

Validity and Reliability Questionnaire Knowledge, Attitude, and Practice of Pharmacists towards Antimicrobial Stewardship

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ABSTRACT

Increasing antibiotic resistance can be caused by the use of broad-spectrum antibiotics, which can increase morbidity and mortality. The Antimicrobial Stewardship Program (ASP) has been implemented globally to control antibiotic resistance. The presence of a multiprofessional health team such as physicians, pharmacists, microbiologists, and infection control (IPC) practitioners is a key requirement for implementing the ASP. The purpose of this study was to develop a questionnaire on pharmacists' knowledge, attitudes, and practice regarding Antimicrobial Stewardship. The questionnaire items were developed based on literature review and expert judgment. Validity testing used the Content Validity Index (CVI) method with expert judgment to assess the validity of each questionnaire item. Reliability testing was distributed to thirty pharmacists to measure the consistency of the questionnaire. Validity testing with the CVI obtained a value of 0.75–1.0, meaning that some items were invalid because the CVI was <0.83. Meanwhile, the reliability test showed that 7 items of knowledge variable statements had a corrected item-total correlation value > 0.25. All statement items on the attitude variable showed a corrected item-total correlation value > 0.25. 13 statement items on the behavior variable had a corrected item-total correlation value > 0.25. The developed questionnaire demonstrated acceptable validity and reliability and can be used to assess pharmacists' knowledge, attitudes, and practices regarding antimicrobial stewardship.

INTRODUCTION

According to data from the Centers for Disease Control and Prevention (CDC) in 2019, estimated that 35,000 people died per year from infections caused by multi-resistant bacteria in the United States (CDC, 2019). Increasing antibiotic resistance due to the use of broad-spectrum antibiotics, which can increase morbidity and mortality (Mudenda et al., 2021).

Antimicrobial Stewardship Program (ASP) has been implemented globally to control antibiotic resistance (Brinkmann & Kibuule, 2020). The ASP is a program aimed at optimizing the appropriate use of antibiotics in various healthcare institutions. The presence of a multiprofessional health team, including physicians, pharmacists, microbiologists, and infection, prevention and control (IPC)

practitioners, is essential for implementing the ASP (Setiawan et al., 2019).

Limited access of pharmacists to hospital patient care guidelines and the limited availability of pharmacists trained in clinical pharmacy or infectious diseases represent significant barriers for pharmacists to take a more active role in antimicrobial stewardship (Fabre et al., 2024).

Overall, 69% of all healthcare workers (doctors, pharmacists, nurses and microbiologists) stated that the importance of antimicrobial stewardship is communicated in the respondent's healthcare facility, and 23% were not familiar with the term "antimicrobial stewardship" (Fabre et al., 2024).

A study in Punjab, Pakistan, evaluated that community pharmacists' knowledge, perception

and practices regarding antimicrobial stewardship (AMS). A questionnaire was completed by 400 respondents. The study found that respondents had good knowledge of antibiotics. They also had positive perceptions but poor practices regarding AMS (Sarwar et al., 2018).

The implementation of appropriate use of antibiotic is known as antimicrobial stewardship, which aims to improve patient outcomes, characterized by improvements in the quality of antibiotic use, including establishing a diagnosis, choosing the right type of antibiotic, and the appropriate dosage, interval, route, and duration of administration (Kemenkes RI, 2021)

Study on pharmacists' knowledge, attitudes, and practice regarding antimicrobial stewardship can be conducted by using questionnaires to collect valid and reliable data. Measurement methods play a crucial role in determining research results, as research results are obtained from measuring variables (Notoatmodjo, 2014). The study must utilize research instruments that have undergone validity and reliability testing, the validity of a measuring instrument is key determined the quality of the scientific research conducted (Darsini et al., 2020). The purpose of this study was to develop a questionnaire on pharmacists' knowledge, attitudes, and practice regarding Antimicrobial Stewardship.

MATERIALS AND METHODS

This study used a structured self-administered questionnaire distributed to pharmacists working in 9 hospitals around the Solo Raya area. This study used cluster sampling. The sample required for this reliability test was 30 pharmacists working in hospitals around the Solo Raya area.

This study employed a methodological design for instrument development. For the content validity assessment, expert judgement was conducted involving selected experts in the relevant field. For the reliability analysis, the sample consisted of pharmacists who met the predefined inclusion criteria.

Research Procedure

The first stage of this research was a literature review to develop a blueprint for the questionnaire. The questionnaire items were derived from the Guidelines for Antibiotic Use

(Ministry of Health of the Republic of Indonesia, 2021), the Antimicrobial Resistance Control Program in Hospitals (Ministry of Health of the Republic of Indonesia, 2015), Antimicrobial stewardship interventions: A practical guide (World Health Organization, 2021), The Core Elements of Hospital Antimicrobial Stewardship Programs (Centers for Disease Control and Prevention, 2019), the WHO AWaRe Antibiotic Book (World Health Organization, 2023), and previous studies (Fabre et al., 2024; Setiawan et al., 2019).

The blueprint consisted of several aspects. The statement items were taken from various books and previous research related to antimicrobial stewardship. The knowledge questionnaire contained 20 statements using the Guttman scale, which was used to measure respondents' level of knowledge regarding antimicrobial stewardship. The attitude questionnaire contained 20 statements using the Likert scale, which was used to measure respondents' attitudes toward antimicrobial stewardship. The practice questionnaire contained 20 statements using the Likert scale, which was used to measure respondents' practice toward antimicrobial stewardship.

Second, the questionnaire was consulted with experts (expert judgment). A total of 8 experts consisted of pharmacist practitioner in hospitals and academic pharmacists with the criteria for a minimum of a Master's degree and a pharmacist profession. The results of the 8 expert judgments were calculated using the Content Validity Index (CVI) method. The questionnaire instrument was provided to expert judgment, followed by an assessment using the Content Validity Index (CVI). The CVI evaluation included four aspects: relevance, clarity, simplicity, and ambiguity. Experts will assess the relevance of the items from 1-4 and then calculate the CVI value.

Subsequently, the relevance ratings were recoded as 1 (relevance scale of 3 or 4) and 0 (relevance scale of 1 or 2). The CVI was calculated by dividing the number of experts in agreement by the total number of experts. An acceptable statement item value is a CVI value > 0.83 (Yusoff, 2019). Based of expert judgment consultation, several questionnaire item were revised.

Third, after all statement items were revised, a pilot test on 30 pharmacist respondents fulfill the inclusion criteria. The inclusion criteria for

this study were pharmacists working in hospitals and willing to participate in the study. The exclusion criteria for this study were pharmacists working outside of pharmaceutical services. After that, the results of the pilot test on 30 respondents were subjected to reliability testing by entering data into the Excel program and processing the results with SPSS software version 25.

Data Analysis

Validity test

Validity test is defined as the level of relevance and representation of an assessment instrument to the targeted constructs for a specific assessment objective (Yusoff, 2019). Content validity is a technique for validating instrument content by assessing the relevance of questions or statements in the questionnaire to be completed by respondents. Content validity results are useful for researchers in ensuring the questionnaire aligns with the research problem, objectives, and benefits (Suryadi et al., 2023).

Content validity was assessed using expert judgement and quantified using the Content Validity Index (CVI). The experts evaluated each item based on relevance, clarity, simplicity, and ambiguity. The CVI includes four assessment aspects, namely relevance, clarity, simplicity, and ambiguity. The relevance rating was then calculated by recoding the scores, where 1 was assigned for a relevance score of 3 or 4, and 0 was assigned for a relevance score of 1 or 2. The acceptable CVI value is ≥ 0.83 (Yusoff, 2019).

Reliability test

A measurement instrument is considered reliable if it produces the same measurement results even when measurements are taken repeatedly (Anggraini et al., 2022). A questionnaire is considered reliable if the answers to the questionnaire are consistent or stable over time. Reliability calculations can only be performed if the questionnaire was valid during the validity test. Therefore, validity must be calculated first before calculating reliability (Busschaert et al., 2015). In this study, the corrected item-total correlation value > 0.25 was used (Azwar, 2024). The item-total correlation value compares each item with the overall measurement, excluding item under evaluation. The item-total correlation evaluates the internal consistency of the measuring instrument (Husna & Ichsan, 2023).

RESULT AND DISCUSSION

Blueprint Instrument

The blueprint instrument, each aspect contains more than one statement item. This ensures that if an item is not used after validity and reliability testing, there are still other items available for that aspect. The instrument blueprint is presented in Table 1.

Validity Test

Questionnaire validity testing aims to measure the extent to which a questionnaire accurately measures the intended construct. The questionnaire instrument is given to expert validators and then assessed using the Content Validity Index (CVI). The CVI encompasses four assessment aspects: relevance, clarity, simplicity, and ambiguity. The relevance rating is then calculated by recoding it as 1 (relevance scale 3 or 4) or 0 (relevance scale 1 or 2) (Yusoff, 2019). The result of CVI value is presented in Table 2.

According to Table 2, the knowledge variable questionnaire has a CVI value of 0.75–1.0. One item, Q3, had a CVI value < 0.83 , so it was excluded. Therefore, the CVI test for the knowledge variable reduced the number of items from 20 to 19 for reliability testing.

The attitude variable questionnaire has a CVI value of 0.75–1.0. Two items, Q19 and Q20, had a CVI value < 0.83 , so they were excluded. Therefore, the CVI test for the attitude variable reduces the number of statements from 20 to 18 for reliability testing.

The practice variable questionnaire has a CVI value of 0.75–1.0. Four items, Q3, Q4, Q14, and Q19, had a CVI value < 0.83 , therefore, these four items were excluded. Therefore, the CVI test for the practice variable reduced the 20 statement items to 16 statement items for reliability testing.

Reliability Test

The reliability test was conducted on 30 pharmacist respondents who practice in hospitals around the Solo area. Reliability was measured by examining the correlation between the score of one item and the total score of all other items in the instrument. The corrected item-total correlation value was > 0.25 . Table 3 shows the results of the corrected item-total correlation value for the knowledge variable.

Table 1. Blueprint Instrument Knowledge, Attitude, and Practice of Pharmacists towards Antimicrobial Stewardship

Variable	No	Aspect	Number of item	
			Favorable	Unfavorable
Knowledge	1.	Objective of <i>Antimicrobial Stewardship Program</i>	1,4,8,11,12	-
	2.	Principles of <i>Antimicrobial Stewardship Program</i>	2,3,7,9,14	18,19
	3.	Implementation of <i>Antimicrobial Stewardship Program</i>	5,6,10,13,	15,16,17,20
Attitude	Total item		14	6
	1.	Appropriate of antibiotic use	1,2,3,14	20
	2.	Implementation of <i>Antimicrobial Stewardship Program</i>	4,5,6,7,8,9,12,13,15,16,17	18,19
	3.	Training of <i>Antimicrobial Stewardship Program</i>	10,11	-
Practice	Total item		17	3
	1.	Appropriate of antibiotic use	7,8,11,12	-
	2.	Implementation <i>Antimicrobial Stewardship Program</i>	1,2,3,4,5,13,14,15,16	17,18,19,20
	3.	Training of <i>Antimicrobial Stewardship Program</i>	6,9,10	-
	Total item		16	4

Table 2. Content Validity Index (CVI) Results for Pharmacists' Knowledge, Attitude and Practice of Antimicrobial Stewardship

Item	CVI		
	Knowledge	Attitude	Practice
Q1	1	1	1
Q2	1	0.875	1
Q3	0.75	1	0.75
Q4	1	1	0.75
Q5	1	1	1
Q6	1	1	1
Q7	1	1	1
Q8	1	1	1
Q9	1	1	1
Q10	1	1	0.875
Q11	1	0.875	1
Q12	1	1	1
Q13	1	1	1
Q14	1	1	0.75
Q15	1	1	1
Q16	1	1	1
Q17	1	1	1
Q18	1	1	1
Q19	1	0.75	0.75
Q20	1	0.75	1

Note: Accepted if CVI $\geq$ 0.83

Based on the results of the corrected item-total correlation test, there were 12 statement items with values <0.25 , namely Q1, Q2, Q4, Q5, Q6, Q8, Q9, Q13, Q14, Q15, Q16, Q20. These items were removed, and the researcher then

conducted a reliability test on items with a corrected item-total correlation value >0.25 . Table 4 shows the final results of the reliability test for the knowledge variable.

Table 3. Reliability Test Results for Pharmacists' Knowledge of Antimicrobial Stewardship

Item	Corrected item-total correlation
Q1	0.000
Q2	0.000
Q4	0.000
Q5	0.000
Q6	0.000
Q7	0.420
Q8	0.000
Q9	0.000
Q10	0.373
Q11	0.581
Q12	0.716
Q13	-0.060
Q14	0.013
Q15	0.000
Q16	0.000
Q17	0.591
Q18	0.745
Q19	0.740
Q20	-0.137

Based on the final results of the reliability test, 7 items in the knowledge variable statement had a corrected item-total correlation value $>$

0.25. Therefore, of the 19 questions, 7 items can be used to measure the knowledge variable.

Table 4. Final Reliability Test Results for Pharmacists' Knowledge of Antimicrobial Stewardship

Item	Corrected item-total correlation
Q7	0.448
Q10	0.400
Q11	0.642
Q12	0.757
Q17	0.642
Q18	0.824
Q19	0.748

Table 5. Reliability Test Results for Pharmacists' Attitude of Antimicrobial Stewardship

Item	Corrected item-total correlation
Q1	0.778
Q2	0.686
Q3	0.533
Q4	0.477
Q5	0.615
Q6	0.376
Q7	0.694
Q8	0.810
Q9	0.711
Q10	0.679
Q11	0.454
Q12	0.775
Q13	0.718
Q14	0.743
Q15	0.506
Q16	0.765
Q17	0.649
Q18	0.696

Based on the results (Table 5) of the corrected item-total correlation test, all statement items showed a corrected item-total correlation value of > 0.25 , so that 18 statement items can measure attitude variables.

Based on the results of the corrected item-total correlation test for the practice variables, Table 6 shows that three items had values < 0.25 , namely Q15, Q16, and Q17. These three items were excluded, and the researcher then conducted a reliability test on the items with corrected item-total correlation values > 0.25 . Table 7 shows the final results of the practice variable reliability test.

Table 6. Reliability Test Results for Pharmacists' Practice of Antimicrobial Stewardship

Item	Corrected item-total correlation
Q1	0.842
Q2	0.628
Q5	0.801
Q6	0.735
Q7	0.634
Q8	0.720
Q9	0.730
Q10	0.709
Q11	0.561
Q12	0.756
Q13	0.627
Q15	-0.263
Q16	-0.268
Q17	-0.235
Q18	0.795
Q20	0.500

Table 7. The final Reliability Test Results for Pharmacists' practice of Antimicrobial Stewardship

Item	Corrected item-total correlation
Q1	0.868
Q2	0.633
Q5	0.812
Q6	0.785
Q7	0.699
Q8	0.774
Q9	0.751
Q10	0.716
Q11	0.563
Q12	0.800
Q13	0.596
Q18	0.798
Q20	0.493

Based on the final reliability test results, 13 practice variable statement items had a corrected item-total correlation value > 0.25 . Therefore, of the 16 questionnaire items, 13 could be used to measure practice variables.

Table 3. Results of the reliability test using Cronbach's alpha

Variable	Total valid items	Cronbach's alpha
Knowledge	7	0.867
Attitude	18	0.924
Practice	13	0.939

Based on the results of the reliability test, the Cronbach's alpha value for the knowledge variable with 7 valid items was 0.867. The Cronbach's alpha value for the attitude variable with 18 valid items was 0.924, while the Cronbach's alpha value for the practice variable with 13 valid items was 0.939. Cronbach's alpha value greater than 0.7 indicates that the items are consistent in measuring the variable (Taherdoost et al., 2016). The Cronbach's alpha values for the knowledge, attitude, and practice items were all greater than 0.7, the instrument was considered reliable and suitable for use in this study. A measurement is considered to have high validity if the data generated accurately reflects the variables being measured. Content validity assesses the extent to which the elements of a measurement instrument are truly relevant and represent the measurement objectives. This assessment is qualitative and judgmental and is conducted by a panel of experts (Azwar, 2025). A study conducted by Kurniasari and Ichsan, (2023) which has conducted validity testing using the Content Validity Index (CVI) method on the knowledge, attitudes and practice of pharmacists towards antibiotic resistance in pharmacies resulted in 24 knowledge questionnaire items obtained CVI values between 0.8 and 1.0. A total of 24 attitude questionnaire items obtained CVI values between 0.9 and 1.0 and 24 behavior questionnaire items obtained CVI values between 0.8 and 1.0.

In a previous study, nine experts assessed a draft questionnaire on the development and validation of a questionnaire on knowledge, attitudes, and practices regarding antibiotics for the general public. Based on content validity results, seven items in the knowledge domain, two items in the attitude domain, and seven items in the practice domain were removed due to CVR <0.78 and CVI <80% (Karuniawati et al., 2022).

In this study, the validity and reliability tests used corrected item-total correlation values that showed internal consistency with the aim of ensuring that the measurement instrument provided consistent results when repeated measurements were taken or on the same subject (Azwar, 2025).

The minimum corrected item-total correlation value in this study was 0.25. The item-total correlation coefficient ranges from 0

to 1.00, with a positive or negative sign. The better the discriminatory power, the closer the value is to 1.00. A small coefficient close to 0 or negative sign indicates the item has no discriminatory power. Discriminatory power is the extent to which an item can distinguish between individuals who do or do not have the attribute being measured (Azwar, 2022).

The developed questionnaire may serve as a useful tool for assessing pharmacists' knowledge, attitudes, and practices related to antimicrobial stewardship. The validated questionnaire can help healthcare institutions identify gaps in pharmacists' competencies and support the implementation of antimicrobial stewardship programs aimed at reducing antibiotic resistance (Akbar et al., 2021)

This study has several limitations. First, the reliability testing was conducted with a relatively small sample size of pharmacists, which may limit the generalizability of the results. Second, the study did not include construct validity testing, such as exploratory or confirmatory factor analysis, which could provide stronger evidence regarding the structural validity of the instrument. To address the limitations of this study, future research should involve a larger and more diverse sample of pharmacists to improve the generalizability and stability of the reliability estimates. The benefit of validation of the questionnaire is that it ensures that the instrument accurately measures the intended construct, thereby improving the validity of the findings.

CONCLUSIONS

This study developed a questionnaire to assess pharmacists' knowledge, attitudes, and practices regarding antimicrobial stewardship. The results showed that the instrument demonstrated acceptable content validity based on the Content Validity Index and acceptable internal consistency as indicated by Cronbach's alpha values for each domain. However, the instrument was limited to content validity and internal consistency using a pilot sample of 30 respondents. Therefore, further studies involving larger samples and additional psychometric analyses, such as construct validity and test-retest reliability, are recommended to further confirm the validity and reliability of the instrument before broader implementation.

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AUTHORS' CONTRIBUTIONS

B.I. served as the supervisor and contributed to the study design, methodological guidance, and critical revision of the manuscript. I.N.A., as the student researcher, was responsible for data

collection, data analysis, and drafting of the manuscript.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

ETHICAL CONSIDERATION

Ethical clearance for this study was granted by the Ethics Committee of the Health Research Ethics Commission (KEPK) of the Faculty of Health Sciences, Muhammadiyah University of Surakarta, No. 778/KEPK-FIK/XII/2024.

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