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Relationship between Knowledge about Antibiotics and Behavior in the Use of Antibiotics in University Students

Tirta Darmawan Susanto[1*], Trevino Aristarkus Pakasi[2], Dewanto Andoko[1], Tiara Julianti[3], Naftali Intania Kristianti[3]

[1]Department of Family Medicine and Primary Care, Faculty of Medicine, Universitas Pelita Harapan, Tangerang

[2]Department of Family Medicine and Primary Care, Faculty of Medicine, Universitas Indonesia, Jakarta

[3]Faculty of Medicine, Universitas Pelita Harapan Tangerang

*Corresponding author: tirta.d.susanto@gmail.com

Abstract

Background: Antibiotics are the type of antimicrobials that have been used to treat bacterial infection in the body. The knowledge about antibiotics can influence antibiotic use. In Indonesia, many studies have contradictory results regarding the relationship between antibiotic knowledge and attitude toward antibiotic use. Therefore, this study aims to know about the level of knowledge and attitude regarding antibiotic use in medical students and other students and to determine the relationship between knowledge about antibiotics and attitude toward antibiotic use. **Aim:** To determine the relationship between knowledge about antibiotics and attitude regarding antibiotic use in the medical students class of 2020 UPH. **Methodology:** This analytic cross-sectional study was conducted in January 2023. The questionnaires were distributed through social media to

177 students at UPH. The submitted data was arranged in Microsoft Excel and analyzed with SPSS Statistics using Chi-Square, Fisher's Exact, and Binary Logistic methods. **Result:** Of a total of 183respondentst, there are 102 (55,6%respondentsnt who have a good knowledge of antibiotics, and 101 (55,2%) respondents who possess a good attitude in using antibiotics. **Conclusion:** The result denoted a significant correlation between knowledge and attitude regarding antibiotic use in medical students class of 2020 UPH (p= 0,0001 in the chi-square method and p= 0,016 in Fisher's Exact; 95% CI = 1,87-54,03).

Keywords: knowledge, behavior, antibiotics use, university students

1. Introduction

Antibiotics are antimicrobials used to treat bacterial infections in the body. They work by inhibiting the growth and replication of bacteria or directly killing them.[1] From 2000 to 2015, global antibiotic consumption increased by 65%, from 21.1 billion to 34.8 billion DDD (Defined Daily Dose), while the average antibiotic consumption rate worldwide increased by 28%, from 16.4 billion DDD per 1,000 population per day to 20.9 billion DDD. This increase was driven by low- and middle-income countries, where the rise in antibiotic consumption correlated with an increase in the countries' per capita GDP (Gross Domestic Product) (p=0.004). Economic growth enhances the flow of goods and services, including antibiotics.

Additionally, these countries experienced increased urbanization, facilitating the transmission of infectious diseases and contributing to the relationship between GDP growth and antibiotic consumption. The rapid urbanization was also associated with increased bacterial infections such as enteric fever. The rising incidence of non-bacterial infections due to urbanization, such as dengue fever, chikungunya, and virus-induced diarrhea, significantly drove inappropriate antibiotic use.[2]

Improper and excessive antibiotic use can lead to a condition known as antibiotic resistance. Antibiotic resistance occurs when bacteria adapt over time and no longer respond to the antibiotics given, making infections more challenging to treat and increasing the risk of severe diseases.[3] According to the Lancet Journal, in 2022, it is

estimated that 1.27 million deaths worldwide resulted directly from infections caused by antibiotic-resistant bacteria in 2019. The World Health Organization (WHO) states that six primary pathogens contribute to antibiotic resistance: Escherichia coli, Staphylococcus aureus, Klebsiella pneumoniae, Streptococcus pneumoniae, Acinetobacter baumannii, and Pseudomonas aeruginosa.[4] Based on the WHO Global Report on Surveillance of Antimicrobial Resistance in 2015, Southeast Asia has the highest rates of antibiotic resistance globally, with 30-80% of antibiotic use lacking indications. Among the 27 countries with a high burden of antibiotic resistance, Indonesia ranks 8th. The prevalence of S. pneumoniae resistance to tetracycline reaches 56% in Jakarta, while resistance to cotrimoxazole is approximately 45% and to penicillin is around 24% in the Semarang Province. According to the Antimicrobial Resistant in Indonesia (AMRIN-Study), 81% of E. coli exhibits very high resistance to ampicillin (73%), cotrimoxazole (56%), chloramphenicol (43%), ciprofloxacin (22%), and gentamicin (18%).[5]

Antibiotic use can be influenced by knowledge about antibiotics. Pratiwi et al.'s study in 2019 found a significant correlation (correlation coefficient 0.524) between knowledge about antibiotics and attitudes and behaviors in antibiotic use.[6] Another study by Wulandari et al. in 2021 analyzed the relationship between knowledge about antibiotics and behavior in antibiotic use using Fisher's exact test, obtaining a value of 0.04 (p-value < 0.05), proving a significant relationship between knowledge about antibiotics and behavior in antibiotic use.[7] However, a study by Sianturi et al. in 2019 demonstrated no significant relationship between the level of knowledge about antibiotics and attitudes and actions in using antibiotics without a prescription ($p > 0.05$).[8] Additionally, a study showed high knowledge and perceptions of antibiotics, antibiotic use, and antibiotic resistance among healthcare professionals. More than 80% of respondents (healthcare professionals) acknowledged a connection between prescribing, dispensing, and administering antibiotics and the spread of antibiotic resistance. Therefore, this study excluded healthcare professionals from the sample to avoid bias.[9]

Furthermore, Lim et al.'s study in 2022 demonstrated that young adults aged 18-24 spend a significant amount of time exploring social media to find content related to health from friends, news, or advertisements. Most seek health information by joining communities or following relevant social media pages. 89.1% of participants stated that they use social media thrice or more daily, and 10.9% use it twice daily. Overall, 67.8%

of participants use social media to learn about health.[10] A study by Goodyear et al. in 2017 also stated that health-related information from social media impacts their health-related behavior, with 46% of young people reporting that they have changed their health-related behavior due to something they saw on social media. Health-related content on social media ultimately influences the understanding and behavior of young people because they assume that the content is reasonable, coupled with the fact that access to health information for young people is still limited.[11] Young people are also more independent in decision-making, as confirmed by Fleary et al.'s study in

Research Objectives

1. General Objective: Explore the relationship between antibiotic knowledge and usage behavior among University Pelita Harapan students (class of 2020).

2. Specific Objectives:

- Assess the antibiotic knowledge level among University Pelita Harapan students.
- Examine the antibiotic usage behavior among University Pelita Harapan students.

Research Questions

1. Is there a relationship between antibiotic knowledge and usage behavior among University Pelita Harapan medical students (class of 2020)?

2. What is the antibiotic knowledge level among University Pelita Harapan students (class of 2020)?

3. What is the antibiotic usage behavior among University Pelita Harapan students (class of 2020)?

Research Benefits

1. Academic Benefits: As a reference for future research on interventions to enhance antibiotic knowledge and behavior.

2. Practical Benefits:

- Enhances awareness among respondents regarding proper antibiotic use.
- Evaluates health-related knowledge and behavior among students.

2. Method

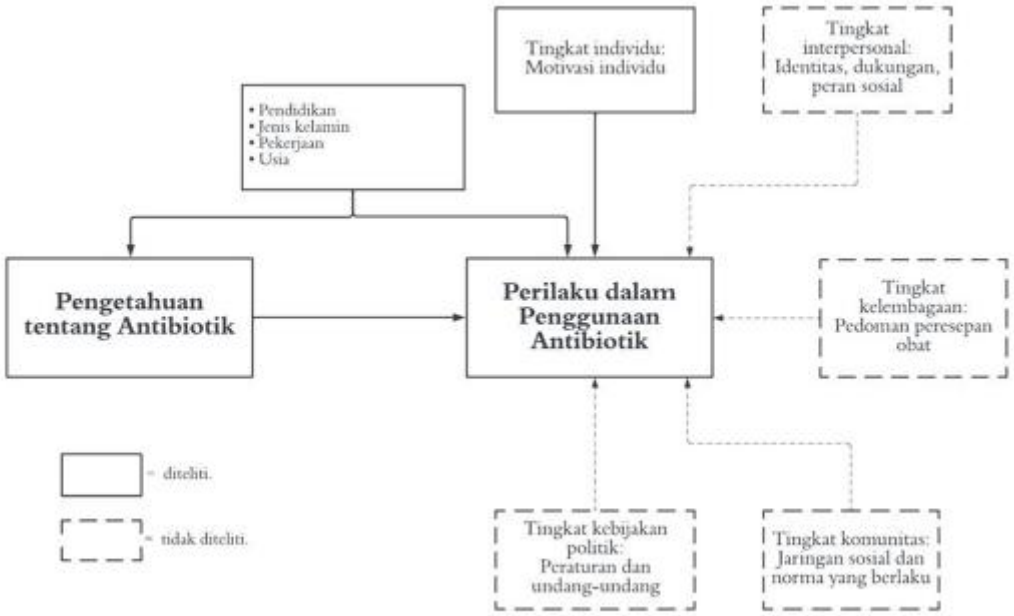

Figure 1 Theoretical Framework

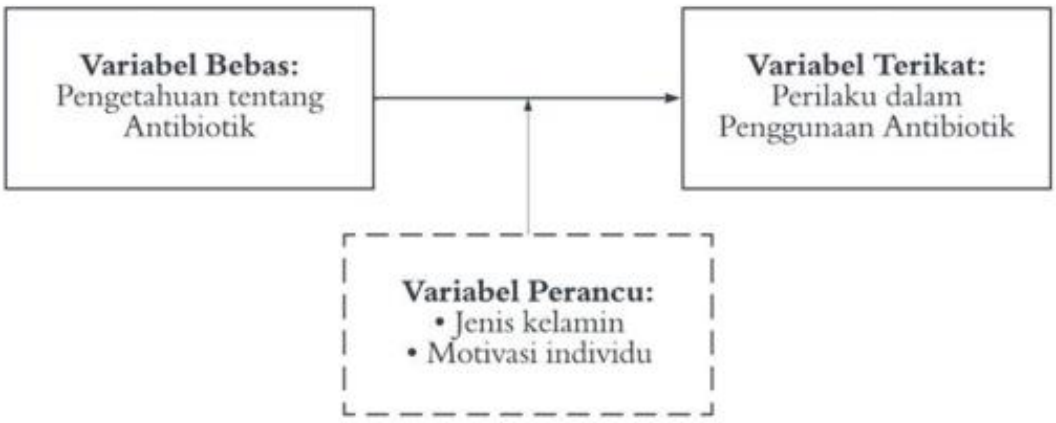

Figure 2. Conceptual Framework

Hypotheses

There is a relationship between knowledge about antibiotics and behavior in the use of antibiotics among the class of 2020 students at Pelita Harapan University.

Variables

The independent variable in this study is knowledge about antibiotics.

The dependent variable in this study is behavior in the use of antibiotics.

The confounding variables in this study are gender and individual motivation.

Research Design

The research design employed in this study is an analytical descriptive design with a cross-sectional study.

Location and Time of Research

The research was conducted online, utilizing a g-form questionnaire distributed through social media from January 2023 to March 2023.

Research Materials

The research materials include a questionnaire to measure the level of knowledge about antibiotics and a questionnaire to measure behavior in the use of antibiotics. These have been validated in previous research by Pratiwi et al. Additionally, the study employs the MMAS-8 questionnaire to measure individual motivation in medication intake.

Research Meth]od

This study gathers primary data through questionnaires distributed as Google Forms on social media platforms such as LINE, WhatsApp, and Instagram. Prior to questionnaire completion, researchers provided an explanation about the study and obtained informed consent from respondents. Those willing and meeting the inclusion criteria were collected

and entered into the database. Subsequently, respondent data was further analyzed.

Research Population

The target population for this study is students in Banten.

The study covers students from the class of 2020 at Pelita Harapan University, consisting of five faculties: Economics and Business, Design, Tourism, Music, and Law, conducted online through social media platforms such as LINE, WhatsApp, and Instagram.

Research Sample

The research sample included in the database and analyzed comprises students from the 2020 class at Pelita Harapan University who meet the inclusion criteria and agree to participate in the study.

Inclusion Criteria

Inclusion criteria for this study include:

- Students from the class of 2020 at Pelita Harapan University.
- Students from the Economics and Business, Design, Tourism, Music, and Law faculties.
- Ability to complete online questionnaires.
- Previous use of antibiotics.

Exclusion Criteria

Exclusion criteria for this study include:

- Medical students or students in other health-related fields, such as nursing and pharmacy.
- Respondents unwilling to participate.

Sampling Method

The sampling method used in this study is cluster random sampling for potential subjects meeting the research criteria.

3. Result

Characteristics of Research Respondents

The sampling for this study took place from January 2023 to March 2023. Through cluster random sampling, 186 respondents filled out the questionnaire. One respondent declined to participate, resulting in the exclusion of one participant. Additionally, two respondents who had never used antibiotics were excluded. Consequently, the study included 183 respondents who met the criteria.

Out of the 183 respondents, the majority were female (55.2%), while 44.8% were male. Concerning age distribution, most respondents were 20 years old (57.4%). The level of knowledge among UPH 2020 students regarding antibiotics is presented in Table 2, assessed through a questionnaire covering seven domains. The interpretation of questionnaire results is detailed in Table 5.3, categorizing respondents into three groups based on their scores: good (75-100%), moderate (56-74%), and poor (≤55%)

Table 1 Demographic Data of Research Respondents

Variable	n (%)
Gender	
Female	101 (55.2%)
Male	82 (44.8%)
Age	
19 years	6 (3.3%)
20 years	105 (57.4%)
21 years	53 (29%)
22 years	13 (7.1%)
23 years	5 (2.7%)
25 years	1 (0.5%)
Faculty of Origin	
Law	39 (21.3%)
Design	34 (18.6%)

Tourism	39 (21.3%)
Business	36 (19.7%)
Music	35 (19.1%)

Table 2 Interpretation of the Knowledge Questionnaire

Pertanyaan	Jawaban Tepat
Informasi Antibiotik	
Apakah antibiotik harus dibeli dengan resep dokter?	Ya
Apakah antibiotik boleh disimpan dan digunakan kembali saat kambuh?	Tidak
Indikasi Antibiotik	
Apakah antibiotik dapat menyembuhkan semua jenis penyakit?	Tidak
Apakah antibiotik dapat mengobati infeksi karena bakteri?	Ya
Interval Penggunaan Antibiotik	
Apakah semua antibiotik diminum 3 kali dalam sehari?	Tidak
Lama Penggunaan Antibiotik	
Apakah penggunaan antibiotik boleh dihentikan ketika gejala sudah hilang?	Tidak
Efek Samping Antibiotik	
Apakah antibiotik memiliki efek samping seperti gatal dan alergi serta mual?	Ya
Dosis Antibiotik	
Apakah penggunaan antibiotik yang tidak sesuai aturan dapat menyebabkan bakteri kebal terhadap antibiotik (resistensi)?	Ya
Pemilihan Obat	
Apabila terjadi demam, haruskah saya meminum antibiotik?	Tidak

Table 3 Respondents' level of knowledge

No	Pertanyaan	n (%)	
		Tepat	Tidak Tepat
1	Apakah antibiotik harus dibeli dengan resep dokter?	144 (78,7%)	39 (21,3%)
2	Apakah antibiotik dapat menyembuhkan semua jenis penyakit?	167 (91,3%)	16 (8,7%)
3	Apakah antibiotik dapat mengobati infeksi karena bakteri?	163 (89,1%)	20 (10,9%)
4	Apakah semua jenis antibiotik diminum 3 kali dalam sehari?	125 (68,3%)	58 (31,7%)
5	Apakah penggunaan antibiotik boleh dihentikan ketika gejala sudah hilang?	116 (63,4%)	67 (36,6%)
6	Apakah antibiotik memiliki efek samping seperti gatal dan alergi serta mual?	96 (53,3%)	84 (46,7%)
7	Apakah antibiotik boleh disimpan dan digunakan kembali saat sakit kambuh?	112 (61,2%)	71 (38,8%)
8	Apakah penggunaan antibiotik yang tidak sesuai aturan dapat menyebabkan bakteri kebal terhadap antibiotik (resistensi)?	156 (85,2%)	27 (14,8%)
9	Apabila terjadi demam, haruskah saya meminum antibiotik?	142 (77,6%)	41 (22,4%)

Wrong answers will get a score of 0. Then, to determine the level of knowledge, the following formula is used: the level of expertise (%) = score obtained / total value (9) x 100%. Respondents will be categorized as having good knowledge if they score 75-100%, sufficient knowledge of 56-74%, and poor category if ≤55%.

Meanwhile, the level of behavior of UPH students in the 2020 class was assessed using a questionnaire, which can be interpreted as follows:

Table 4 Interpretation of the Behavioral Questionnaire

No	Pernyataan	Interpretasi			
		Selalu	Sering	Kadang	Tidak Pernah
1	Saya membeli antibiotik tanpa resep dokter	1	2	3	4
2	Saya membeli antibiotik dengan resep dokter	4	3	2	1
3	Saya menggunakan antibiotik saat sakit gigi atau flu	1	2	3	4
4	Saya menggunakan antibiotik apabila disarankan oleh teman atau keluarga yang bekerja sebagai dokter	4	3	2	1
5	Saya menggunakan antibiotik ketika disarankan teman atau keluarga tanpa diperiksa oleh dokter	1	2	3	4
6	Saya menyimpan antibiotik dan menggunakannya kembali saat sakit kambuh	1	2	3	4
7	Petugas apotek mengijinkan saya membeli antibiotik tanpa resep dokter	1	2	3	4
8	Saya mengurangi jumlah antibiotik yang diberikan dokter jika merasa membaik	1	2	3	4
9	Saya tetap meminum antibiotik sesuai aturan dari dokter meskipun sudah merasa membaik	4	3	2	1
10	Saya segera mengganti jenis antibiotik yang saya gunakan apabila gejala yang saya alami tidak segera membaik	1	2	3	4
11	Saya membeli antibiotik tanpa resep dokter karena saya pernah menggunakan antibiotik tersebut sebelumnya	1	2	3	4
12	Penggunaan antibiotik tanpa resep dokter dapat menghemat biaya pengobatan saya	1	2	3	4
13	Saya membeli antibiotik tanpa resep dokter di apotek karena gejala penyakit saya sekarang sama dengan gejala penyakit sebelumnya dan sembuh dengan antibiotik	1	2	3	4

Table 5 Level of Respondent Behavior

No	Pernyataan	n (%)			
		Selalu	Sering	Kadang	Tidak Pernah
1	Saya membeli antibiotik tanpa resep dokter	7 (3,8%)	17 (9,3%)	84 (45,9%)	75 (41%)
2	Saya membeli antibiotik dengan resep dokter	81 (44,3%)	54 (29,5%)	44 (24%)	4 (2,2%)
3	Saya menggunakan antibiotik saat sakit gigi atau flu	6 (3,3%)	17 (9,3%)	77 (42,1%)	83 (45,4%)
4	Saya menggunakan antibiotik apabila disarankan oleh teman atau keluarga yang bekerja sebagai dokter	27 (14,8%)	56 (30,6%)	57 (31,1%)	43 (23,5%)
5	Saya menggunakan antibiotik ketika disarankan teman atau keluarga tanpa diperiksa oleh dokter	14 (7,7%)	19 (10,4%)	73 (39,9%)	77 (42,1%)
6	Saya menyimpan antibiotik dan menggunakannya kembali saat sakit kambuh	9 (4,9%)	26 (14,2%)	53 (29%)	95 (51,9%)
7	Petugas apotek mengijinkan saya membeli antibiotik tanpa resep dokter	9 (4,9%)	33 (18%)	65 (35,5%)	76 (41,5%)
8	Saya mengurangi jumlah antibiotik yang diberikan dokter jika merasa membaik	24 (13,1%)	27 (14,8%)	48 (26,2%)	84 (45,9%)
9	Saya tetap meminum antibiotik sesuai aturan dari dokter meskipun sudah merasa membaik	79 (43,2%)	47 (25,7%)	40 (21,9%)	17 (9,3%)
10	Saya segera mengganti jenis antibiotik yang saya gunakan apabila gejala yang saya alami tidak segera membaik	17 (9,3%)	23 (12,6%)	50 (27,3%)	93 (50,8%)
11	Saya membeli antibiotik tanpa resep dokter karena saya pernah menggunakan antibiotik tersebut sebelumnya	15 (8,2%)	26 (14,2%)	71 (38,8%)	71 (38,8%)
12	Penggunaan antibiotik tanpa resep dokter dapat menghemat biaya pengobatan saya	16 (8,7%)	22 (12%)	53 (29%)	92 (50,3%)
13	Saya membeli antibiotik tanpa resep dokter di apotek karena gejala penyakit saya sekarang sama dengan gejala penyakit sebelumnya dan sembuh dengan antibiotik	11 (6%)	42 (23%)	56 (30,6%)	74 (40,4%)

Interpretation and categories of respondents' behavior levels are carried out by adding up the scores obtained by respondents / total value (54) x 100% and classified as correct behavior if the score is 76-100%, sufficient if the score is 56-75%, and inadequate if the score is ≤55%.

By interpreting the questionnaire above, the knowledge and behavior characteristics of research respondents can be grouped in the table below.

Table 6 Characteristics of Knowledge and Behavior of Research Respondents

Variable	n (%)
Knowledge	
Poor	41 (22.4%)
Moderate	40 (22%)

Good	102 (55.6%)
Behavior	
Poor	14 (7.6%)
Moderate	68 (37.2%)
Good	101 (55.2%)

Based on the distribution of respondent characteristics in Table 3, the majority demonstrated good knowledge about antibiotics (55.6%). Similarly, 55.2% exhibited good behavior in antibiotic use.

Comparison of Knowledge Between Groups of Confounding and Demographic Variables.

Table 7 Comparison of Knowledge Between Groups of Confounding and Demographic Variables

	Knowledge (%)		**OR (95% CI)**	**P-value**
	Bad	**Good**		
Motivation				
Low	16 (9.7%)	149 (90.3%)	0.54	0,41
High	3 (16.7%)	15 (83.3%)	(0.14 - 2.06)	
Gender				
Female	11 (10.9%)	90 (89.1%)	1.13	1
Male	8 (9.8%)	74 (90.2%)	(0.43 - 2.96)	
Faculty				
Law	6 (15.4%)	33 (84.6%)		
Design	2 (5.9%)	32 (94.1%)		0.35
Tourism	3 (7.7%)	36 (92.3%)		
Business	6 (16.7%)	30 (83.3%)		
Music	2 (5.7%)	33 (94.3%)		

Bivariate Analysis of the Relationship Between Antibiotic Knowledge and Behavior

Bivariate analysis of the relationship between antibiotic knowledge and behavior was assessed using Pearson Chi-Square. The results in Table 4 indicate a significant association between knowledge and behavior ($p < 0.05$).

Table 8 Pearson Chi-Square Test

Knowledge	Behavior (%)			Total	*P-Value*
	Incorrect	Adequate	Correct		
Poor	9 (22%)	21 (51.2%)	11 (26.8%)	41	
Moderate	2 (5%)	22 (55%)	16 (40%)	40	0,0001
Good	3 (2.9%)	25 (24.5%)	74 (72.5%)	102	
Total	14 (7.7%)	68 (37.2%)	101 (55.2%)	183	

The table shows that 74 respondents (72.5%) with good knowledge demonstrated correct antibiotic use behavior. The Pearson Chi-Square analysis yielded a p-value of 0.0001, proving a significant relationship between antibiotic knowledge and behavior.

The researcher performed additional bivariate analysis for odds ratio (OR) calculation by grouping variables into two categories. The results are presented in Table 5.

Table 9 Fisher's Exact Test

Knowledge	Behavior (%)		Total	OR (95% CI)	P-value
	Incorrect	Correct			
Poor	3 (15.8%)	16 (84.2%)	19	10,06	0,016
Good	3 (1.8%)	161 (98.2%)	164	(1,87-54,03)	
Total	6 (3.3%)	177 (96.7%)	183		

The Fisher's Exact Test demonstrated a significant relationship between antibiotic knowledge and behavior ($p = 0.016$).

Multivariate Analysis Results

Before conducting multivariate logistic regression analysis, bivariate chi-square tests were performed to identify candidate independent variables for further study. Variables with p-values ≤ 0.250 were considered candidates. The variables analyzed included individual motivation and gender. It can be concluded that the knowledge level, which is the independent variable, can be a candidate for multiple logistic regression testing. It can also be observed that gender and individual motivation variables do not have a significant relationship with antibiotic use behavior.

Subsequently, data analysis continued with multiple logistic regression analysis, excluding individual motivation and gender variables. The results are presented in Table 6.

Table 10 Multiple Logistic Regression Test

Behavior	P-value	OR (95% CI)
Good	0.006	14.24 (2.11 - 96)

The table above shows that the knowledge level influences an individual's antibiotic use behavior. This analysis obtained an R2 value of 27%, indicating that the examined independent variables affect the dependent variable by 27%. The likelihood of someone having correct antibiotic use behavior with good knowledge is 98.5%, and the chance of someone behaving incorrectly with poor knowledge is 82.1%.

4. Discussion

Supported by previous studies' inconsistent results regarding the relationship between knowledge and behavior in antibiotic use, this research demonstrates a significant association between these two variables. Unlike some studies that didn't analyze confounding variables influencing antibiotic use behavior, this study considered factors such as motivation and gender.

The bivariate analysis indicates no significant relationship between gender and antibiotic use behavior, contrary to findings in other studies. As measured by the MMAS-8, motivation did not show a significant association with antibiotic use behavior in this study. However, the limited number of highly motivated respondents may have affected the results.

Significantly, the study establishes a strong association between knowledge and antibiotic use behavior. The findings align with studies by Pratiwi et al. and Wulandari et al., emphasizing the importance of knowledge in shaping behavior related to antibiotic use. The study's strengths include a diverse respondent population and considering confounding variables.

Strengths and Limitations

While the study benefits from a diverse respondent pool and the inclusion of confounding variables, limitations exist. The online questionnaire method might lead to misunderstandings, and the generic MMAS-8 may not precisely measure motivation for antibiotic use. External factors like healthcare access and the attitudes of healthcare providers weren't fully explored, impacting the comprehensive understanding of antibiotic use behavior.

Overall, this research adds valuable insights into the complex interplay between knowledge,

motivation, and behavior in antibiotic use, contributing to the broader understanding of antibiotic resistance.

5. Conclusion

In conclusion, the research reveals the following key points:

1. There is a significant relationship between knowledge about antibiotics and behavior in antibiotic use among the class of 2020 students at Universitas Pelita Harapan. This is evidenced by a p-value of 0.0001 in the Pearson Chi-Square test and a p-value of 0.016 in the Fisher's Exact test (95% CI= 1.87-54.03).

2. Multivariate analysis identifies knowledge with a p-value of 0.006 as influencing antibiotic use behavior. The independent variable contributes 27% to the variation in the dependent variable.

3. Most of the 2020 cohort's knowledge level about antibiotics is good (55.6%), with a prevalence of sufficient knowledge at 22% and poor knowledge at 22.4%.

4. The percentage of antibiotic use behavior among the 2020 students is 55.2% correct, 37.2% sufficient, and 7.6% inadequate.

Recommendations

For Future Research

Based on the conducted research, the following recommendations are provided for future studies:

1. Utilize direct interview methods to gather data, reducing misunderstandings and errors in questionnaire completion by respondents.

2. Consider investigating and measuring external factors such as healthcare access and the attitudes and behaviors of healthcare providers, which can influence an individual's antibiotic use behavior.

For Universitas Pelita Harapan Students

Several recommendations for students at Universitas Pelita Harapan include:

1. Maintain correct behavior in antibiotic use and trust valid information related to antibiotics from reliable sources, particularly healthcare professionals.

2. Enhance motivation for proper medication intake by ensuring the completion of antibiotic courses and finishing them even if symptoms improve to prevent antibiotic resistance.

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