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Telemedicine in the Health Communication Industry: A Systematic Review and Implications for Indonesia

Andanareswari Wardhani, Febrina Galuh Permanasari, Yolanda Natasia Letare, Niken Febrina Ernungtyas
Universitas Indonesia
E-mail: andanareswari.wardhani@ui.ac.id, febrina.galuh@ui.ac.id, yolanda.natasia@ui.ac.id, nikenfebrina@gmail.com

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ABSTRACT

Technological advancements have significantly transformed the healthcare sector, with telemedicine emerging as a key innovation that integrates healthcare services with the communication industry. Telemedicine, defined as the use of electronic communication to deliver healthcare remotely, offers notable benefits such as expanded access to services, cost efficiency, and enhanced quality of care. These advantages are particularly relevant in Indonesia, where geographical challenges and uneven population distribution often limit healthcare accessibility. The COVID-19 pandemic further accelerated telemedicine adoption globally and nationally, underscoring its critical role in ensuring service continuity during health crises. This study aims to analyze the development, challenges, opportunities, and future trends of telemedicine in relation to the communication industry. Employing a systematic literature review method, the research synthesizes findings from English-language journal articles indexed in Scopus to provide an evidence-based overview of telemedicine's trajectory. The findings reveal that while telemedicine has improved access and efficiency, its implementation in Indonesia still faces barriers such as digital infrastructure limitations, regulatory gaps, and digital literacy disparities. Opportunities exist in strengthening policy frameworks, expanding broadband access, and fostering cross-sector collaborations between healthcare and communication industries. The study contributes to both healthcare and communication fields by highlighting telemedicine as a convergence point that requires integrated governance and innovation. The implications suggest that sustainable telemedicine development will depend on addressing structural barriers while leveraging technological growth to enhance equitable healthcare delivery in Indonesia.

INTRODUCTION

Technological developments have undeniably provided various conveniences in human life. One form of technological development is in the healthcare industry. Technology has significantly changed the way healthcare organizations operate (Morilla et al., 2017). In their journal, Morilla et al. (2017) provide two different terms in health technology: *e-health* and *telemedicine*. *E-health* refers to healthcare services and information delivered or enhanced via the internet and related technologies. *Telemedicine* refers to the use of medical information to improve patient health through electronic communication. Ayatollahi et al. (2015) define *telemedicine* as the application of information and communication technology in a healthcare environment. *Telemedicine* is very beneficial for patients because they can receive care whenever and wherever they need it without having to make an in-person visit (Record,

Ziegelstein, Christmas, Rand, & Hanyok, 2021). This is especially helpful for people with limited mobility, such as those living in rural or remote areas, and those managing chronic conditions (Maugeri et al., 2024). *Telemedicine* also offers various benefits, such as improving access to healthcare services, reducing costs, and potentially resulting in better patient outcomes (Maugeri et al., 2014). It is also hoped that *telemedicine* will improve the fairness and equity of healthcare distribution, particularly in remote areas (Rangasamy et al., 2011).

In the healthcare industry, Indonesia faces several challenges. One such challenge is the disparity in medical access between urban and rural areas. According to Statista (2025), Indonesia is the fourth most populous country in the world. The large number of provinces in Indonesia also contributes to the suboptimal distribution of both medical equipment and medical personnel. Public access to healthcare facilities continues to face challenges due to uneven population distribution, long distances, geographical conditions, and limited transportation facilities. Several provinces in Eastern Indonesia experience this, including Papua, West Papua, Maluku, North Maluku, and East Nusa Tenggara. As a result, many residents still struggle to easily access services from general practitioners (Hikmah et al., 2021).

The presence of *telemedicine* can, in fact, bridge this gap. The COVID-19 pandemic significantly accelerated the adoption and implementation of *telemedicine* practices globally due to the extreme circumstances it created (Leite et al., 2020). In Indonesia, since the COVID-19 pandemic hit, several hospitals have begun developing teleconsultation services to expand healthcare coverage and prevent the spread of the COVID-19 virus (Alexandra et al., 2021). *Telemedicine* has emerged as a key solution for providing healthcare services without physical interaction, enabling "remote healing." This is crucial in managing the pandemic and reducing the spread of the virus (Leite et al., 2020). Technology and *telemedicine* have transformed healthcare delivery, particularly in rural areas (Saputra, 2024). Several major players in Indonesia, such as Halodoc, Alodokter, and KlikDokter, rely solely on robust telecommunications networks to provide video consultations, e-prescriptions, and remote diagnosis.

This report aims to provide a comprehensive overview of the relationship between *telemedicine* and the communications industry. This report outlines the historical development, challenges, opportunities, and future trends emerging from the convergence of these two sectors. The benefits of this research lie in providing evidence-based insights for policymakers, healthcare providers, and communication industry stakeholders to design strategies that address barriers such as infrastructure limitations, regulatory gaps, and disparities in digital literacy.

RESEARCH METHOD

This report used a systematic overview method, synthesizing findings from various studies on telemedicine and the communications industry. The approach involved searching relevant literature to gather information on the scope, synergies, impacts, challenges, opportunities, and future trends of telemedicine in relation to the communications industry. Research articles were sourced from Scopus.com using the keywords "Telemedicine AND Communication," which initially yielded 197 documents. These were then narrowed down by selecting only scientific journal articles and excluding reviews, conference proceedings, and other types of documents. The screening process resulted in 36 articles for analysis. The

analysis identified key themes and patterns from the reviewed literature to provide a comprehensive overview of the topic (Grant & Booth, 2009).

RESULTS AND DISCUSSION

Definition, History, and Scope of Telemedicine

Telemedicine is defined as the provision of remote healthcare services by healthcare professionals using information and communication technologies (Alexandra et al., 2021; Sholihah et al., 2024), facilitating remote medical care and enabling 'remote healing' (Leite et al., 2020). This technology supports and promotes remote clinical medicine (Arkandhi & Harjaningsih, 2022), including remote consultations, diagnosis, treatment follow-up, and patient care management (Sholihah et al., 2024).

Telemedicine has undergone significant evolution from its initial conceptualization to its current state of sophistication, driven by continuous technological developments (Kyriacou et al., 2003; Guo et al., 2019; Panayides et al., 2013; Shimizu, 1999). The concept of telemedicine was introduced approximately 30 years ago through the use of basic communication technologies such as telephones and fax machines (Kyriacou et al., 2003). Its primary purpose was to extend expert-based healthcare services to remote, understaffed areas and to improve the provision of emergency care (Kyriacou et al., 2003). Remote ECG diagnosis via telephone networks is cited as a well-known early example. This early application demonstrated the feasibility and utility of providing healthcare services across distances (Shimizu, 1999).

The next crucial phase in the development of telemedicine was the High Performance Computing and Communications (HPCC) initiative in the United States (Ackerman et al., 2022). Beginning in 1987, the National Library of Medicine (NLM) played a key role in connecting the healthcare and HPCC communities, recognizing telemedicine as a key area merging the two fields (Ackerman et al., 2022). The National Laboratory for Medical Information Technology (NLM) initiated research to demonstrate how advanced computing and networking could improve medical practice, leading to the multi-year HPCC Health Care Awards in 1994, focused on areas such as data and image sharing, real-time collaborative care, information access, and virtual reality in medicine, often utilizing high-speed networks (Ackerman et al., 2022). Furthermore, the NLM addressed data security concerns as telemedicine expanded over the internet, leading to regulations under the Health Insurance Portability and Accountability Act (HIPAA) (Ackerman et al., 2022).

Evolution continued with the development of an open-source telemedicine platform with wireless medical video communications (Panayides et al., 2013). This platform aimed to provide reliable, low-cost remote diagnostic capabilities for applications such as emergency incidents, mass screenings, and medical education, leveraging advances in wireless networking (WLAN, HSPA) and video compression technology (Panayides et al., 2013).

The increasing availability and speed of the internet has significantly advanced telemedicine (Guo et al., 2019). Programs such as the NLM Scalable Information Infrastructure (SII) program (established in fiscal year 2003) continue the work of previous initiatives by focusing on health-related applications of scalable, network-aware wireless geographic information systems and identification technologies. SII aims to connect diverse healthcare entities, including hospitals, homes, and research centers (Ackerman et al., 2022). This era has

witnessed a shift towards the efficient transmission of text, images, and other multimedia data (Guo et al., 2019).

The COVID-19 pandemic in 2020 drastically accelerated the adoption and importance of telemedicine (Coleman, 2020; Nguyen et al., 2024; Valencia-Arias et al., 2024). Telemedicine has become crucial for maintaining continuity of care, minimizing virus transmission, and managing healthcare resources (Nguyen et al., 2024; Valencia-Arias et al., 2024; Sholihah et al., 2024). Millions of patient-initiated visits are conducted via real-time audio and video (Mulcare et al., 2020). The pandemic has highlighted the benefits and need for better infrastructure, training, and regulation for telemedicine (Leite et al., 2020; Nguyen et al., 2024).

Recent advances in telemedicine are aimed at addressing various healthcare challenges and leveraging emerging technologies such as mobile phones, instant messaging, and wireless sensor networks, and have been expanded into specialized fields.

Mobile phone technology offers significant potential for health assessment, education, and other services between face-to-face encounters, particularly in less developed countries with high mobile phone penetration (Piette et al., 2010). Meanwhile, a study by Chen et al. (2022) explored telemedicine communication using instant messaging, which is being developed to improve prehospital triage in disaster management. Beyond the technological side, there is growing interest in telemedicine collaboration in specialized areas such as pediatric trauma between the outpatient and inpatient sectors, utilizing video telephony and imaging applications (Mokhaberi et al., 2024).

New conceptual frameworks are being developed to better understand and evaluate telemedicine interventions, such as classifying telemedicine as a communication process with functions such as telemetry, telephasis, and telepraxis (Colucci et al., 2017). This approach shifts the focus from purely technological aspects to the underlying communication and its impact on health outcomes (Colucci et al., 2017).

Numerous and interconnected factors influence patient adoption of telemedicine, leading to its current development. Technological factors play a crucial role, including the availability of high-speed and broadband internet access, as well as digital literacy and patient familiarity with technology (Valencia-Arias et al., 2024). The need for specific technology and devices can also be a barrier for some patients (Nguyen et al., 2024). The perceived ease of use and utility of the telemedicine platform are critical to adoption, as is the availability of technical support (Valencia-Arias et al., 2024).

Personal factors significantly impact patients' decisions to adopt telemedicine. Health literacy influences their ability to understand medical information remotely (Nguyen et al., 2024; Ningsih et al., 2025). Patients' knowledge and understanding of telemedicine and their attitudes toward it, both positive and negative, are influential (Rahman et al., 2023). The perceived convenience of telemedicine, especially for patients in rural areas, the elderly, or those with young children, is a strong motivator for telemedicine adoption (Nguyen et al., 2024). Patients facing transportation and cost constraints for in-person care are often more willing to adopt telehealth (Piette et al., 2010). Emotional factors, such as anxiety, fear of technology, and concerns about lack of physical connection, can hinder adoption (Valencia-Arias et al., 2024). Previous experiences with telemedicine can also shape future adoption. Trust in the technology, the healthcare providers using it, and the security of their personal

information are crucial. Concerns about data privacy and confidentiality can also act as a barrier (Valencia-Arias et al., 2024).

Social and environmental factors also play a role. Social influence and support from their social networks can encourage patients to try telemedicine (Valencia-Arias et al., 2024). In the Indonesian context, the accessibility of telemedicine services in their neighborhood is another factor (Rahman et al., 2023). Broader social determinants of health, including socioeconomic status, education, and geographic location, can create disparities in access and adoption (Valencia-Arias et al., 2024).

The development of telemedicine in Indonesia has made significant progress, particularly during the COVID-19 pandemic (Sholihah et al., 2024). Telemedicine services in Indonesia have a long history, with the Ministry of Health designating two priorities in 2012: teleradiology and telecardiography services (Rahman et al., 2023). The Ministry of Health also officially launched the TEMENIN app to facilitate telemedicine between healthcare providers (Rahman et al., 2023). The legal basis for providing telemedicine services between healthcare facilities is regulated by Minister of Health Regulation No. 20 of 2019, and the Medical Council issued Regulation No. 74 of 2020 concerning clinical authority and telemedicine practice during the COVID-19 pandemic (Rahman et al., 2023).

Although still under development and lacking specific legal certainty governing its use in the community, the adoption of telemedicine app services continues (Rahman et al., 2023). One telehealth platform saw a rapid surge in usage during the COVID-19 pandemic, with over 20 million users in 2020, a tenfold increase (Rahman et al., 2023). This surge aligns with a reported 600% increase in access to telemedicine apps due to the pandemic (Sholihah et al., 2024). A report from Deloitte (2022) also stated that around 57% of Indonesians have used telemedicine services, with the majority (77%) using them between one and five times a year.

Communication Dimensions in Telemedicine Practice

Beyond the technical and technological aspects, communication in telemedicine services presents unique conceptual challenges, particularly when patient-healthcare provider interactions take place without a physical presence. One key challenge identified in various studies is the absence of nonverbal cues such as facial expressions, eye contact, voice intonation, and body language, which are traditionally crucial for building empathy and trust in healthcare consultations (Coleman, 2020; Nguyen et al., 2024). In this context, key concepts such as online presence and medical presence have emerged, which refer to the ability of healthcare providers to effectively project a professional and emotional presence in digital spaces (Colucci et al., 2017).

The concept of therapeutic communication is also relevant in telemedicine practice. This communication strategy emphasizes the importance of using more empathetic language, clarifying messages, and warm verbal responses to compensate for the loss of visual affective expression (Coleman, 2020). In this context, communication serves not only as a means of conveying information but also as a means of building relationships and a sense of security for patients. The use of techniques such as teach-back, verbal mirroring, or verbal reassurance has been shown to help patients feel more understood and actively engaged in the consultation process (Nguyen et al., 2024).

Furthermore, the consultation experience in telemedicine is often perceived as narrower and more instructional than in-person consultations. Studies show that telemedicine consultations tend to focus on biomedical aspects, with less exploration of the patient's psychosocial or lifestyle issues (Liu et al., 2007; Agha et al., 2009). Furthermore, physicians tend to be more verbally dominant in telemedicine sessions, which can lead to decreased patient agency and participation in the decision-making process (Agha et al., 2009). Therefore, it is crucial for service providers to not only master technology but also equip themselves with adaptive and patient-centered digital communication skills.

The presence of these dimensions suggests that the success of telemedicine relies not only on the quality of technology or network speed but also on the ability of healthcare professionals to practice reflective, empathetic, and responsive communication in the virtual space. Specialized training related to communication in the context of telemedicine is an urgent need to ensure that online consultations maintain the relational quality that has long been the foundation of holistic health practice (Coleman, 2020; Colucci et al., 2017; Nguyen et al., 2024).

Communication Challenges in Telemedicine

Telemedicine faces several communication challenges stemming from the physical distance between the parties involved (Nguyen et al., 2024). A significant challenge is the loss or reduction of nonverbal cues, such as facial expressions, gestures, and body language, which are crucial for building rapport and mutual understanding (Coleman, 2020; Nguyen et al., 2024). This is particularly evident in telephone encounters, but can also be diminished in video calls, making it difficult to gauge patient understanding or detect unspoken concerns (Coleman, 2020). Consequently, building rapport and empathy can be more challenging in telemedicine settings compared to face-to-face interactions, with studies showing fewer empathetic utterances from physicians (Nguyen et al., 2024; Liu et al., 2007). The quality of audio and internet connections can also impact communication, leading to potential misunderstandings and the need for repetition to ensure clarity (Coleman, 2020). Explaining complex medical information poses another challenge, as visual aids such as images or physical demonstrations are limited or impossible during remote consultations (Nguyen et al., 2024; Coleman, 2020).

Furthermore, technological barriers and the digital divide significantly impact communication in telemedicine (Nguyen et al., 2024; Leite et al., 2020; Valencia-Arias et al., 2024). Lack of access to stable internet and necessary devices can create gaps in accessing care (Leite et al., 2020; Valencia-Arias et al., 2024), and individuals less familiar with technology, such as the elderly, may exhibit resistance to these technologies (Nguyen et al., 2024). Consultation flow and information gathering can also be affected, with some studies showing longer telemedicine consultations, while others indicate medical records may be less detailed (Liu et al., 2007; Nguyen et al., 2024). Telemedicine can also pose disadvantages for certain populations, including those with hearing impairments, visual impairments, or those for whom English (the language used in consultations) is a second language, if appropriate accommodations are not made (Coleman, 2020; Nguyen et al., 2024). Setting the agenda and effectively addressing all patient concerns may be more difficult without common nonverbal cues (Coleman, 2020; Nguyen et al., 2024).

Health literacy plays a critical role in telemedicine communication, as patients with low health literacy may struggle to understand medical terminology remotely without visual aids (Nguyen et al., 2024). The absence of a physical examination can also decrease patient confidence in the diagnosis (Ningsih et al., 2025). Furthermore, there is a lack of communication guidelines and specific training for healthcare professionals conducting telemedicine consultations, with many relying on trial and error. Building a connection and gathering initial information from new patients can also take longer than with remote communication (Nguyen et al., 2024). Ensuring patient understanding requires deliberate strategies such as teach-back, but the effectiveness of some methods is limited by digital literacy. There is also a reported risk that telemedicine consultations become more physician-centered, potentially compromising patient agency (Nguyen et al., 2024). Finally, technical difficulties with the internet, devices, and phone reception, as well as concerns about privacy and data protection, can hinder effective and open communication (Coleman, 2020; Leite et al., 2020; Valencia-Arias et al., 2024).

Integrating Telemedicine with Emerging Technologies

The integration of telemedicine with emerging technologies is becoming increasingly important to address various challenges in the healthcare sector. These challenges include shortages of specialized medical personnel, disparities in treatment outcomes, the need to balance the work-life demands of healthcare workers, and the growing demand for more efficient and sustainable care systems (Korai et al., 2023). Technological advances such as 5G networks, IoT, and secure communication protocols are further strengthening telemedicine platforms by addressing issues such as latency, data security, and high-quality multimedia transmission. These innovations have significantly expanded telemedicine applications and made telemedicine more effective for remote and emergency care.

One key focus is the development of ultra-low latency communication systems that leverage existing internet infrastructure, namely shared internet access (AIS), to promote the use of telemedicine. Korai et al. (2023) successfully implemented a low latency communication system based on AIS with an average latency of 27.5 ms using the TELEPRO® system for distance medical education between Sapporo and Tokyo. This system is designed to enable live video transmission without server routing to minimize latency. However, expanding bandwidth and ensuring communication stability are crucial for large-scale applications (Korai et al., 2023).

The Internet of Things (IoT) plays a crucial role in telemedicine, enabling remote monitoring and surveillance of patient health conditions through various sensors and wearable devices (Joshi et al., 2022). Patients have the ability to interact with medical equipment at any time and from any location. These devices are equipped with sensors that can detect and record patient medical data such as heart rate, blood pressure, and body temperature (Joshi et al., 2022). Energy-efficient and secure technologies are being developed for IoT-based telemedicine, incorporating technologies such as Multi-Authority Ciphertext-Policy Attributes-Based Encryption (MA-CPABE) and Advanced Encryption Standard (AES) to ensure secure communication and protect patient privacy. To increase the lifespan of wireless sensor networks (WSNs) used in IoT telemedicine, the Johnson algorithm has been proposed to minimize energy consumption. Gateway devices such as smartphones, tablets, PCs, and IoT

hub systems are increasingly facilitating the efficient collection and transmission of patient data (Joshi et al., 2022).

The emergence of 5G communication systems, offering high capacity, ultra-fast speeds, and low latency, creates new opportunities for transforming telemedicine (Saeki et al., 2022). A demonstration experiment using mobile ultrasound and telerehabilitation in a remote mountainous area revealed that 5G enabled the transmission of multiple high-definition images with significantly lower latency compared to LTE (Saeki et al., 2022). This enhancement improved video quality, reduced delays, and positively impacted evaluations by physicians and physical therapists (Saeki et al., 2022). Additional technologies, such as mobile echo probes, a remote interview system (NIPRO HeartLine™), markerless motion capture (Simi Motion 2D/3D®), and IoT insole devices, were also integrated into the demonstration (Saeki et al., 2022).

Data security and patient privacy are top priorities in integrating telemedicine with emerging technologies (Lin, 2022). Several secure communication schemes for 5G-IoT telemedicine systems, including integration with Emergency Medical Services (EMS), have been proposed (Lin, 2022). These schemes utilize key protection to mitigate the risk of confidentiality leaks on wearable devices and lightweight cryptographic security solutions such as Chebyshev chaotic maps (Lin, 2022). These proposed systems facilitate secure communication between patients, smart devices, and medical institution servers over 5G, ensuring authentication and secure key session generation (Lin, 2022).

Thus, the integration of telemedicine with advanced technologies such as low-latency communication systems, 5G, and IoT has tremendous potential to improve access, efficiency, and quality of healthcare services, particularly in remote areas and areas with aging populations (Saeki et al., 2022). These technologies also play a crucial role in standardizing surgical procedures and promoting minimally invasive surgery (MIS) globally (Korai et al., 2023). Furthermore, telemedicine can address the shortage of specialist physicians and reduce disparities in treatment outcomes (Saeki et al., 2022). However, challenges such as scalability, security, privacy, regulatory constraints, and implementation costs must be overcome to achieve wider adoption (Lin, 2022). Piette et al. (2010), in their study in Honduras, emphasized how widespread access to mobile technology and patient willingness to engage with automated telemedicine systems can create opportunities to improve chronic disease management in developing countries.

Comparison of Patient-Doctor Interactions

The advent of telemedicine has transformed the way healthcare providers interact with patients. This presents unique challenges and opportunities compared to traditional face-to-face consultations. Understanding these dynamics is crucial to maximizing virtual service delivery and ensuring that patient outcomes are not compromised. A review of several comparative studies revealed key differences in communication styles, consultation duration, and expressions of empathy, highlighting some advantages and potential disadvantages of telemedicine.

In terms of consultation duration and structure, Liu et al. (2007) found that telemedicine consultations were significantly shorter. A typical telemedicine consultation lasted an average of 13.6 minutes compared to 20.6 minutes for a face-to-face consultation. Liu et al. (2007)

observed that during telemedicine sessions, physicians spoke less and engaged in fewer conversational exchanges. Contrary to Liu et al. (2007), Agha et al. (2009) reported no significant difference in consultation duration. Telemedicine consultations lasted 22.2 minutes compared to 21.9 minutes for face-to-face consultations. However, Agha et al. (2009) noted that physicians dominated the conversation during telemedicine sessions, with a verbal dominance ratio of 1.45 compared to 1.13 for face-to-face consultations.

Regarding verbal communication, Liu et al. (2007) found no significant difference in the number of open-ended and closed-ended questions asked by physicians across the two consultation modes. However, expressions of empathy, praise, and accompaniment were less frequent during telemedicine sessions. Patients also tended to provide shorter responses in telemedicine consultations. Similarly, Agha et al. (2009) noted that patients more frequently requested repetitions in telemedicine consultations. This indicates a perception challenge. Liu et al. (2007) also found that the number of requests for repetitions was significantly higher in telemedicine. While telemedicine sessions focused more on biomedical-based counseling, face-to-face consultations focused more on psychosocial and lifestyle issues. Agha et al. (2009) also found that unclear speech in physician dialogue was more common during face-to-face consultations. In addition to verbal communication, nonverbal forms of communication should also be examined. The absence of face-to-face interaction in telemedicine can limit physicians' affective behaviors, such as empathy and praise (Liu et al., 2007). This lack of physical proximity can reduce nonverbal expressions of empathy or emotion on the part of physicians. Physician emotion plays a crucial role in building trust in the patient relationship, and patient trust is strongly associated with better treatment outcomes. However, these behaviors were less frequently observed during telemedicine consultations, suggesting that the telemedicine system itself may hinder these interactions. During telemedicine interactions, physicians typically must continuously focus on the screen to observe the patient, even while recording medical information, for fear of missing important cues if they look away. This contrasts with face-to-face consultations, where physicians have more flexibility in focusing on the patient (Liu et al., 2007). However, Agha et al. (2009) found no significant difference in overall emotional impact between the two types of consultations, either face-to-face or telemedicine. In the context of stroke care in an ambulance, Joseph et al. (2021) demonstrated nonverbal communication during telemedicine, particularly involving face-to-face interactions within the ambulance between the patient and paramedics. Joseph et al. (2021) noted a lack of use of on-screen indicators or gestures for nonverbal communication between the separately located teams.

In terms of patient and physician satisfaction, patients generally report high satisfaction with telemedicine consultations, with rates ranging from 70% to 90% (Liu et al., 2007). This satisfaction is attributed to effective communication experiences, minimal barriers, and no significant differences compared to face-to-face consultations. Unlike patients, physicians are dissatisfied with telemedicine consultations and feel hampered by communication barriers. Only 40% of physicians feel they can communicate effectively, and 45% believe they understand what their patients are thinking (Liu et al., 2007). Physicians perceive poor communication, difficulty understanding patients' thoughts, and excessive time spent on small talk. Agha et al. (2009) suggest that high patient satisfaction may reflect lower expectations or an appreciation for the convenience of telemedicine. Paige et al. (2021) found that levels of satisfaction with patient-centeredness in telemedicine varied by patient condition. Paige et al.

(2021) found that patients with moderate to high levels of psychological distress reported lower satisfaction across all satisfaction domains. Current smokers also reported lower levels of satisfaction. Individuals at high risk for COPD were uniquely associated with lower satisfaction with how providers expressed empathy remotely. Conversely, patients with low risk for COPD and low levels of psychological distress reported higher satisfaction.

Telemedicine communication tends to be more task-oriented and educational in nature because it contains fewer affective and social cues than face-to-face consultations. While patients often appreciate the convenience of telemedicine, physicians may face challenges in building rapport and gaining a deeper understanding of the patient's condition due to communication limitations (Liu et al., 2007). Liu et al. (2007) also emphasized the importance of training programs that emphasize techniques such as using exaggerated nods, expressive body language, and clear, empathetic speech to promote better patient engagement and improve conversational flow.

Use of Telemedicine in Specialized Fields

Telemedicine has proven its worth in various medical fields, enabling remote consultations between healthcare professionals and patients (Choi et al., 2022). In acute stroke care, telemedicine allows neurologists to communicate with patients and paramedics in ambulances, allowing interventions to be initiated before the patient arrives at the hospital. Studies show that verbal communication dominates team interactions in these situations, with neurologists, paramedics, and patients playing almost equal roles in the communication process.

Telemedicine is increasingly proving to be a vital tool in various medical fields. In the healthcare world, this technology not only bridges distances but also opens up broader, faster, and more personal communication between doctors and patients (Choi et al., 2022). Each medical field uses it in different ways, but one thing remains constant: communication is always at the heart of its successful implementation.

In the case of liver cancer patients, the medical team used telemedicine to directly convey the results of Multidisciplinary Tumor Board (MTB) discussions to the patients. They not only explain treatment recommendations but also assist patients in making important decisions (Choi et al., 2022). Patients feel comfortable discussing matters via video call because they can see the doctor's facial expressions and involve their families in the process. Conversely, they resist receiving information solely via electronic messages without the personal touch. Meanwhile, in prenatal care, doctors and midwives rely on telemedicine to monitor the condition of pregnant women in real time (Heřman et al., 2022). Doctors and midwives can respond immediately to any concerning symptoms, and patients feel reassured by staying connected. Conversations can take place via text, phone, or secure, encrypted video calls.

Turning to pediatric trauma care, Mokhaberi et al. (2024) noted that telemedicine successfully strengthened communication between outpatient and inpatient physicians. Doctors felt more prepared to collaborate when flexible communication systems such as video calls, PACS for sharing medical images, and messaging apps were available. Mokhaberi et al. (2024) also found that physicians with prior experience using telemedicine tended to be more enthusiastic about this technology as a tool for cross-sector collaboration. In emergency situations such as stroke care in an ambulance, Joseph et al. (2021) found that verbal

communication was the most dominant element. They noted that neurologists often initiated conversations, but paramedics often served as the primary liaison between patients and physicians due to visual limitations in video systems. This study emphasized the need for telemedicine interface systems that better support nonverbal communication to ensure a more complete information transmission, especially in the distracting environment of an ambulance. In this case, system design and audio-video quality are crucial to supporting effective communication in emergency situations (Joseph et al., 2021).

Rapid technological advances can also assist medical teams in remote mountainous areas by utilizing 5G networks to conduct telerehabilitation and ultrasound examinations. In a remote mountainous area, Saeki et al. (2022) demonstrated the use of telemedicine for telerehabilitation and ultrasound using a 5G network. They noted that the quality of visual communication is highly dependent on network strength. Low-latency video helps therapists and doctors provide real-time and accurate directions, while poor video quality can potentially compromise the quality of diagnoses and medical decisions. Meanwhile, in the context of health education, Kanmodi et al. (2025) showed that Cambodians showed high interest in an "mHealth" application for oral cancer education, although most had not yet actively used it. This study emphasizes the importance of engaging and easy-to-understand communication design to increase the effectiveness of health education through digital applications.

Comparatively, all these studies emphasize that the success of telemedicine depends not only on the technology itself but also on how people use it to communicate, whether conveying sensitive information, assisting patients in decision-making, or ensuring the smooth running of therapy. This all comes back to our ability to build empathetic, honest, and responsive relationships. Ultimately, technology is just a tool, and it's humans who make it meaningful.

Innovation in Telemedicine Platforms

Innovation in telemedicine platforms refers to various efforts to update and develop new ways of utilizing technology to deliver healthcare services remotely. The goal is to improve the quality of communication between patients and healthcare providers, as well as between healthcare providers themselves, in a more efficient, secure, and accessible way (Rozario, 2018). Innovation in telemedicine platforms continues to evolve to address real-world needs: how to connect patients and healthcare providers more quickly, securely, and humanely, even when separated by distance (Zhang et al., 2024). Each medical field is trying to address this challenge with its own approach, resulting in various breakthroughs based not only on technology but also on empathy and efficiency.

In the hospital sector, healthcare providers are beginning to utilize encrypted instant messaging technology to expedite clinical communication. For example, Oakville Trafalgar Memorial Hospital in Canada uses the Signal app as a replacement for conventional pagers. Through this platform, surgeons, anesthesiologists, and nurses can resolve operational issues in real time, from confirming patient status to discussing urgent medical decisions (Rozario, 2018). The use of this application not only increases efficiency but also ensures the security of patient data through encryption. In addition to clinical communication, the hospital also implements web-based surveys such as SurveyMonkey to obtain feedback from medical personnel on the effectiveness of communication within the surgical program. The information gathered from these surveys allows hospital management to continuously improve its internal

communication system (Rozario, 2018). This strategy demonstrates that telemedicine innovation is not only technical but also prioritizes the participation of healthcare personnel in the process of evaluating and improving services.

Information dissemination is also a key focus in telemedicine innovation. Oakville Trafalgar Memorial Hospital regularly publishes a monthly newsletter and develops a surgical department website as a means of sharing important information, as well as introducing various new initiatives, including telemedicine services. This approach builds stronger internal engagement and expands the reach of institutional communication (Rozario, 2018). From a patient perspective, consultations via encrypted video calls have opened up new opportunities for accessing services. Through the Ontario Telemedicine Network (OTN), patients can undergo routine check-ups, discuss laboratory results, and even examine post-operative wounds without having to visit the hospital in person. In addition to increasing patient comfort, video consultations also provide physicians with the opportunity to read patients' facial expressions and body language, a feature generally unattainable through traditional telephone conversations (Rozario, 2018).

In the context of developing countries, affordable and accessible solutions are a top priority. Panayides et al. (2013) developed an open-source telemedicine platform that uses WLAN and HSPA (3.5G) networks to wirelessly transmit diagnostic-quality medical video. This platform is designed to be compatible with open source software such as the x264 codec and VLC player, making it more affordable and flexible for use in remote areas, emergency situations, and medical education. This innovation directly addresses the challenges of limited digital infrastructure in various regions. Zhang et al. (2024) designed a smartglass-based telemedicine application for use by Emergency Medical Services (EMS) personnel. This application allows personnel to connect directly with doctors via video call, transmit patient data through the app, and receive medical instructions in real time, even while en route to the hospital. The embedded touchless interaction feature enhances the personnel's ability to remain focused on patient care while also improving hospital readiness to receive patients with specific conditions.

Meanwhile, on a national scale, telemedicine is also beginning to be implemented as a solution to address disparities in access to healthcare. A pilot project in Ethiopia reported by Shiferaw and Zolfo (2012) demonstrated that, despite infrastructure limitations and technical challenges, the project successfully reached remote communities with a locally tailored approach. One innovation is the development of Telemed-ETH software, designed with the region's internet network capabilities and ease of use in mind for local medical personnel. In addition to technology, the project's success was also influenced by ongoing training and the involvement of local stakeholders (Shiferaw & Zolfo, 2012). In their study, Guo et al. (2019) emphasized the importance of cultural context in telemedicine implementation. They demonstrated that the adoption of telehealth technology is more effective when the system is adapted to local languages, community customs, and familiar communication methods for patients. This finding underscores the importance of a culturally sensitive approach in developing digital healthcare systems.

Overall, the comparison of various telemedicine applications above illustrates that technology is not the sole answer to improving healthcare services. The success of telemedicine implementation depends on the health system's ability to adapt contextually, addressing

cultural issues, resources, and actual needs on the ground. In this process, telemedicine becomes not merely a technical tool but also a catalyst for transformation toward more inclusive, efficient, and humane healthcare.

CONCLUSION

Telemedicine has become an essential component of healthcare, driven by advances in communication technology that enhance access, reduce costs, and improve treatment outcomes, especially for patients with limited mobility or in remote areas. The COVID-19 pandemic accelerated its adoption, positioning telemedicine as a long-term solution for transforming national healthcare systems. Despite challenges like nonverbal communication barriers, unstable connections, and trust issues due to the lack of physical examinations, emerging technologies such as 5G, IoT devices, and data security offer promising solutions. In Indonesia, telemedicine has been successfully applied across various medical fields—including stroke management, oncology, pregnancy monitoring, and pediatric trauma—through flexible and innovative approaches like encrypted apps, open-source platforms, and smart glasses. However, its success depends not only on technological advances but also on robust communication systems that enable empathetic, culturally sensitive interactions. Future research should explore strategies to enhance therapeutic communication and socio-cultural adaptation within telemedicine to ensure its equitable and sustainable integration in diverse healthcare settings.

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