Jurnal Manajemen dan Pelayanan Farmasi (JMPF)
(Journal of Management and Pharmacy Practice)
ISSN-p : 2088-8139 | ISSN-e : 2443-2946
JMPF Vol 15(1) 2025: 23-31

Knowledge and Behavior of Health Workers on Antibiotic Stewardship at Private Hospital in Pontianak

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ARTICLE INFO
Submitted : 26-12-2023
Revised : 10-06-2024
Accepted : 23-01-2025

Published : 31-03-2025

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ABSTRACT

Background: One of the causes of increasing antimicrobial resistance is health workers' lack of knowledge about antibiotics, thus causing irrational behavior in antibiotic stewardship.

Objectives: This study aimed to analyze the knowledge and behavior among health workers about antibiotic stewardship and their relationship at a private hospital in Pontianak.

Methods: This study was a descriptive observational study with a cross-sectional design. Data were collected using consecutive sampling of health workers involved in antibiotic prescribing using a validated and reliable questionnaire. The data were analyzed using Spearman Rank correlation to determine the relationship between knowledge level and behavior.

Results: 39 respondents participated, including nine general doctors, 17 specialists, and 13 pharmacists. Most health workers were 26–35 years old (43.59%) and had worked for 1–5 years (48.72%). All respondents had a good knowledge (100%) of the knowledge topic of the etiology, control, and effect of antibiotic resistance. However, only 76.92% of respondents had good behavior, and the rest had moderate behavior (23.08%) on the behavioral topics in the performance of antimicrobial resistance control programs, controlling antibiotic prescribing, performance preventing the spread of resistant microbes, and good antibiotic prescribing practice. The knowledge had a significant relationship towards behavior ($p<0.05$) with a correlation coefficient (r)=0.568.

Conclusion: Most health workers in a private hospital had good knowledge and behavior about antibiotic stewardship, and there was a moderately strong and positive relationship between them.

Keywords: Antibiotic Resistance; Behavior; Knowledge

INTRODUCTION

Antibiotic resistance is bacteria's weakening antibiotic action due to bacterial mutation and incomplete bacterial eradication. Antibiotic resistance can increase mortality, morbidity, and economic burden, as well as reduce the effectiveness of therapy.[1] The World Health Organization (WHO) reported an increase in antibiotic resistance of 55.5% in Southeast Asia in 2019-2020. While in Indonesia, there was an increase in antibiotic resistance of 25%.[2] Antibiotic resistance can increase due to the irrational use of antibiotics by health workers such as doctors and dentists who are in charge of prescribing antibiotics and pharmacists who are in charge of assessing, managing, and providing antibiotics. This is due to the lack of knowledge about antibiotics, antibiotic use, and the development and spread of antibiotic resistance.[3–7]

The problem of antibiotic resistance is difficult to eliminate, but it can be prevented by using antibiotics wisely, known as antibiotic stewardship.[8] Good knowledge of antibiotic stewardship by health workers can avoid therapeutic failure, increased risk to patient safety, and the spread of resistance. Knowledge has a vital role in shaping behavior in the use of antibiotics.[9] Some studies state that more than 60% of health workers have good

knowledge and behavior about antibiotic stewardship.[10,11] However, some other studies state that most health workers have good knowledge about antibiotic use and antibiotic resistance, but only a few have good behavior in using antibiotics. Based on some studies, the lack of good behavior about antibiotic stewardship can be caused by a lack of awareness in antibiotic stewardship implementation.[7,12,13]

Hospitals must increase understanding and awareness of the use of antibiotics for all health workers and staff, especially doctors, dentists, and pharmacists, to prevent antibiotic resistance.[14] Research by Omar et al. (2020) showed a decrease in hospital-acquired infections caused by multidrug-resistant organisms, especially in the intensive care unit (ICU), by 65% in 2020 compared to 2015 due to antibiotic stewardship.[15] Good knowledge and behavior are essential for understanding and implementing appropriate antibiotic stewardship. Research on the knowledge and behavior of health workers about antibiotic stewardship in health workers has been conducted by Herawati et al. (2021) in private hospitals in Surabaya, Mojokerto, and Pasuruan areas, which showed that 19% of respondents had lower scores on knowledge of antibiotic stewardship and 39% of respondents had low scores on antibiotic stewardship trust.[12,16] Moreover, Lim et al. (2024) reported that private primary care antibiotic prescribing was almost ten times higher than in public primary care. This is suggested because implementing the National Antibiotic Guidelines is more decisive in the public sector than the private sector.[17] Thus, we conduct this study to describe the knowledge and behavior of health workers regarding antibiotic stewardship in private hospitals and analyze the correlation between them.

METHODS

Study design

This study used a cross-sectional design and observational method with a descriptive approach. It was conducted at one of the private hospitals in Pontianak city from March to July 2023. The research has been approved by the Faculty of Medicine Health Research Ethics Committee of Universitas Tanjungpura, Pontianak, with No.7353/UN22.9/PG/2022.

Population and samples

The population in this study included health workers who worked in hospitals, including general doctors, general dentists, specialist doctors, specialist dentists, and pharmacists. This study's respondents were health workers who met the inclusion and exclusion criteria. The inclusion criteria included health workers related to antibiotic prescription. The exclusion criteria were respondents who did not complete the questionnaire. The sample calculation used in this study was the Lemeshow formula, with a minimum of 26 respondents. Respondents were taken by consecutive sampling.

Study instruments

The instrument in this study is a modified questionnaire from research by Herawati et al. (2021) and Limato et al. (2022) that has been through validity and reliability tests.[12,16] The questionnaire was declared valid by r count greater than the r table, which ranged from 0.538 – 0.756 for knowledge and 0.556 – 0.951 for behavior (p > r table: 0.514) and reliable with a Cronbach's alpha item value of 0.901 (P>0.6) for the knowledge questionnaire and 0.933 (P>0.6) for the behavior questionnaire with a significance level of 5%.

The questionnaire used in this research consists of two parts, namely the knowledge section and the behavior section. The knowledge section consists of 25 questions with “correct” or “incorrect” answers, and the behavioral section consists of 20 statements, which are answered using a Likert scale. The values shown on the Likert Scale for positive statements use "always" (score 3), "rarely" (score 2), and "never" (score 1). In contrast, for negative statements, the values from the Linkert scale are applied in reverse, with one representing always and three representing never. Knowledge and behavior were categorized into good (>75%), moderate (56-75%), and low (<56%).[18]

The knowledge questionnaire used in this study has three topics. The first topic was the etiology of antibiotic resistance (10 items). The questions were given about inappropriate antibiotic administration regarding indication, time and duration, antibiotic selection, route of administration, dosage, and not paying attention to side effects and drug interactions. The second topic was antibiotic resistance control (9 items). Questions were given regarding antibiotic combinations, providing information about antibiotic use to patients, knowing the importance of resistant bacteria and hand hygiene before giving antibiotics, knowing the Antibiotic Resistance Control Program (ARCP), hospital formulary, and the importance of adequate microbiology laboratory

availability. The last topic is the effect of antibiotic resistance (6 items). The questions given regarding antibiotic resistance can cause increased costs, morbidity, mortality, and complications.

The behavioral questionnaire in this study has four topics. The first topic was the Performance ARCP (13 items). The questions were given about respondents' behavior in explaining antibiotic use to patients, the collaboration between health workers, monitoring antibiotics, utilizing laboratory results, recommending antibiotics appropriately, and antibiotic reconstitution. The second topic was good antibiotic prescribing practice (5 items). The questions were given about respondents' behavior in administering antibiotics according to indication, route of administration, duration, and diagnosis. The third topic was performance in preventing the spread of resistant microbes (1 item). The questions were given about respondents' behavior in recommending patient room cleaning to the infection control team. The last topic was controlling antibiotic prescribing (1 item). The questions were given regarding respondents' behavior in implementing antibiotic guidelines and formulary.

Data collection

Data was collected using Google Forms questionnaires and a paper on health workers who met the inclusion criteria after the health worker gave written informed consent.

Data Analysis

Univariate analysis was conducted to obtain the frequency distribution of characteristics, knowledge, and behavior. The relationship between knowledge and behavior was analyzed using the Spearman Rank correlation test. The relationship was declared significant if the p-value was <0.05.

RESULTS AND DISCUSSION

Respondent Characteristic

This study involved 39 respondents who met the inclusion criteria and had given informed consent. Data on respondent characteristics are presented descriptively in Table I. Respondents engaged in the study were specialist doctors and specialist dentists, as many as 17 people (43.59%), pharmacists as many as 13 people (33.33%), and general doctors and general dentists, as many as nine people (23.08%). The categorization of professional groups in the study is based on the level of education. A specialist doctor (including a specialist dentist) is a doctor who specializes in a particular field of medical science.[19] Therefore, the group is separated into general doctors and specialists. The level of knowledge is very close to education, where it is expected that someone with a higher education will have extensive knowledge.[20] Most respondents were 26-35 years old, 17 people (43.59%), followed by 36-45 years old, as many as 12 people (30.77%). This study's results align with those of Sefah et al. (2023), where most respondents were 25-49 years.[21] Age can affect a person's knowledge, where by age, thinking and behavior become mature.[22] Most respondents were female, that is 20 people (51.28%). In a study conducted by El-Khalek et al. (2020), there was no statistically significant relationship between knowledge and behavior with gender.[23] In this study, most respondents (48.72%) have had work experience in hospitals for 1-5 years. This result is in line with Alamin et al. (2020), where most respondents have 3-5 years of work experience.[13] The law of exercise states that the relationship between conditions (stimuli) and actions will be stronger due to practice (law of use). This implies that the longer the work experience of a doctor and pharmacist, the more proficient he is.[20,22]

Knowledge and behavior of Health Workers on Antibiotic Stewardship

Knowledge and behavior of health workers about antibiotic stewardship are shown in Table II.

All respondents (100%) have good knowledge about antibiotic stewardship. This study's results are in line with research by Diane et al. (2021), which states that >70% of health workers have good knowledge about antibiotics, antibiotic use, and antibiotic resistance,[7] as well as research by Barchitta et al. (2021), which states that doctor and pharmacist have good knowledge about antibiotic resistance and good antibiotic prescribing practice. [24] Good knowledge among health workers regarding antibiotic stewardship can prevent the spread of antibiotic resistance. Knowledge is one factor that influences the behavior of prescribing antibiotics.[9]

Overall, 30 health workers (76.92%) have good behavior, and nine (23.08%) have moderate behavior. This study presents results that are in line with research by Tegagn et al. (2017), where > 60% of health workers have good behavior related to antibiotic stewardship.[11] Good behavior in antibiotic stewardship can help reduce the incidence of antibiotic resistance. The behavior of respondents based on professional groups also showed that

Table I. Characteristics of Health Worker

Characteristics	Total (n=39)	Percentage (%)
Profession		
General Doctor/Dentist	9	23.08
Specialist Doctor/Dentist	17	43.59
Pharmacist	13	33.33
Age (years)		
18-25	2	5.13
26-35	17	43.59
36-45	12	30.77
46-55	7	17.95
56-65	1	2.56
Gender		
Male	19	48.72
Female	20	51.28
Working Experience (Year)		
<1	1	2.56
1-5	19	48.72
6-10	12	30.77
>10	7	17.95

Table II. Knowledge and Behavior of Health Workers

Category	Professional Groups			Total (n=39)	Correlation between Knowledge and Behavior
	General doctor/ dentists (n=9)	Specialist doctors/dentists (n=17)	Pharmacist (n=13)		
	n (%)	n (%)	n (%)	n (%)	
Knowledge level					
Good	9 (100)	17 (100)	13 (100)	39 (100)	
Moderate	0 (0)	0 (0)	0 (0)	0 (0)	
Low	0 (0)	0 (0)	0 (0)	0 (0)	p = 0.000
Behavior level					r = 0.568
Good	7 (77.78)	13 (76.47)	10 (76.92)	30 (76.92)	
Moderate	2 (22.22)	4 (23.53)	3 (23.08)	9 (23.08)	
Low	0 (0)	0 (0)	0 (0)	0 (0)	

the majority of each profession had good behavior regarding antibiotic stewardship, that is, seven general doctors/dentists (77.78%), 13 specialist doctors/dentists (76.47%), and ten pharmacists (76.92%).

Several studies mentioned that health worker behavior regarding antibiotic use could be influenced by some factors such as age, number of patients treated, and work location. In addition, lack of knowledge and awareness of possible risks related to drug use and their interactions, especially for antibiotics, by both doctor and patient, access to non-prescription antibiotics and leftover antibiotics from previous prescriptions, inadequate medical training, lack of pharmaceutical promotion, lack of prompt diagnosis, lack of laboratory testing, and patient-doctor interactions (satisfaction of patient expectation or fear of possible future complications in patient) were found to be the main factors that encourage irrational use of antibiotics.[25,26]

Knowledge is a factor that can facilitate the formation of one's behavior. This study analyzed a relationship between knowledge and behavior using the Spearman Rank test. The results show (Table II) that the significance value is p=0.000 (p<0.05) and correlation coefficient (r)=0.568, indicating a moderate correlation and positive direction. This result reflects that someone with good knowledge will have good behavior. This result is in accordance with Xu et al. (2021) in East China, which states that health workers with higher knowledge scores have positive behavior in the use of antibiotics with a p-value <0.001 (p<0.05).[27] Every individual has a behavior that is different from other individuals. Behavior does not always follow and is based on knowledge and attitudes. There are several theories regarding the determining factors that can influence behavior formation. Lawrence

Green's theory, which explains the factors that determine or influence behavior, states that knowledge is a factor that can facilitate the formation of a person's behavior.[28]

Knowledge of Each Professional Group Based on Parameters in the Questionnaire Dimensions

Health worker knowledge based on the topic is shown in Table III.

Based on the results shown in Table III, all specialist doctors/pharmacists (100%) and 88.89% of general doctors/dentists have good knowledge of the topic "etiology of antibiotic resistance." These results are in line with research by Limato et al. (2022), which states that >80% of respondents agreed that the cause of resistance could be the irrational use of antibiotics.[12] The etiology of antibiotic resistance includes inaccurate indications, antibiotic selection, time and duration of drug administration, dose, route of administration, and not paying attention to side effects and drug interactions.[5,6]

In the second topic, "antibiotic resistance control," all health workers (100%) exhibited good knowledge. Research by Limato et al. (2022) shows similar results, which state that >85% of respondents agreed that the wise use of antibiotics and the guidelines for giving antibiotics can control antibiotic resistance.[12] Controlling antibiotic resistance can be done by providing antibiotic information to patients, implementing the ARCP, prescribing antibiotics according to guidelines, maintaining good hand hygiene before direct contact with patients, combining antibiotics prescribing, and microbiology laboratory role in antibiotic resistance control.[5,6]

In the third topic, "the effect of antibiotic resistance," 88.89% of general doctors/dentists, 94.12% of specialist doctors/dentists, and 69.23% of pharmacists had good knowledge. In this topic, all health workers answered incorrectly the question about the "etiology of sepsis is antibiotic-resistant bacteria." Sepsis is an inflammatory and infectious body reaction caused by pathogens and toxins entering the blood circulation. Antibiotic-resistant bacteria do not necessarily cause sepsis, but sepsis can occur if an infection is not treated properly, causing therapeutic failure. The resistance that occurs in sepsis patients could double the mortality rate.[29,30] The effect of antibiotic resistance includes increased costs, mortality and morbidity, and complications.[5,6]

Overall, most health workers have good knowledge of the three topics. Antibiotic stewardship forms a strategy to control antibiotic resistance by increasing patient care and optimal therapeutic outcomes, reducing adverse effects by reducing antimicrobial use (lower antibiotic resistance), and reducing antibiotic costs.[31] Good knowledge of health workers about antibiotic stewardship is needed to escalate therapeutic success, prevent risks to patient safety, and prevent the spread of antibiotic resistance.[9]

Behavior of Each Profession Based on Parameters in the Questionnaire Dimension

The health worker behavior based on the questionnaire topic is shown in Table IV.

Based on the study results, most health workers have good behavior on the first and second topics listed in Table IV. The first topic describes the behavior of health workers in performance ARCP, such as providing information about using antibiotics to the patients, coordinating antibiotics prescribing with other health workers, microbiological examination as an antibiotic prescribing guide, and recommending and monitoring antibiotic prescribing.[5,6] The results show that 66.67% of general doctors/dentists, 82.35% of specialist doctors/dentists, and 84.62% of pharmacists present good behavior. Minister of Health regulations No. 8 Year 2015 states that the hospital must implement ARCP optimally. The main goal of ARCP is to prevent the development of antibiotics by applying antibiotic stewardship and prevent the spread of resistant microbes by increasing the practice of infection prevention and control principles. Achievement of ARCP goals is expected to decrease morbidity and mortality, secondary infection, length of hospital stays, and antibiotic costs.[14]

The second topic concerns good antibiotic prescribing practices in health workers, such as giving antibiotics to patients with the proper indication, duration of administration, diagnosis, and the route of administration.[5,6] The results showed that most general doctors/dentists and specialist doctors/dentists have good behavior, that is, 77.78% and 70.59%, respectively. The majority of pharmacists have moderate behavior (84.62%). Minister of Health regulations No. 8 Year 2015 also stated that good antibiotic prescribing practices are the rational use of antibiotics by considering the impact of the emergence and spread of resistant microbes (bacteria) to inhibit the selection pressure of antimicrobial resistance.[14]

In the third topic, 44.45% of general doctors and dentists tend to have good behavior, and 52.94% of specialists tend to have moderate behavior. Meanwhile, 46.15% of pharmacists have low behavior, such as recommending decontamination of patient care equipment in the patient's room to the Infection Control Prevention team. This difference is likely because doctors have more access to the patient's room and know more about the condition of the patient and the patient's room so that they will more quickly convey information

Table III. Knowledge of Health Worker Based on Questionnaire Topics

Knowledge	Professional Groups			Total (n=39)
	General doctor/ dentists (n=9)	Specialist doctors/dentists (n=17)	Pharmacist (n=13)	
	n (%)	n (%)	n (%)	n (%)
The etiology of antibiotic resistance				
Good	8 (88.89)	17 (100)	13 (100)	38 (97.44)
Moderate	1 (11.11)	0 (0)	0 (0)	1 (2.56)
Low	0 (0)	0 (0)	0 (0)	0 (0)
The antibiotic Resistance Control				
Good	9 (100)	17 (100)	13 (100)	39 (100)
Moderate	0 (0)	0 (0)	0 (0)	0 (0)
Low	0 (0)	0 (0)	0 (0)	0 (0)
The effect of antibiotic resistance				
Good	8 (88.89)	16 (94.12)	9 (69.23)	33 (84.62)
Moderate	1 (11.11)	0 (0)	4 (30.77)	5 (12.82)
Low	0 (0)	1 (5.88)	0 (0)	1 (2.56)

Table IV. Behavior of Health Worker Based on Questionnaire Topics

Behaviors	Professional Groups			Total (n=39)
	General doctor/ dentists (n=9)	Specialist doctors/dentists (n=17)	Pharmacist (n=13)	
	n (%)	n (%)	n (%)	n (%)
Performance of Antimicrobial Resistance Control Program				
Good	6 (66.67)	14 (82.35)	11 (84.62)	31 (79.49)
Moderate	3 (33.33)	2 (11.76)	2 (15.38)	7 (17.95)
Low	0 (0)	1 (5.88)	0 (0)	1 (2.56)
Good Antibiotic Prescribing Practice				
Good	7 (77.78)	12 (70.59)	1 (7.69)	20 (51.28)
Moderate	2 (22.22)	5 (29.41)	11 (84.62)	18 (46.15)
Low	0 (0)	0 (0)	1 (7,69)	1 (2.56)
Performance of Preventing the Spread of Resistant Microbes				
Good	4 (44.45)	5 (29.41)	3 (23.08)	12 (30.77)
Moderate	2 (22.22)	9 (52.94)	4 (30.77)	15 (38.46)
Low	3 (33.33)	3 (17.65)	6 (46.15)	12 (30,77)
Controlling Antibiotic Prescribing				
Good	1 (11.11)	4 (23.53)	11(84.62)	16 (41.03)
Moderate	5 (55.56)	7 (41.18)	0 (0)	12 (30.77)
Low	3 (33.33)	6 (35.29)	2 (15.38)	11 (28.20)

related to the condition of the patient's room to the infection control team, unlike pharmacists are usually responsible for determining whether the prescribed medication optimally meets the patient's needs and treatment goals.[32] All health workers should be able to collaborate in this ARCP, so it is hoped that not only doctors will recommend room cleaning to the infection prevention and control team, but pharmacists too can play a role in this matter. The spread of bacterial infections can be prevented by cleaning the rooms of patients with antibiotic-resistant microbial strains.[14]

The fourth topic on the behavior questionnaire shows that 84.62% of pharmacists have good behavior, while 55.56% of general doctors/dentists and 41.18% of specialist doctors/dentists tend to have moderate behavior, such as in using the guidelines for the use of antibiotics, and formulary when giving antibiotics to patients. Moderate behavior in the doctor group was due to the absence of guidelines for the use of antibiotics, or information about the guidelines had not been informed to a health worker. Furthermore, other studies

explain that doctors sometimes know about antibiotic use guidelines but do not obey the guidelines. This is due to pressure from patients, uncertainty about infectious disease treatment, infection pathogenesis, and the belief that treatments other than those recommended are more effective.[33]

Health workers had varying behavior towards these four topics. This can occur because most health workers have not attended ARCP training. In addition, the absence or dissemination of antibiotic guidelines and formulary information can affect health worker behavior in antibiotic stewardship. Thus, disseminating antibiotic guidelines and formularies to health workers is crucial. Some studies show that doctors have increased knowledge about antibiotics after attending training on antibiotic use, and there has been a decrease in antibiotic prescribing after three months of using antibiotic guidelines and dissemination.[34–36] Antibiotic selection must be done according to antibiotic guidelines, and antibiotics must be available in the hospital formulary. The antibiotic guideline is based on each hospital's agreement according to the hospital's antibiogram and is updated regularly to provide the latest information on antibiotics. Moreover, collaborative practice from all health workers is important to stop the spread of antibiotic resistance.[5,37] A study showed a 34% risk reduction in the average level of antibiotic use with increasing collaborative practices.[38] Based on our knowledge, this was the first data about the knowledge and behavior of health workers at a private hospital in Pontianak, despite the small population of the respondents. Therefore, further research is recommended using a larger population.

CONCLUSION

Overall, health workers have good knowledge and behavior on antibiotic stewardship, and a significant relationship exists between their knowledge and behavior. Antibiotic stewardship plays an important role in preventing antibiotic resistance. Thus, health workers and stakeholders need to collaborate in implementing antibiotic stewardship in health facilities.

ACKNOWLEDGEMENT

The reseacher would like to thank the hospital for the research permit. The study was funded by DIPA of Medical Faculty, Universitas Tanjungpura year of 2023.

STATEMENT OF ETHICS

The research has been approved by the Faculty of Medicine Health Research Ethics Committee of Universitas Tanjungpura, Pontianak, with No.7353/UN22.9/PG/2022.

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