work on digital health communication platforms and innovations, in-depth comparative studies of Indonesia’s two leading mHealth applications, Alodokter and Halodoc, from the perspectives of digital communication, technology, and society remain limited, and this study addresses that gap by comparing the two applications in social and digital communication contexts that have been understudied. Although many studies have evaluated the effectiveness of mHealth globally, research that specifically compares these two popular Indonesian mHealth applications in terms of user experience of digital communication and interactive design remains scarce.

Computer-Mediated Communication has been defined as a method of creating, exchanging, and receiving information that assists in encoding, decoding, and transmitting messages through telecommunication networks, encompassing any human interaction that is symbol-based and facilitated by digital technologies (December, 2006). Computer Mediated Communication is a form of communication and interaction among internet users that occurs as they share and seek information relevant to their needs (Yusminanda, 2019). The concept includes the internet, email, instant messaging, mobile phone text messaging, multi-user interactions, and other modalities (Anil Kumar et al., 2017). Computer-Mediated Communication involves message exchange via computer networks, initially viewed as low in social cues, yet now recognized for its capacity to actively shape messages and relationships (Liang & Walther, 2015).

Mobile Health applications frequently rely on Computer-Mediated Communication technologies to facilitate communication between patients and healthcare providers, including

text messaging, email, and telemedicine platforms (Jat & Grønli, 2023). Integrating mHealth and Computer-Mediated Communication can improve healthcare delivery by providing timely, personalized, and accessible care (Buttigieg, 2025). Telemedicine uses communication and information technologies to support diagnosis, treatment, monitoring, consultation, and education between doctors and patients (DiSantostefano, 2008). In practice, however, both doctors and patients need to feel comfortable with telemedicine technologies, and studies have reported mixed results, with patients generally satisfied while doctors voice concerns about communication barriers (Nguyen et al., 2024). Effective mHealth applications can foster better patient-provider communication, which is essential for accurate diagnosis, treatment decisions, and overall health outcomes (Tunnell et al., 2018).

User-Centered Design is a multidisciplinary design approach based on active user involvement to deepen understanding of user requirements and tasks, as well as design and evaluation literacy (Mao et al., 2005). It ensures that the end product is not only functional but also usable and understandable (Luna Daniel et al., 2015). The design of mobile devices used at the point of care is crucial, and devices should support face-to-face dialogue, nonverbal communication, and visibility of actions to enhance doctor-patient collaboration (Alsos et al., 2012). Visually appealing design also positively influences user experience in mHealth applications (Liu et al., 2020) and users are more likely to evaluate applications positively when aesthetics are attractive (Gomez et al., 2023). Mobile Health applications are designed to facilitate patient-doctor interaction, strengthening communication and engagement on both sides (Chen et al., 2024). User-Centered Design methodologies are therefore essential to ensure that applications meet the needs of patients and clinicians, and they involve gathering input from end-users to build more intuitive and effective interfaces (Saparamadu et al., 2021).

Halodoc is an mHealth application that provides doctor consultations, laboratory testing, and pharmacy delivery services (Mangkunegara et al., 2018). In a survey of 1,762 respondents conducted from 30 November to 7 December 2024, 69% reported using telehealth applications, most of whom used more than one, with Halodoc used by 54% and Alodokter by 27% (Yesidora, 2025). Alodokter reportedly has 20 million monthly active users (Djumena, 2019). Both platforms offer low-cost, real-time methods for delivering care that are accessible to broader populations, including those in remote areas (Mohd & Mustafah, 2023).

Focusing on user experience, with doctors as healthcare providers and patients as service recipients, this study is important for understanding how users make sense of the two applications as channels of health communication, and for assessing the extent to which these applications accommodate user needs across social strata, with the aim of identifying comparative forms of digital communication between doctors and patients in Indonesia's two largest mHealth platforms.

Guided by the above framework and the identified gap in comparative, communication-focused studies on Indonesian mHealth, this study asks: (1) How do doctors and patients construct mediated communication through Alodokter and Halodoc in everyday consultations?; (2) How do platform features and workflows influence communication quality, trust, and clinical decision-making?; and (3) What user-centered design implications follow for strengthening clarity, safety, and experience in digital health consultations?

METHODS

This study employed a qualitative approach aimed at gaining an in-depth understanding of how the Alodokter and Halodoc mobile health applications were used and interpreted by healthcare providers and users in Indonesia. Data collection involved non-participant observation to capture interactions and social contexts in the field, which enabled the researchers to document behavior, social dynamics, and the natural context directly (Kawulich, 2012). Supplementary data were gathered through document study by reviewing relevant documents and reports to verify and enrich the findings.

In addition, semi-structured, in-depth interviews were conducted with two groups of informants, doctors as healthcare providers and patients as recipients of care. In-depth interviewing was chosen because it enabled the exploration of informants' perceptions and experiences to elicit the meanings they constructed from those experiences (Alshenqeeti, 2014). We used purposive recruitment to obtain information-rich cases relevant to mHealth use. The final sample comprised two medical doctors and two adult users (all ≥ 18 years). Inclusion criteria for doctors were at least two years of experience providing consultations via mHealth and inclusion criteria for users were at least two years of personal mHealth use for health consultations. Participants were contacted through direct outreach and referrals and were enrolled after providing audio-recorded verbal informed consent.

Non-participant field observations were conducted over three weeks, spanning weekdays and weekends to capture routine consultation patterns under varying temporal conditions. Fieldnotes documented settings, sequences of actions, and salient communication behaviors observed on site. Data were gathered face-to-face through semi-structured, in-person interviews with doctors and users, complemented by non-participant observations and a short document review. Interviews were audio-recorded with permission and transcribed verbatim to support reliable coding and auditability.

The research strategy adopted an exploratory-descriptive approach, suitable for investigating underexplored phenomena and systematically describing how digital health communication operated (Neuman, 2014). The collected data were then analyzed through three coding stages, namely open, axial, and selective, which were interrelated and helped in mapping

themes and relationships among concepts in the data (Creswell, 2009). We conducted open, axial, and selective coding using a manual, codebook-driven approach with iterative memoing and version-controlled spreadsheets to manage codes and theme development. Subsequently, data analysis techniques employed thematic and narrative approaches to interpret the data from multiple vantage points and weave them into a coherent, reflective narrative (Braun & Clarke, 2006; Riessman, 2008). To ensure validity and reliability, the researchers conducted data triangulation by integrating the results of observation, interviews, and documentation, thereby strengthening the credibility of the study (Patton, 1999).

The study adhered to the ethical guidelines of FISIP Universitas Indonesia. All participants received an information script and provided audio-recorded verbal informed consent prior to participation. Personal identifiers were removed from transcripts, pseudonyms are used in reporting, and audio files, transcripts, and fieldnotes were stored in encrypted folders accessible only to the researchers. Participation was voluntary, and participants could withdraw at any time without consequence.

RESULTS AND DISCUSSION

Halodoc and Alodokter have become highly popular digital health applications and have gained significant public trust, as reflected in Google Playstore data, where each has been downloaded more than 10 million times. As shown in Figure 2, Alodokter recorded a rating of 4.3 from 475 thousand reviews, while Halodoc achieved a higher rating of 4.6 from 437 thousand reviews. These figures illustrate the broad acceptance and strong interest of Indonesian society in using digital technology for healthcare needs, while also reaffirming the position of Alodokter and Halodoc as adaptive and responsive mHealth service providers.

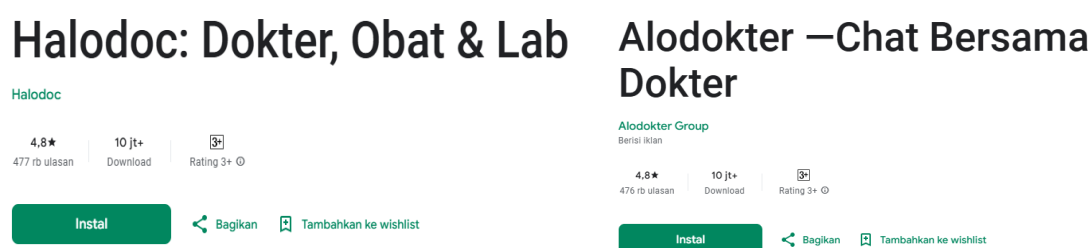


Figure 2. Download Menu Display of the Halodoc and Alodokter Applications

Source: Google Playstore (2025)

Both applications also display distinct core features on their home pages. On Halodoc's main page, users are presented with primary services such as Chat with Doctor, Health Store, Homecare, and Make Offline Appointment, along with specialized services such as Haloskin and Sexual Health that are designed for skin care and sexual health education. By contrast, Alodokter

emphasizes the Chat with Doctor feature, which streamlines the search for general practitioners and specialists, and provides immediate information on consultation fees, online status, and patient satisfaction ratings. At the bottom of Alodokter's screen there are additional main menus, including Make Appointment, Articles, Subscription, and Aloshop, indicating a focus on facilitating medical interactions, scheduling face-to-face visits, accessing health articles, and offering subscription and e-commerce services. These differences in layout and flagship services reflect each application's digital communication strategy in addressing user needs and preferences in an increasingly mature mHealth era. The main pages of both applications are shown in Figure 3.

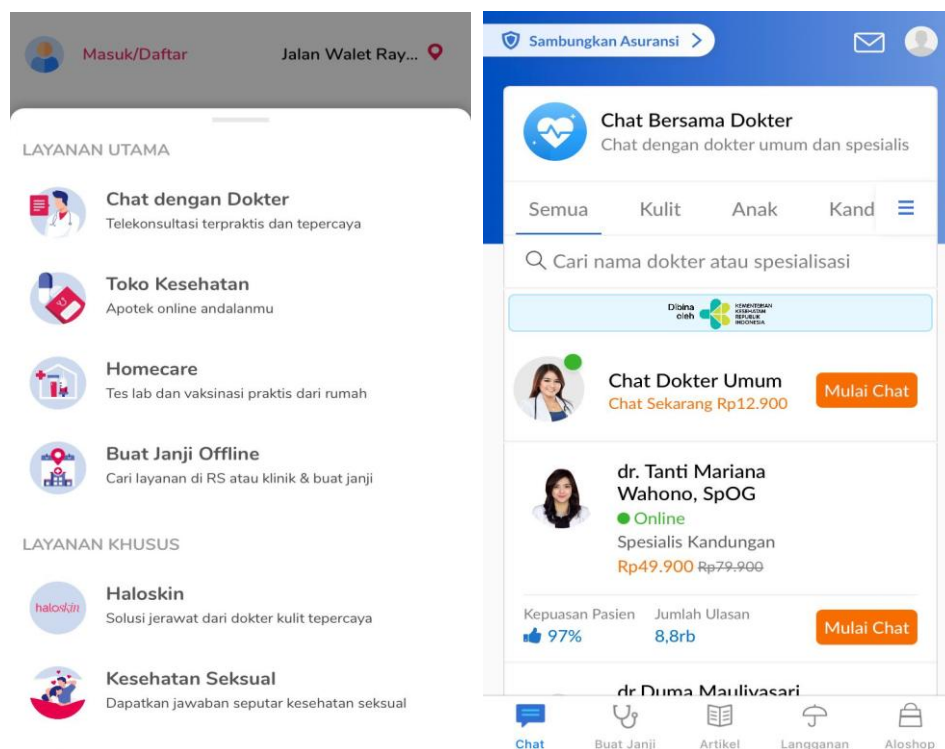


Figure 3. Main Menu Display of the Halodoc and Alodokter Applications

Source: Halodoc and Alodokter (2025)

The findings of this study reveal how Alodokter and Halodoc have become primary media for digital communication between doctors and patients in Indonesia. Data were gathered through field observations, in-depth interviews with doctors and application users, and document analysis, then organized into three overarching themes as presented in Table 1.

The “User Activities” theme shows that interaction patterns between doctors and patients are relatively similar across both applications. Doctors use the apps to make direct contact with patients, while patients use them to communicate with doctors and to search for health products,

including scheduling face-to-face appointments in Alodokter. A doctor using Alodokter expressed this view:

“We can get closer to patients. It is easier for them to reach us. Most importantly, it helps with remote patient monitoring while allowing us to manage our own schedules.” (PG, doctor on an mHealth application, interview, 31 May 2025)

Table 1. User Activities, mHealth Needs, and Core Home-Page Features

No	Theme	Halodoc	Alodokter
1	User Activities	Doctors: contact with patients Patients: - contact with doctors; - search for health products; - search for doctor schedules; - search for homecare services.	Doctors: contact with patients. Patients: - contact with doctors; - search for health products; - search for doctor schedules.
2	mHealth Needs	Doctors: - increase access to communication with patients, - increase professional exposure. Patients: - first aid unconstrained by distance, - search for medicines from home, - make appointments for face-to-face visits at hospitals, - search for homecare services.	Doctors: - increase access to communication with patients, - increase professional exposure. Patients: - first aid unconstrained by distance, - search for medicines from home, - make appointments for face-to-face visits at hospitals.
3	Core Features on the Home Page	Chat with Doctor; Health Store; Homecare; My Insurance (<i>Asuransiku</i>); Haloskin; Halofit.	Chat with Doctor; Make Appointment; Aloshop; Subscription; Alochoice.

Source: Authors (2025)

Conversely, a user of both Halodoc and Alodokter described the health-related motivations underlying their use of mHealth applications. One key reason was efficiency of effort and time compared with meeting a doctor in person, including how they obtained medicines from a pharmacy:

“In general, it is practical. It helps, for example when you suddenly get sick and there is no one to assist, maybe your spouse or child cannot help, you just consult through the app, and the medication is sent directly from the pharmacy.” (EP, mHealth application user, interview, 2 June 2025)

The “mHealth Needs” theme reveals distinctive perspectives from both sides of the interface. From doctors’ viewpoints, using Alodokter and Halodoc was seen as improving access to patient communication, supporting professional exposure, and facilitating the management of digital medical records. Reputation was considered important because the medical profession heavily depends on the quality of diagnosis and consultation delivered to patients:

“As a doctor, it is actually good for our professional reputation. It helps build a good name and broader recognition, instead of only relying on private practice.” (PG, doctor on an mHealth application, interview, 31 May 2025)

From patients’ perspectives, the primary need was rapid communication with medical professionals to obtain first-line assistance without distance constraints. This need was supported by photo-sharing features that strengthen interaction between patients and providers. One user emphasized this point:

“What matters is communicating clearly with the doctor, for example what the condition is. I once had a skin problem, I took a photo to show the doctor what it looked like, and it was reviewed right away.” (EP, mHealth application user, interview, 2 June 2025)

The “Core Features” theme highlights each application’s digital service strengths. Halodoc offers core services such as doctor chat, a health store, homecare, and digital insurance services such as Asuransiku and Haloskin, which substantially ease patient access. Alodokter, on the other hand, features “Make Appointment” for face-to-face hospital visits, in addition to subscription services and health e-commerce features such as Aloshop and Alochoice. A doctors using Alodokter noted how these features support patient comfort:

“Halodoc focuses more on medication purchases and homecare. Doctors can visit the home, or you can request vaccination at home. Alodokter is convenient for making hospital appointments. Both are good, but they have different emphases.” (NP, doctors on an mHealth application, interview, 28 May 2025)

From the patient side, the completeness and automation of features also stand out as advantages. These aspects help differentiate one application from another and shape how patients interpret mHealth in relation to their needs. As one user explained:

“I initially used Alodokter, but at the time it was not linked and did not automatically integrate with medication pricing, pharmacies, and delivery services, so I switched to

Halodoc and have continued using it ever since.” (IN, mHealth application user, interview, 4 June 2025)

Taken together, these analyses indicate that Alodokter and Halodoc function not only as channels for digital health communication, they also constitute health-service ecosystems that are more personal, adaptive, and responsive to the needs of both doctors and patients. These findings underpin the study’s discussion and underscore the central role of mHealth in Indonesia’s digital health communication, medical data management, and progress toward health-related SDGs.

Based on interview data with doctors and patients regarding their experiences using Halodoc and Alodokter, qualitative analysis began with open coding. The codes generated at this initial stage were then organized and refined through selective coding to derive more focused core concepts. Finally, thematic analysis was carried out to map the principal themes that represent the experiences of doctors and patients, as shown in Tables 2 and 3.

Table 2. Thematic Analysis from the Perspective of Doctors as Healthcare Providers

No	Theme	Definition
1	Medical Practice Flexibility	Doctors were able to serve patients online with more flexible schedules and locations.
2	Diagnostic and Examination Limitations	Doctors faced challenges in making diagnoses without direct physical examinations.
3	Mobile-AI-Based Communication Adaptation	Doctors used mobile-AI devices to improve the efficiency of online consultations and communication with patients.
4	Economic Incentives and Work Challenges	Doctors obtained additional economic benefits, yet they also encountered challenges such as extra workload and technical constraints.

Source: Authors (2025)

Table 2 presents a thematic analysis of doctors’ experiences using mHealth services, covering four main themes, namely Medical Practice Flexibility, Diagnostic and Examination Limitations, Mobile-AI-Based Communication Adaptation, and Economic Incentives and Work Challenges. These themes capture the principal patterns emerging from online consultations through Halodoc and Alodokter. In Indonesian mHealth applications, doctors employ AI technology during online consultations through suggestions, that is, answer options generated from patient medical histories that can be adjusted by the doctor, as illustrated in Figure 4.

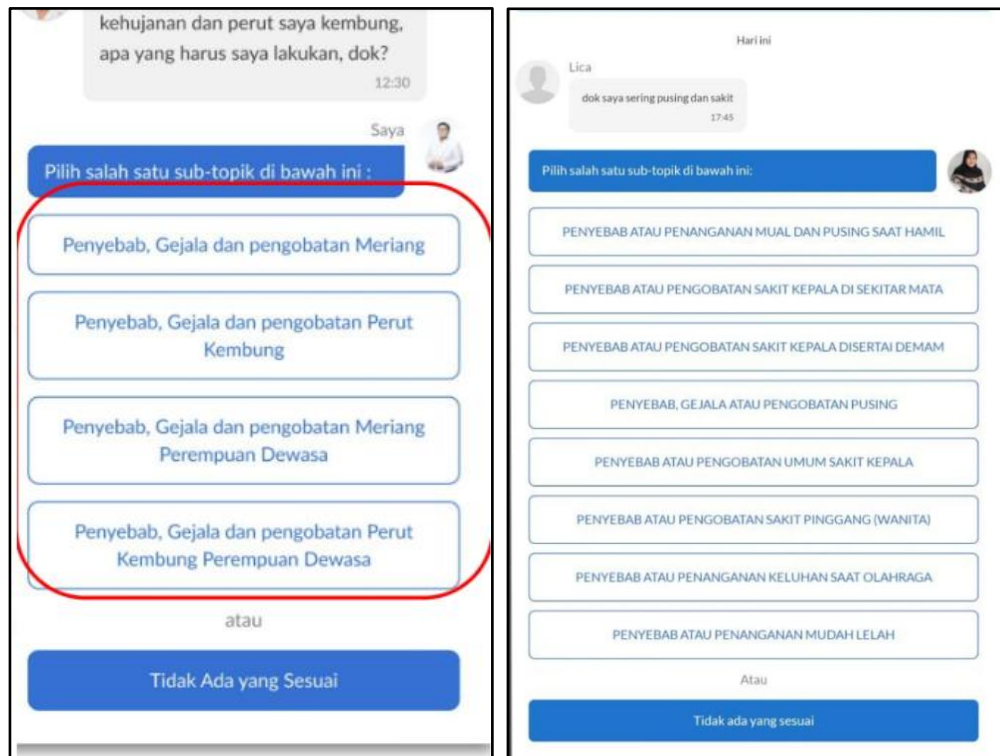


Figure 4. Display of AI-Generated Suggestions (Answer Options) in Chat Consultations

Source: Alodokter (2025)

After outlining doctors' perspectives, the analysis turns to the thematic findings from the viewpoint of patients as users of digital health services.

Table 3. Thematic Analysis from the Perspective of Patients as Users of Health Services

No	Theme	Definition
1	Communication Quality	Convenient access to services and efficiency in cost and time without the need for in-person visits.
2	Ease and Access to Communication	User-friendly application features and seamless automation across subsequent processes.
3	Privacy and Trust	Awareness of risks arising from the submission of personal data.
4	Interaction Constraints and Service Development	Limited consultation duration and a continuing need for virtual face-to-face communication.

Source: Authors (2025)

As shown in Table 3, patient experiences and perceptions with Alodokter and Halodoc clustered into four principal themes, namely Communication Quality, Ease and Access to Communication, Privacy and Trust, and Interaction Constraints and Service Development.

Together, these themes describe how patients interpreted digital health services in terms of practical benefits, the quality of communicative exchanges, and perceived trust and limitations. Based on these findings, the use of mHealth applications such as Halodoc and Alodokter functioned not only as channels for delivering digital health services, it also operated as a communication medium that shaped new relationships between patients and providers.

The dynamics of the mHealth communication indicate the need to examine this application not only for its technological functionality, but also for how mediated communication was constructed, enacted, and interpreted by its users. Accordingly, the following discussion elaborates the main themes that emerged in the findings, linking them to the frameworks of Computer-Mediated Communication (CMC) and User-Centered Design (UCD), in order to understand the extent to which digital communication in mHealth accommodated interaction needs and user experience in Indonesia.

Medical Practice Flexibility and Mobile-AI-Based Communication Adaptation for Doctors

Mobile Health technologies have been a crucial factor in supporting flexible medical practice, particularly for doctors who need to adjust the timing and location of services dynamically. In Indonesia, the COVID-19 pandemic and technological advances strengthened the demand for user-friendly mHealth applications, enabling real-time monitoring for patients and their families (Novrianda & Sarfika, 2023). Mobile Health designs tailored to user needs improved medication safety and facilitated effective communication between doctors and patients' families, giving doctors room to adapt more personally to patient needs (Jolliff et al., 2024). This philosophy aligns with User-Centered Design, which focuses on developing mHealth applications that meet the specific needs, preferences, and expectations of end users, including doctors (Jat & Grønli, 2023). It is also consistent with doctors' aspirations for future features that meaningfully support consultations, such as video calls.

The introduction of artificial intelligence in mobile application development has also reshaped digital health services, since AI integration in mHealth significantly enhanced user experience and the efficiency of digital interactions (Fedorov, 2024). The use of natural language processing and machine learning allowed providers to deliver more targeted responses while improving the accuracy of preliminary diagnoses. In Indonesia's mHealth services, doctors used AI during online consultations, where the system offered suggested replies tailored to patients' medical histories. To make such digital communication effective, application design needed to be adapted to user characteristics and preferences, including cultural backgrounds and everyday practices (Krikowa et al., 2024). Applying universal design principles further increased accessibility and made communication more informative and patient-centered (Wiljén et al., 2022). In addition, a User-Centered Design approach enabled feature customization for user

comfort, including controlling what should be displayed and what should be withheld to protect patient privacy (Schaaf et al., 2024).

Mediated Communication Challenges and Additional Benefits for Doctors

Although mHealth can provide an additional source of income for doctors, diagnosing patients during app-based consultations presented challenges. Doctors who conducted video consultations could simulate eye contact by looking directly at the camera, which has been shown to improve ratings of communication and interpersonal skills and may strengthen relationships with patients (Helou et al., 2022). Empathic experience in healthcare is closely associated with patient satisfaction and clinical outcomes, although this association in virtual settings has remained relatively underexplored (Yamada et al., 2025).

The use of mHealth applications as a form of mediated communication can be understood as human social interaction mediated by information and communication technologies, including the exchange of digital messages, online communication, and a range of modalities from brief social attention to in-depth conversations (Meier & Reinecke, 2021). Computer-Mediated Communication theory indicates a tool that patients may value and a mode of care delivery that aligns with their needs, particularly when resources are constrained (Wagg et al., 2018). In computer-mediated contexts, when nonverbal cues are limited, communicators optimize verbal or textual cues to sustain communicative effectiveness and to build relationships comparable to face-to-face encounters (Xu et al., 2024). The application of Computer-Mediated Communication through mHealth platforms therefore opens new possibilities for inclusive, adaptive, and patient-responsive services, while maintaining a level of communication quality comparable to in-person visits.

Communication Quality and Ease of Access for Patients

Beyond doctors' perspectives, it was essential to consider patients' views regarding their experiences as users of the Alodokter and Halodoc applications. Each thematic finding was elaborated to highlight how patients interpreted practical benefits, the quality of communication, and the challenges they faced when using digital health services. The results showed that patients appreciated the ease of communication and the rapid access enabled by mHealth applications. Features such as chat with a doctor, appointment scheduling, and home delivery of medicines allowed patients to obtain services efficiently without geographical or temporal constraints.

These results are consistent with mHealth research that emphasizes how such applications facilitate better communication between patients and healthcare providers, which is a core aspect of Computer-Mediated Communication. This includes real-time interactions via chat functions, enabling patients to receive timely advice and medical support (Rey Velasco et al. 2022;

Bhardwaj et al. 2024). Effective Computer-Mediated Communication also helps build trust between patients and providers, which in turn supports greater adherence to medical recommendations (Blake, 2013).

From a User-Centered Design perspective, the success of these communicative exchanges was closely tied to user-friendly application design. A clear home-page layout, efficient navigation, and well-integrated features aligned with patients' everyday needs made the user experience more comfortable and useful. When comparing options, patients tended to prefer applications with more complete features and greater automation, which simplified subsequent processes. Continuous user feedback during development helped refine applications and made them more user-friendly and effective (Saparamadu et al., 2021), and involving patients and healthcare providers in the design process ensured that applications met real-world needs and preferences, improving the usability and functionality of mHealth tools (Haynes & Katherine K. Kim, 2016). Patient involvement in providing feedback should therefore be noted as a practical recommendation.

Need for Face-to-Face Interaction and Data Privacy for Patients

On the other hand, this study also identified several constraints faced by patients when using mHealth applications, particularly those stemming from the limits of mediated communication. Short consultation durations, restricted opportunities to describe complaints in detail, and cues confined to text with minimal nonverbal expression made doctor-patient exchanges feel suboptimal, indicating the need for more elaboration and for doctors to be prepared to provide virtual face-to-face consultations. This suggests that patients' communicative experience in mHealth is shaped by media richness, since, according to Media Richness Theory, using richer media with the capacity to convey multiple cues, for example vocal intonation and gesture, yields better performance for equivocal tasks (Littlejohn & Foss, 2009).

The need for face-to-face consultation features persists for patients with certain conditions, and this aligns with prior analyses showing that customizable and personalized design, which tailors user interfaces to individual needs, can increase patient engagement and improve quality of care (Kabyshev & Kovalchuk, 2023). Studies also indicate that mHealth applications can enhance patient trust and adherence by facilitating continuous and personalized communication (Blake, 2013).

A further challenge concerns data privacy. Providers must address users' privacy concerns, because even though the need for mobile health services is substantial and may lead patients to accept certain risks, earlier findings show that common issues such as app crashes, navigation difficulties, and privacy problems can hinder adoption and can significantly undermine user satisfaction and engagement (Alzghaibi, 2025). Privacy is highly personal and

depends on how individuals perceive threats to their possessions, bodies, or dignity, perceptions that are often shaped by culture and social context (Schroeder et al., 2022).

In the context of mHealth, although these technologies can expand access to care, personal data collection practices that are not always transparent or secure raise serious privacy issues related to access to sensitive patient information (Tangari et al., 2021). Data privacy has long been a central concern, yet it has often lagged because technological development moves faster than regulation (Benjumea et al., 2020). Applications frequently require location data to support specific services, therefore assurances are needed that such data are used safely and in compliance with the law. Strong regulation is required to address the privacy paradox, in which individuals express high concern about privacy, yet remain willing to share personal data when perceived benefits outweigh the costs (Ying et al., 2023).

CONCLUSION

This study underscored that the success of mHealth services such as Halodoc and Alodokter depended not only on technological sophistication, but also on the effectiveness of mediated communication that could address the emotional, practical, and social needs of patients and doctors. Thematic analysis indicated that doctors viewed AI-integrated mHealth applications as useful for increasing flexibility in medical practice, although challenges remained in establishing diagnoses without direct physical examination. From the patient perspective, users preferred applications with comprehensive features and automated continuity of services over those without such capabilities. These applications also facilitated rapid access to clinicians and improved efficiency in terms of time and cost. However, communicative effectiveness was strongly conditioned by the media richness afforded by the application. When exchanges occurred only through text or brief chat, patients with complex complaints reported unmet informational and emotional needs, therefore virtual face-to-face communication remained necessary for certain conditions that could not be accommodated by text or chat alone.

As practical recommendations, developers of mHealth applications should enrich communication features, for example by adding video call options and strengthening user data security to build greater trust. Transparency regarding how user data are used and stored is also needed so that patients feel safe when sharing health information. For future research, it is important to examine how cultural background, digital literacy, and user preferences influence acceptance and use of these applications. In doing so, subsequent studies can yield a more comprehensive understanding of the factors that shape the effectiveness and adoption of mHealth, and can guide the development of application designs that are increasingly inclusive, adaptive, and responsive to the needs of Indonesian society.

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