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KNOWLEDGE AND PERCEPTIONS OF PHARMACY STUDENTS TOWARD TELEPHARMACY SERVICES IN SOUTH KALIMANTAN, INDONESIA

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ABSTRACT

Background: Telepharmacy offers a promising solution to improve access to pharmaceutical care in remote regions such as South Kalimantan, Indonesia. However, research on pharmacy students' knowledge and perceptions of telepharmacy remains limited, even though their perspectives are crucial for the digital transformation of pharmaceutical services. **Objective:** This study aimed to assess pharmacy students' knowledge and perceptions of telepharmacy in South Kalimantan and to identify associated factors. **Methods:** A cross-sectional online survey was conducted among 453 pharmacy students from six universities in South Kalimantan (October–December 2024) using a validated 40-item questionnaire. Knowledge and perception scores were categorized by sample medians, and non-parametric statistical analyses were performed using SPSS version 27. **Results:** Overall, 58.7% of participants had high telepharmacy knowledge, indicating a moderate regional knowledge level, and 54.3% reported positive perceptions. Knowledge was significantly associated with academic year ($p < 0.001$), parental education ($p = 0.014$), and university type ($p < 0.001$), while perceptions were influenced by age ($p < 0.001$), academic year ($p < 0.001$), parental education ($p = 0.009$), and healthcare work experience ($p = 0.027$). No significant correlation was observed between knowledge and perception scores ($\rho = 0.089$, $p = 0.058$). **Conclusion:** Pharmacy students in South Kalimantan exhibited moderate knowledge and generally positive perceptions of telepharmacy, but these domains were not significantly correlated. The findings underscore the importance of standardized telepharmacy education, integration of practical training, and stronger emphasis on regulatory and data-security aspects to strengthen readiness for digital healthcare transformation.

Keywords: Knowledge; Perception; Pharmacy student; Telepharmacy

INTRODUCTION

Equitable access to healthcare remains a global challenge, particularly in remote and underserved regions[1]. In Indonesia, geographical barriers and limited healthcare infrastructure further restrict the availability of health services[2]. The rapid development of information and communication technology (ICT) has opened opportunities for innovative healthcare delivery systems, including telemedicine and telepharmacy. Telepharmacy refers to the provision of

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pharmaceutical care remotely through digital platforms, enabling pharmacists to deliver services such as counseling, drug information, and therapy monitoring without requiring face-to-face interaction[3].

Evidence shows that telepharmacy can expand access to pharmacy services, reduce medication errors, and improve service efficiency, especially in regions with pharmacist shortages[4]. However, successful implementation depends not only on technological infrastructure but also on the readiness of human resources, including future pharmacists [5, 6]. Pharmacy students, who are increasingly exposed to digital environments, represent a crucial group in supporting the digital transformation of pharmaceutical care [7]. Their knowledge and perceptions will shape the extent to which telepharmacy can be effectively adopted in the coming years[8].

Previous research has primarily examined practicing pharmacists' knowledge and readiness for telepharmacy [9–11], while studies involving pharmacy students remain limited. In Indonesia, existing studies have mostly focused on students in major cities, leaving gaps in understanding how those in geographically disadvantaged regions perceive telepharmacy. Addressing this gap is important, as disparities in digital literacy, infrastructure, and curriculum exposure may influence students' preparedness to embrace telepharmacy services.

South Kalimantan provides a relevant setting for this research due to its vast geographical area, uneven population distribution, and ongoing digital development. At the same time, the presence of multiple pharmacy schools offers a valuable opportunity to explore pharmacy students' perspectives as a proxy for future workforce readiness.

Therefore, this study aims to assess the knowledge and perceptions of pharmacy students in South Kalimantan toward telepharmacy services. The findings are expected to provide insights into educational needs and inform curriculum development to better prepare future pharmacists for digital healthcare transformation.

METHODS

1. Study Design, Setting, and Population

An online-based cross-sectional survey was carried out between October 19th and December 20th, 2024. This study was conducted and reported in accordance with the STROBE guidelines for cross-sectional studies and involved six universities located in South Kalimantan, Indonesia: Universitas Lambung Mangkurat, Universitas Borneo Lestari, Universitas Muhammadiyah Banjarmasin, Universitas Sari Mulia, Universitas Islam Kalimantan, and STIKES ISFI Banjarmasin. Pharmacy students who were actively enrolled in either the Bachelor of Pharmacy or Pharmacist Professional Program, aged 17–30 years, with internet access, and who provided informed consent, were eligible to participate in the survey. These six universities were selected because they offer pharmacy education programs and have a sufficient number of pharmacy students.

2. Study Tool, Sampling, and Sample Size

This questionnaire was developed through a comprehensive literature review, adapting knowledge items from a validated instrument[12] and perception items from another study[5]. Content validity assessment by four experts achieved I-CVI scores of 1.00 for both sections. Pilot testing with thirty pharmacy students (excluded from the final sample) demonstrated good reliability: Cronbach's alpha 0.779 (knowledge) and 0.944 (perception). The 40-item questionnaire comprised three sections:

demographics (12 items covering standard characteristics and digital health experience, healthcare exposure, and service recommendations), knowledge (15 dichotomous items on telepharmacy concepts), and perceptions (13 items using five-point Likert scales). Knowledge scores were dichotomized using the sample median as a cutoff (high ≥13, low <13), since the data were not normally distributed. Perception scores were classified as positive (≥46) or negative (<46) based on the sample median. The minimum required sample size was estimated at approximately 357 students based on Slovin's formula (population=3,250; 95% confidence level; 5% margin of error). A total of 453 valid responses were obtained through convenience sampling using an online survey (Google Forms).

3. Ethical Considerations

This study was approved by the Ethics Committee of Universitas Muhammadiyah Banjarmasin (Approval No. 521/UMB/KE/2024).

4. Statistical Analysis

Descriptive statistics (frequency, mean, and standard deviation) were used to present knowledge and perception data. The Kolmogorov-Smirnov test indicated non-normal distribution, so non-parametric tests were applied: Kruskal-Wallis test for multi-category variables, Mann-Whitney U test for two-category variables, and Spearman's correlation for knowledge-perception relationships. All analyses were conducted using SPSS for Windows version 27, with a p-value of <0.05 considered statistically significant.

RESULTS

1. Sociodemographic Characteristics of Participants

A total of 453 students participated, predominantly female (84.3%) and aged 20-22 years (44.6%). Most were first-year students (26.0%), and 17.4% were in the professional program. Nearly all participants had internet access (97.6%), with 57.0% reporting prior use of digital health services and 58.7% having healthcare facility experience (Table 1).

Table 1. Sociodemographic Characteristics of Participants.

Variable	Frequency (%)
Age	
17-19 years	179 (39.5)
20-22 years	202 (44.6)
≥23 years	72 (15.9)
Gender	
Female	382 (84.3)
Male	71 (15.7)
Academic Year	
1 years	118 (26.0)
2 years	86 (19.0)
3 years	76 (16.8)
4 years	94 (20.8)
5 years (professional program)	79 (17.4)
University	
Universitas Borneo Lestari	133 (29.3)
Universitas Lambung Mangkurat	98 (21.6)
Universitas Muhammadiyah Banjarmasin	98 (21.6)
Universitas Sari Mulia	56 (12.3)
STIKES ISFI Banjarmasin	43 (9.5)
Universitas Islam Kalimantan	25 (5.7)
Parental Education Level	
Primary (Elementary, Junior High School)	88 (19.4)
Secondary (Senior High School)	196 (43.3)
Higher Education (Diploma, Bachelor's, Master's, PhD)	169 (37.3)
Work Experience in a Healthcare Facility	
Yes	266 (58.7)
No	187 (41.3)
Experience Using Digital Health Services	
Yes	258 (57.0)
No	195 (43.0)
Recommendation to Use Digital Health Services	
Ever Recommended	320 (70.6)

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Variable	Frequency (%)
Never Recommended	133 (29.4)
Internet Access Availability	
Yes	442 (97.6)
No	11 (2.4)

2. Knowledge of Pharmacy Students toward Telepharmacy

Of the 453 respondents, 58.7% demonstrated high telepharmacy knowledge, indicating a moderate overall knowledge level in the region (Figure 1). Students showed strong understanding of core concepts, with more than 95% recognizing the importance of ICT and the feasibility of providing counseling and drug information through telepharmacy. However, misconceptions remained: 55.6% believed face-to-face meetings were required, and only 66.0% correctly identified that psychotropic prescriptions could be served electronically (Table 2).

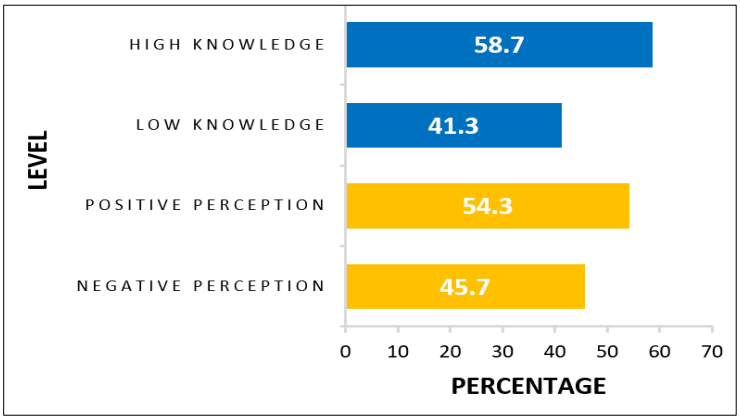

Figure 1. Distribution of Knowledge and Perception Levels among Respondents

Table 2. Distribution of Knowledge Questionnaire Responses (N=453)

Statement	Correct Responses n (%)
Pharmacists and patients meet face-to-face in a telepharmacy	201 (44.4)
Knowledge related to information and communication technology (telecommunications) is needed by pharmacists to conduct telepharmacy	446 (98.5)
Telepharmacy can be done using video conference (e.g, Zoom or Google Meet)	401 (88.5)
Telepharmacy can be done using digital health applications (e.g, halodoc, alodoc, etc.)	438 (96.7)
Purchases of narcotic drugs can be served by an electronic prescription	345 (78.1)
Purchases of psychotropic drugs can be served by an electronic prescription	299 (66.0)
Telepharmacy allows pharmacists to confirm electronic prescriptions with doctors	429 (94.7)
Telepharmacy allows pharmacists to provide recommendations for overcoming drug-related problems in electronic prescriptions to doctors	418 (92.3)
Pharmacists cannot gather patients' information through telepharmacy	344 (75.9)
Monitoring patients' medications can be done by telepharmacy	402 (88.7)
Drug counselling can be done by telepharmacy	435 (96.0)
Providing information on drugs and medical devices can be done by telepharmacy	439 (96.9)
Telepharmacy increases access to pharmacy services in areas with a limited number of pharmacists	408 (90.1)
Telepharmacy reduces the number of direct patients visit to pharmacy service facilities	354 (78.1)
Telepharmacy is a legally recognised pharmacy service	411 (90.7)

3. Perception of Pharmacy Students toward Telepharmacy

As shown in Figure 1, 54.3% of students expressed positive perceptions toward telepharmacy, while 45.7% reported negative perceptions. Table 3 indicates that most students agreed on telepharmacy's potential benefits, particularly in supporting pharmacy education (73.1%) and reducing time and cost for patients (74.4%). However, uncertainties remained regarding clinical effectiveness, with 51.2% neutral responses, and concerns about data security, as only 47.5% were willing to share personal information online.

Table 3. Distribution of Perception Questionnaire Responses (N=453)

Statement	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
Telepharmacy will improve patient adherence to medication.	7 (1.5)	31 (6.8)	193 (42.6)	161 (35.5)	61 (13.5)
Telepharmacy will have a higher error rate in dispensing and prescription fulfillment compared to conventional pharmacies.	27 (6)	91 (20.1)	192 (42.4)	113 (24.9)	30 (6.6)
Telepharmacy will increase patients' access to medications, especially in areas with limited healthcare services.	19 (4.2)	17 (3.8)	102 (22.5)	176 (38.9)	139 (30.7)
Telepharmacy will ensure complete privacy during consultation periods.	7 (1.5)	10 (2.2)	118 (26)	196 (43.3)	122 (26.9)
Telepharmacy will increase the workload and commitment of pharmacists.	38 (8.4)	105 (23.2)	183 (40.4)	99 (21.9)	28 (6.2)
Telepharmacy can help patients save time and travel costs to healthcare facilities.	12 (2.6)	9 (2)	95 (21)	178 (39.3)	159 (35.1)
You are willing to provide your personal information to be stored in an online database when using telepharmacy services.	15 (3.3)	28 (6.2)	195 (43)	178 (39.3)	37 (8.2)
Telepharmacy can reduce costs for establishing pharmaceutical healthcare businesses compared to conventional healthcare providers.	13 (2.9)	22 (4.9)	183 (40.4)	177 (39.1)	58 (12.8)
Patient consultations through telepharmacy will be effective.	9 (2)	31 (6.8)	232 (51.2)	140 (30.9)	41 (9.1)
Pharmacy schools should provide training in computers, IT, and telepharmacy to support future telepharmacy implementation.	12 (2.6)	8 (1.8)	102 (22.5)	176 (38.9)	155 (34.2)
Drug therapy monitoring through telepharmacy will be feasible in areas with limited access to healthcare services.	14 (3.1)	26 (5.7)	143 (31.6)	185 (40.8)	85 (18.8)
Telepharmacy security in remote areas requires greater attention compared to conventional pharmacies.	8 (1.8)	18 (4)	149 (32.9)	191 (42.2)	87 (19.2)
Telepharmacy can help address pharmacist shortages that result in medications being dispensed without pharmacist involvement.	18 (4)	23 (5.1)	170 (37.5)	158 (34.9)	84 (18.5)

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4. Determinants of Knowledge among Pharmacy Students

As presented in Table 4, knowledge scores were significantly associated with academic year (p=0.006), parental education level (p=0.014), and type of university (p<0.001). Students in higher years of study and those enrolled in public universities demonstrated higher knowledge levels. No significant associations were observed with age, gender, healthcare work experience, internet access, or use of digital health services.

Table 4. Comparison of Telepharmacy Knowledge Scores Based on Participant Characteristics

Variable	Knowledge	
	Mean ± Std. Deviation	P-value
Age		
17-19 years	12.66 ± 1.45	
20-22 years	12.87 ± 1.56	0.190
≥23 years	12.56 ± 1.54	
Gender		
Female	12.51 ± 1.45	0.094
Male	12.78 ± 1.56	
Academic Year		
1 years	12.52 ± 1.23	
2 years	12.86 ± 1.56	
3 years	12.32 ± 1.41	0.006*
4 years	12.57 ± 1.68	
5 years (professional program)	12.75 ± 1.58	
Parental Education Level		
Primary (Elementary, Junior High School)	12.56 ± 1.56	
Secondary (Senior High School)	12.75 ± 1.48	0.014*
Higher Education (Diploma, Bachelor's, Master's, PhD)	12.53 ± 1.51	
Internship/Work Experience in a Healthcare Facility		
Yes	12.65 ± 1.53	0.153
No	12.87 ± 1.49	
Experience Using Digital Health Services		
Yes	12.83 ± 1.55	0.108
No	12.61 ± 1.46	
Recommendation to Use Digital Health Services		
Ever Recommended	12.73 ± 1.50	0.608
Never Recommended	12.77 ± 1.57	
Internet Access Availability		
Yes	12.75 ± 1.52	0.168
No	12.18 ± 1.40	
Type of University		
Public	13.20 ± 1.34	<0.001*
Private	12.61 ± 1.54	

5. Determinants of Perception among Pharmacy Students

As shown in Table 5, perception scores were significantly associated with age ($p<0.001$), academic year ($p<0.001$), parental education level ($p=0.009$), and healthcare work experience ($p=0.027$). Older students, those in higher academic years, and students with prior work experience in healthcare facilities reported more positive perceptions. No significant associations were observed with gender, internet access, use or recommendation of digital health services, or type of university.

Table 5. Comparison of Telepharmacy Perception Scores Based on Participant Characteristics

Variable	Perception	
	Mean ± Std. Deviation	P-value
Age		
17-19 years	45.07 ± 7.49	
20-22 years	47.19 ± 6.99	< 0.001*
≥23 years	49.27 ± 9.06	
Gender		
Female	46.51 ± 8.91	0.885
Male	46.72 ± 7.58	
Academic Year		
1 years	45.75 ± 8.95	
2 years	46.88 ± 8.67	
3 years	47.10 ± 7.89	< 0.001*
4 years	47.25 ± 8.22	
5 years (professional program)	47.50 ± 7.95	
Parental Education Level		
Primary (Elementary, Junior High School)	46.28 ± 7.77	
Secondary (Senior High School)	47.07 ± 7.57	0.009*
Higher Education (Diploma, Bachelor's, Master's, PhD)	46.54 ± 7.77	
Internship/Work Experience in a Healthcare Facility		
Yes	47.19 ± 8.10	0.027*
No	45.98 ± 6.98	
Experience Using Digital Health Services		
Yes	46.82 ± 8.07	0.371
No	46.51 ± 7.12	
Recommendation to Use Digital Health Services		
Ever Recommended	47.04 ± 7.73	0.102
Never Recommended	45.83 ± 7.49	
Internet Access Availability		
Yes	46.68 ± 7.64	0.767
No	47.00 ± 7.21	
Type of University		
Public	47.63 ± 7.70	0.177
Private	46.43 ± 7.66	

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6. Correlation between Knowledge and Perception Scores

Spearman's rank correlation analysis (Table 6) showed no significant relationship between knowledge and perception scores ($\rho = 0.089$, $p = 0.058$). This finding suggests that higher levels of telepharmacy knowledge did not necessarily correspond with more positive perceptions among the students.

Table 6. Correlation between Knowledge and Perception of Pharmacy Students Toward Telepharmacy

Variable	(ρ)	p-value	N
Knowledge	1	-	453
Perception	0.089	0.058	453

DISCUSSION

The findings of this study revealed that 58.7% of pharmacy students demonstrated a high level of telepharmacy knowledge, while 54.3% exhibited positive perceptions. However, no statistically significant correlation was observed between knowledge and perception ($\rho = 0.089$; $p = 0.058$). The near-significant p-value suggests a possible weak association that may not have been detected due to limited statistical power. Therefore, this finding should be interpreted cautiously and does not necessarily indicate a complete disconnect between knowledge and perception. Furthermore, the dichotomization of knowledge and perception variables may have reduced data variability and attenuated the observed correlation, potentially contributing to the lack of statistical significance. According to the Technology Acceptance Model (TAM), technology acceptance is more influenced by behavioral factors such as perceived usefulness, ease of use, trust, and social influence rather than merely the level of knowledge[13]. This aligns with previous research in digital health, which demonstrated that despite high knowledge levels, acceptance is often hindered by concerns about data privacy, infrastructure reliability, and confidence in professional competence [5].

The knowledge–perception gap can also be interpreted through other theoretical perspectives. The Theory of Planned Behavior (TPB) highlights the influence of subjective norms and perceived behavioral control on behavioral intentions[14], while Innovation Diffusion Theory emphasizes the importance of perceived relative advantage, compatibility, complexity, trialability, and observability in innovation adoption processes[15]. In this study, students may have understood the basic concepts of telepharmacy but lacked exposure to successful real-world implementations, leading to uncertain or cautious attitudes.

The unique conditions in South Kalimantan further shaped these findings. Although the majority of students (97.6%) reported internet access, limitations in digital infrastructure, connectivity quality, and device availability remain barriers to telepharmacy readiness[16]. The significant difference between students from public and private universities also highlights educational disparities. Students from public universities displayed higher knowledge levels, likely due to stronger curricula, resource availability, and faculty expertise in digital health[17]. By contrast, the majority of respondents were from private universities (70.4%), which demonstrated lower knowledge levels, underscoring the need for curriculum standardization and resource equalization to ensure consistent graduate readiness across institutions.

Several misconceptions regarding regulations were also identified. Only 44.4% of students understood that telepharmacy does not always require face-to-face meetings, and only 66% recognized that electronic prescriptions could also be used for psychotropic medications. These findings suggest that recent regulations, such as

Permenkes No. 20/2019 on telemedicine, which are often interpreted as indirect guidance for telepharmacy in the absence of specific regulations, are not yet fully integrated into pharmacy curricula[18]. This reflects the fragmented and evolving regulatory landscape of telepharmacy in Indonesia. In addition, students' trust in data security was relatively low, with only 47.5% willing to share personal information online. This trust deficit represents a key factor explaining why higher knowledge levels are not always accompanied by more positive attitudes[9, 11].

When compared to other regions, the knowledge level of students in South Kalimantan (58.7%) was lower than in Central Java (97.9%)[12] and Malaysia (70% [5]), but higher than in Ethiopia (48.6%)[19]. These variations are likely due to differences in curricula, infrastructure readiness, and faculty competence[8]. Meanwhile, students' perception scores (54.3% positive) were relatively consistent with findings in Malaysia (61%) [5] and Jordan (70.1%)[20], suggesting that attitudinal factors toward telepharmacy may be more culturally consistent than knowledge levels across different populations.

Demographic analysis revealed that final-year students had more positive perceptions, indicating that gradual curriculum integration-from basic concepts in early years to advanced applications in later years-may be an effective approach[21]. Another notable finding was that students whose parents had secondary education demonstrated higher knowledge than those with highly educated parents, possibly due to differences in digital exposure, family expectations, or socioeconomic conditions. Although no study directly links parental education to telepharmacy knowledge, research in Taiwan shows that higher eHealth literacy is associated with more positive health beliefs regardless of parental education[22]. Furthermore, students with work experience in healthcare facilities expressed more positive perceptions, emphasizing the importance of integrating practical fieldwork experiences with telepharmacy exposure through internships or clinical placements[23].

This study has several limitations. The cross-sectional design restricts the ability to draw causal conclusions, and the findings may not be generalizable beyond South Kalimantan. In addition, the use of convenience sampling may introduce potential bias in sample representation. Nevertheless, the study provides valuable insights into the current readiness of pharmacy students for telepharmacy implementation and highlights critical gaps that must be addressed in pharmacy education. The findings underscore the importance of curriculum enhancement, the integration of practical experiences, and greater emphasis on trust and digital infrastructure[16], providing a foundation for educational policies that are more responsive to the ongoing digital transformation of healthcare.

CONCLUSION

This study found that pharmacy students in South Kalimantan demonstrated moderate knowledge and slightly positive perceptions of telepharmacy, with no significant correlation between the two. These findings underscore the need for standardized telepharmacy education, complemented by practical training and faculty capacity building, to better prepare future pharmacists for the digital transformation of healthcare. Strengthening students' understanding of regulations and data security is also essential to enhance both knowledge and acceptance, making this study a useful reference for curriculum development and policy formulation in pharmacy education.

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CONFLICT OF INTEREST

This article was written independently, and the authors declare that there are no conflicts of interest related to its publication.

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