Exploring Knowledge, Attitudes, and Perceptions of Young Pharmacists on Telepharmacy Implementation – A Mini Review

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Abstract: *Telepharmacy, a critical subset of telemedicine, has gained prominence as a transformative innovation addressing challenges in pharmaceutical care by enabling the remote delivery of services, including medication dispensing, patient counseling, and therapeutic monitoring. This narrative review investigates the state of telepharmacy in Indonesia, with a focus on the knowledge, attitudes, and perceptions of young pharmacists in the Special Region of Yogyakarta. The findings reveal significant knowledge gaps concerning telepharmacy tools and regulatory frameworks, which adversely influence pharmacists' attitudes and perceptions. Although young pharmacists demonstrate higher technological proficiency and generally positive attitudes toward telepharmacy, hesitancy persists due to insufficient training opportunities and ambiguities in existing regulations. Telepharmacy offers substantial opportunities to bridge geographical barriers and enhance healthcare access, particularly in underserved and rural regions. However, its implementation is hindered by critical barriers, including regulatory gaps, inadequate technical infrastructure, and limited awareness among stakeholders. Drawing on successful telepharmacy models from the United States, Canada, and Australia, this review underscores the need for targeted educational initiatives, robust infrastructural investments, and regulatory reform to support telepharmacy adoption. Addressing these challenges will position telepharmacy as a vital tool in transforming Indonesia's healthcare system, fostering equitable access, and advancing pharmaceutical care nationwide.*

INTRODUCTION

The evolution of technology has significantly transformed the healthcare sector, introducing innovative solutions to address longstanding challenges in service delivery and patient care. Technological advancements such as telemedicine, electronic health records (EHRs), artificial intelligence, and machine learning have redefined the dynamics of healthcare delivery, improving efficiency and patient outcomes (Ameri et al., 2020; Baldoni et al., 2019; Ghozali, 2024b). Among these modern innovations, telepharmacy has emerged as a subset of telemedicine, utilizing telecommunications and digital tools to bridge gaps in pharmaceutical care. This technological shift has gained prominence as healthcare systems worldwide face increasing demands for cost-effective, scalable, and accessible services. During global crises such as the COVID-19 pandemic, telepharmacy proved indispensable by enabling remote access to critical pharmaceutical services, ensuring continuity of care while mitigating the risks associated with in-person consultations (Baldoni et al., 2019). Thereby, telepharmacy exemplifies how technology can complement traditional healthcare systems and improve the reach and quality of pharmaceutical care (Ahmad et al., 2021).

Indonesia, as an archipelagic nation comprising over 17,000 islands, faces unique challenges in achieving equitable healthcare distribution. Healthcare access in rural and remote areas is notably limited due to geographical barriers, infrastructural constraints, and an unequal distribution of medical professionals. Data from the Ministry of Health (2020) indicate that approximately 15% of community health centers lack physicians, and a similar shortfall exists in the availability of pharmacists (Hermansyah et al., 2020; Marcus et al., 2024). All the disparities exacerbate healthcare inequities, leaving vulnerable populations with limited access to essential health services, including pharmaceutical care. Furthermore, rural communities often face additional barriers, such as limited health education and insufficient infrastructure to support modern healthcare delivery. Telepharmacy presents a viable solution to such challenges by allowing pharmacists to provide remote consultations, medication management, and patient education, therefore addressing workforce shortages and bridging the gap in service provision (Saeed et al., 2024). The integration of telepharmacy method into Indonesia's healthcare system could enhance healthcare accessibility, particularly in underserved and geographically isolated regions (Ghozali, Mohany, et al., 2023; Kusuma et al., 2024).

In Indonesia, telepharmacy still remains in its nascent stages, with limited implementation primarily due to regulatory gaps, infrastructural challenges, and insufficient awareness among healthcare professionals. Despite its potential, the successful adoption of telepharmacy depends on the readiness of pharmacists to embrace this innovative practice. Pharmacists play a pivotal role in ensuring medication safety, optimizing therapeutic outcomes, and educating patients, making their engagement critical to the success of telepharmacy approach initiatives (White et al., 2022). Young pharmacists, in particular, represent a critical demographic for telepharmacy adoption, given their higher levels of technological proficiency and adaptability. However, knowledge gaps, varying attitudes, and differing perceptions toward telepharmacy among young pharmacists could pose barriers to its implementation (Ahmed et al., 2023; Alsultan et al., 2024). This narrative review aims to critically examine the existing knowledge, attitudes, and perceptions of young pharmacists in Indonesia, with a particular focus on the Special Region of Yogyakarta, to elucidate the factors that enable or hinder the adoption of telepharmacy. By synthesizing all the current evidence and identifying key gaps, this review seeks to offer actionable insights and recommendations for the effective integration of telepharmacy into Indonesia's healthcare system, thereby enhancing access to pharmaceutical care and promoting

equitable health outcomes.

REVIEW OF LITERATURE

1. Conceptual Foundations

Definition and Scope of Telepharmacy

Telepharmacy is a subset of telemedicine that involves the provision of pharmaceutical care using telecommunications technology, enabling pharmacists to deliver services such as medication dispensing, patient counseling, therapeutic monitoring, and drug information remotely. Globally, telepharmacy is recognized as an essential tool for overcoming barriers in healthcare access, particularly in rural and underserved regions. For instance, in the United States, telepharmacy has been widely implemented to support remote consultations and medication management in areas with a limited number of healthcare professionals. Similarly, Australia has employed telepharmacy to conduct medication reviews and ensure continuity of pharmaceutical care in isolated communities (Allan et al., 2021; Poudel & Nissen, 2016). In Indonesia, telepharmacy is still in its developmental stages but holds significant potential for bridging gaps in healthcare access caused by the country's archipelagic geography. Local applications primarily focus on electronic prescriptions and medication delivery, although broader integration remains constrained by regulatory and infrastructural challenges (Fuad et al., 2023).

Benefits of Telepharmacy

Telepharmacy offers numerous benefits, including improved patient access to pharmaceutical care, particularly in geographically isolated regions. By enabling remote consultations, it reduces the need for physical travel, saving time and resources for patients and healthcare providers. Additionally, telepharmacy has been shown to decrease medication errors by allowing pharmacists to verify prescriptions and counsel patients virtually (West & Szeinbach, 2002). Another critical advantage is addressing the shortage of pharmacists in underserved areas by providing access to their expertise remotely. Studies from countries such as Canada and the United States demonstrate that telepharmacy enhance healthcare outcomes by ensuring medication adherence and reducing adverse drug events (Shafiee Hanjani et al., 2020; Vo & Gustafson, 2023). These benefits are increasingly relevant in Indonesia, where disparities in healthcare access persist.

Barriers of Telepharmacy

Despite its advantages, telepharmacy faces several barriers to implementation. Technical challenges, such as inadequate internet infrastructure and limited access to advanced telecommunications equipment, are particularly pronounced in rural areas. Regulatory gaps further hinder adoption; in Indonesia, while some guidelines exist, they are insufficient to address the complexities of telepharmacy services (Almeman, 2024). Additionally, knowledge gaps among healthcare professionals regarding telepharmacy operations and ethical concerns about patient confidentiality and data security further complicate its integration into routine practice (Alhmoud et al., 2022). Addressing these barriers is essential to fully realize the potential of telepharmacy in improving healthcare access and quality (Blackstock & Roberts, 2021).

Regulatory Landscape in Indonesia

The regulatory framework for telepharmacy technologies in Indonesia includes Minister of Health Regulation (Permenkes – in Bahasa Indonesia) No. 20/2019, which governs telemedicine practices between healthcare facilities, and BPOM No. 8/2020, which regulates online supervision of medicines and food. Permenkes No. 20/2019 outlines telemedicine’s scope, including the exchange of diagnostic information, treatment plans, and patient education through

digital platforms. Meanwhile, BPOM No. 8/2020 stipulates guidelines for the online distribution of medications, requiring pharmacy practices to collaborate with the licensed e-pharmacy platforms (Kusumaningrum & Mulyani, 2023). However, these regulations lack specificity regarding telepharmacy operations, creating uncertainties for stakeholders. Clearer, more comprehensive regulations are needed to support the growth and safe implementation of telepharmacy services in Indonesia.

2. Knowledge

Definition of Knowledge in Healthcare

Knowledge in healthcare refers to the cognitive and practical understanding of medical concepts and procedures necessary for effective professional practice. It covers awareness, comprehension, and application, enabling healthcare providers to make informed decisions and deliver quality care (Reddy, 2024). In the context of telepharmacy, knowledge includes familiarity with digital tools, medication management systems, and remote communication technologies, all of which are essential for efficient service delivery.

Knowledge Indicators in Telepharmacy

Key indicators of pharmacists' knowledge in telepharmacy include their proficiency in using telecommunication platforms, understanding of medication management tools, and awareness of telepharmacy regulations. Familiarity with these systems ensures the accurate dispensing of medications, effective patient counseling, and compliance with legal standards. Studies indicate that pharmacists with higher knowledge levels are better equipped to leverage telepharmacy technologies, thereby improving patient outcomes (Al-Worafi, 2023). In Indonesia, such indicators are particularly relevant as the adoption of telepharmacy grows amid limited training resources.

Knowledge Gaps

Despite its importance, knowledge gaps remain a significant barrier to telepharmacy adoption. Many professional pharmacists lack formal training in telepharmacy practices, resulting in limited understanding and hesitancy toward its implementation. A recent study in Indonesia revealed that only a small proportion of pharmacists are familiar with telepharmacy systems, highlighting the need for targeted educational programs and workshops (Ghozali, 2024a). Bridging these gaps is critical to ensuring that pharmacists are adequately prepared to meet the demands of telepharmacy services.

3. Attitudes

The Role of Attitude in Professional Adoption

Attitudes significantly influence the adoption of new technologies in professional practice. Positive attitudes, characterized by openness to innovation and confidence in technology, facilitate the successful integration of telepharmacy. Conversely, negative attitudes, such as resistance to change and skepticism about technology's reliability, hinder its implementation (Juma, 2016). In telepharmacy, the willingness of pharmacists to embrace digital tools and adapt to new workflows is crucial for its success.

Dimensions of Attitude

Attitudes toward telepharmacy can be analyzed across several dimensions, including responsiveness, willingness to learn, and concerns about patient safety and job relevance. Responsiveness refers to the readiness to adopt telepharmacy as a solution to healthcare disparities, while willingness to learn highlights the importance of continuous professional development. Concerns about patient safety and the relevance of telepharmacy to traditional roles reflect the challenges pharmacists face in reconciling new practices with established norms

(Ghozali, 2023; Lee et al., 2023).

Factors Affecting Attitudes

Several factors shape pharmacists' attitudes toward telepharmacy, including prior training, exposure to successful telepharmacy models, and societal perceptions of digital healthcare. Training programs that demonstrate the benefits of telepharmacy and address potential challenges can significantly improve attitudes. Additionally, exposure to well-implemented telepharmacy systems builds confidence and reduces skepticism (Alfian et al., 2023). Societal acceptance of telepharmacy as a reliable healthcare model further influences professional attitudes, emphasizing the need for public awareness campaigns.

4. Perceptions

Cognitive Basis of Perception

Perception is a cognitive process through which individuals interpret and understand their environment based on prior knowledge and experiences. In the context of telepharmacy, perception influences how pharmacists evaluate its feasibility, benefits, and challenges. Positive perceptions often correlate with successful adoption, while negative perceptions may lead to resistance or delays in implementation (Jauza & Dari, 2023).

Young Pharmacists' Perceptions

Young pharmacists, as digital natives, generally perceive telepharmacy as a beneficial innovation that enhances accessibility and efficiency in pharmaceutical care. However, their perceptions are also influenced by concerns about workload, technological reliability, and regulatory clarity. Studies indicate that young pharmacists are more likely to embrace telepharmacy if they perceive it as aligned with their professional values and goals (Ghozali, Nugraheni, et al., 2023; Jarab et al., 2024). Addressing these perceptions is vital to fostering engagement and support for telepharmacy initiatives.

Perception Variations Across Demographics

Perceptions of telepharmacy vary significantly across demographics, including educational background, urban-rural divide, and access to technology. Pharmacists with higher education levels and exposure to advanced technologies tend to have more favorable perceptions of telepharmacy. Conversely, those in rural areas with limited technological infrastructure may view telepharmacy as impractical or challenging to implement (Lampickienė & Davoody, 2022). Understanding these variations is crucial for designing tailored interventions that address specific needs and concerns.

METHODOLOGY

1. Data Sources

This review employed a comprehensive methodology to gather and analyze relevant data from global and national sources. Indonesian databases, including Neliti and Garuda, were utilized to access peer-reviewed journal articles focused on telepharmacy, pharmacists' readiness, and barriers to implementation. These national studies provided critical insights into the challenges and opportunities for telepharmacy adoption in Indonesia, particularly in rural and underserved areas. In addition to academic literature, regulatory documents were reviewed to understand the existing legal framework. These included Permenkes No. 20/2019, which governs telemedicine practices between healthcare facilities, and BPOM No. 8/2020, which outlines regulations for online supervision of medicines and food. The integration of these diverse data sources ensured a holistic understanding of telepharmacy, combining theoretical frameworks with practical insights. Table 1 represents the eligible (inclusion and exclusion) criteria of the study.

Table 1. Inclusion and Exclusion Criteria of the Study

Inclusion Criteria	Exclusion Criteria
Studies focused on pharmacists' readiness for telepharmacy adoption.	Studies outside the healthcare or pharmacy domains, and those focusing exclusively on regions outside Indonesia without offering generalizable insights.
Studies examining telepharmacy implementation in clinical, hospital, or community settings.	Articles addressing general telecommunication systems without relevance to pharmaceutical services.
Studies analyzing barriers to telepharmacy, such as infrastructural, regulatory, or educational challenges.	Non-pharmacy telemedicine applications (e.g., teleconsultations conducted by physicians).
Studies addressing the role of telepharmacy in improving healthcare access, particularly in underserved or rural areas.	Technology adoption studies unrelated to healthcare professionals or pharmacists.
Both qualitative and quantitative methodologies.	Studies lacking empirical evidence, such as opinion pieces or articles with limited methodological rigor.
Global studies providing comparative insights into telepharmacy adoption and challenges to inform Indonesia's initiatives.	Research published in non-peer-reviewed sources.

2. Synthesis Approach

A narrative synthesis approach was adopted to integrate the theoretical and empirical findings from the selected studies and regulatory documents. This approach facilitated the thematic analysis of diverse data sources, allowing for the synthesis of qualitative and quantitative insights into telepharmacy implementation. Theoretical frameworks on telepharmacy were integrated with empirical evidence related to pharmacists' readiness, barriers to implementation, and operational challenges. Comparative analyses of global best practices were juxtaposed with findings from Indonesia to identify contextual enablers and obstacles to telepharmacy adoption. The synthesis was organized around key thematic areas, including knowledge, attitudes, perceptions, and regulatory frameworks, ensuring a structured and cohesive narrative. This approach not only highlighted the current state of telepharmacy in Indonesia but also offered actionable recommendations for its successful integration into the national healthcare system. By synthesizing a wide array of data sources, this mini narrative review provides a comprehensive understanding of telepharmacy's potential and challenges in the Indonesian context.

RESULTS AND DISCUSSION

The findings of this narrative review, as shown in Table 2, reveal critical insights into the state of telepharmacy in Indonesia and its implications within a global healthcare context. Central

to the analysis are the interconnected variables of knowledge, attitudes, and perceptions, which collectively shape pharmacists' readiness to adopt telepharmacy. Knowledge serves as the cornerstone, providing pharmacists with the foundational understanding of telepharmacy tools, operations, and regulatory frameworks. However, significant knowledge gaps were identified, particularly in the use of electronic prescription platforms and remote counseling systems, which stem from limited exposure to telepharmacy training and the absence of comprehensive educational programs in Indonesia. These deficits directly influence pharmacists' attitudes, as a lack of knowledge often fosters skepticism and resistance toward telepharmacy adoption. Conversely, pharmacists with greater familiarity and training tend to exhibit more positive attitudes, recognizing telepharmacy's potential to enhance healthcare access and efficiency. Perceptions, shaped by individual experiences, societal norms, and professional environments, further mediate attitudes by influencing how pharmacists evaluate the feasibility and value of telepharmacy within their practice. Addressing all these interconnected factors through targeted interventions is critical to fostering readiness and advancing telepharmacy adoption in Indonesia.

Table 2. A Summary of Selected Studies (n=3)

Author	Findings	Differences
(Fernanda, 2022)	The study found respondents' knowledge levels on telepharmacy as High (71%), Moderate (22.1%), and Low (6.9%). Perceptions of telepharmacy implementation were "Strongly Agree," with an achievement rate of 85.11%.	The study examined only two variables (knowledge and perception), whereas the author's research includes three variables: knowledge, attitudes, and perceptions. Additionally, the respondents were general pharmacists, while the author focuses on young pharmacists.
(Ameri et al., 2020)	The study prioritized discussion between doctor-pharmacist, pharmacist-hospital ward, and pharmacist-pharmacist relationships. Barriers included payment issues and lack of access to IT infrastructure. Benefits included efficient education on drug use, interactions, and side effects.	This study focuses on priorities for two-way discussions, while the author's research explores young pharmacists' broader perspectives on telepharmacy implementation.

(Ibrahim et al., 2023)	The study showed that remote pharmacy services improved patient access, especially for suspected or confirmed COVID-19 cases, and reduced medication dispensing errors.	The objectives are fundamentally different. This study is analytical and comparative, while the author's research is descriptive. These differences in objectives and methods make this study distinct from the author's work.

Telepharmacy offers significant strengths and opportunities for transforming healthcare delivery, particularly in addressing disparities in access to pharmaceutical care. By providing remote services, telepharmacy mitigates geographical barriers and ensures that underserved populations can access essential healthcare services. Training programs tailored to telepharmacy practices represent a key opportunity for building pharmacists' knowledge and confidence. For example, workshops and online courses focusing on telepharmacy technologies and patient engagement can equip pharmacists with the skills necessary to navigate this digital model effectively. Moreover, advancements in telecommunications infrastructure, including reliable internet connectivity and user-friendly telepharmacy platforms, will further facilitate implementation. Regulatory enhancements are also crucial; although existing frameworks, such as Permenkes No. 20/2019 and BPOM No. 8/2020, provide a foundational structure, they lack specificity on operational and ethical dimensions. Revising these regulations to include detailed guidelines on telepharmacy practices will bolster stakeholder trust, ensure patient safety, and promote standardization across the healthcare system.

Despite its potential, telepharmacy faces several barriers that must be addressed to achieve widespread implementation in Indonesia. Regulatory gaps remain a significant challenge, with current policies offering limited clarity on the ethical and operational aspects of telepharmacy, thereby creating uncertainty among practitioners and stakeholders. In addition, technical infrastructure limitations, particularly in rural areas, pose a significant obstacle. Inadequate internet connectivity and limited access to advanced telecommunication tools hinder the reliability and scalability of telepharmacy services. A lack of awareness among professional healthcare providers, policymakers, and patients further exacerbates resistance to telepharmacy, as many remain uninformed about its benefits and practical applications. Overcoming these barriers requires a multifaceted approach, including substantial investments in telecommunications infrastructure, the development of enforceable and detailed regulatory policies, and educational campaigns to increase stakeholder awareness and engagement.

However, several barriers must be addressed to fully realize telepharmacy's potential in Indonesia. Technical infrastructure limitations, particularly in rural areas, remain a significant challenge. Inadequate internet connectivity and limited access to advanced telecommunication tools hinder the reliable delivery of telepharmacy services (Alonazi et al., 2024; Jauza & Ghozali, 2024). Regulatory ambiguity further complicates implementation, as stakeholders are often uncertain about the legal and ethical implications of telepharmacy practices. Additionally, a lack of awareness among healthcare providers and policymakers about telepharmacy's benefits exacerbates resistance and underutilization. Multi-faceted strategies are necessary to overcome these barriers, including investments in infrastructure, targeted stakeholder education campaigns, and the development of enforceable regulatory policies.

Lessons from countries with established telepharmacy systems offer valuable insights into

overcoming these barriers. For example, the United States has leveraged telepharmacy to address pharmacist shortages in rural areas through centralized prescription verification and video consultations, improving medication adherence and reducing dispensing errors (Nwachuya et al., 2023). Canada's success with telepharmacy highlights the importance of government support, robust infrastructure, and community engagement in facilitating adoption (Carandang et al., 2024). Similarly, Australia has successfully integrated technologies of telepharmacy into their rural healthcare systems, emphasizing the role of tailored training and localized implementation strategies (Martini et al., 2024). These global practices underscore the importance of a coordinated method that combines regulatory clarity, technological advancements, and community involvement.

CONCLUSION

This narrative review shows that knowledge, attitudes, and perceptions are interdependent variables that shape pharmacists' readiness for telepharmacy. While telepharmacy presents significant opportunities to improve healthcare access, its adoption in Indonesia faces challenges, including regulatory gaps, technical infrastructure limitations, and stakeholder hesitancy. Drawing from global experiences, Indonesia can adopt a tailored approach that addresses these barriers and leverages telepharmacy as a transformative tool in its healthcare system, ultimately enhancing access to pharmaceutical care and promoting equitable health outcomes.

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