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RESEARCH ARTICLE

Knowledge, attitudes, and practices for using and disposing of antibiotics: A cross-sectional study at an Indonesian community

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Abstract

Background: Antibiotic misuse and improper disposal contribute to the rise in antibiotic resistance. **Objective:** This study aimed to assess the knowledge, attitude, and practice of antibiotic use and disposal in Surabaya communities. **Method:** An electronic questionnaire was circulated through social media using convenience sampling. The data was then analysed descriptively, and any correlation between variables was analysed using SPSS. **Result:** The research showed that most of the respondents had good knowledge (71.6%), a positive attitude (68.2%), and good practice (78%). The correlation test showed a strong positive correlation between knowledge and practice (r = 0.568; p < 0.05). **Conclusion:** Most respondents demonstrated good knowledge, attitude, and practice. Nonetheless, education on rational antibiotic use and proper disposal should be significantly expanded.

Introduction

Antibiotic resistance is a global problem that is becoming a concern in the health sector. The Centre for Disease Control and Prevention (CDC) estimates 35,000 million deaths from antibiotic resistance in America (US Department of Health and Human Services & CDC., 2019). Infections caused by resistant bacteria have an economic impact, particularly in developing countries, increasing care and treatment costs (Friedman *et al*., 2016; World Health Organisation, 2017).

Antibiotic resistance develops more quickly in the community due to antibiotic misuse and overuse. Antibiotics that are left over, unused, expired, and improperly disposed of contribute to antibiotic resistance (Thai *et al*., 2018). The community's lack of knowledge, attitudes, and beliefs about antibiotics are the leading causes of irrational antibiotic use (Machowska & Lundborg, 2019). Research in several countries showed that more than half of the respondents had insufficient knowledge, attitudes, and adherence to antibiotic use and resistance (Nepal & Bhatta, 2018; Lim *et al*., 2021).

The World Health Organisation (WHO) has issued a global action plan to tackle antibiotic resistance. One of the goals is to increase public awareness and understanding of antibiotic resistance through effective communication, education, and training (World Health Organisation, 2017). Through the Healthy Indonesia Program and Gema Cermat (Smart Community Movement Using Drugs), as well as the Drug Awareness Family Movement (GKSO) promoted by the Indonesian Pharmacists Association (IAI), the Indonesian government has increased the focus on good drug management programs.

Community behaviour research is critical for global action to combat antibiotic resistance (World Health Organisation, 2017). Surveys to identify the knowledge, attitudes, and practices of antibiotic management have been carried out in various countries, with multiple research respondents, such as the public (Nepal & Bhatta, 2018; Lim *et al*., 2021), students (Marzan *et al*., 2021; Wang *et al*., 2020) and healthcare practitioners (Di Gennaro *et al*., 2020; Widayati *et al*., 2011).

Research related to the use and disposal of antibiotics in families in Indonesia is still limited; therefore, this study aimed to assess the knowledge, attitudes, and practices of using and disposing of antibiotics among the community in Surabaya. This study also aimed to see the differences in knowledge, attitude, and practice based on demographic factors and the relationship between knowledge, attitudes, and practice of using and disposing of antibiotics.

Methods

Settings

A descriptive cross-sectional study was carried out in Surabaya from February to June 2020. People aged over 18 years who had stored or used antibiotics in the previous six months and agreed to participate in the study were included. The convenience sampling technique was used to recruit participants.

Research instrument

The data were collected using a structured questionnaire developed by reviewing the literature (Ayele & Mamu, 2018; Bashaar *et al*., 2017; Salsabila & Kristina, 2020; Widayati *et al*., 2011). The questionnaire's validity and reliability were tested on 30 pilot participants. Prospective respondents were first asked to complete an informed consent form.

The first section contains demographic information, and each of the second through fourth sections has 11 questions. The second section contains knowledge statements with accurate/false answer options. The third section is intended to assess respondents' attitudes using a Likert scale with five levels. The fourth section addresses antibiotic management practice, with five response options.

Data analysis

SPSS version 25.0 was used to analyse the data. Descriptive data are presented as percentages (%) and frequencies (n). The Kolmogorov-Smirnov test was used to determine the normality of the data. The Mann-Whitney test was used to assess gender differences in knowledge, attitudes, and practices, and the Kruskal-Wallis test was used to determine age, education level, and occupation differences. A post hoc test was used to determine the different groups based on the Kruskal-Wallis test results. Spearman's rho correlation analysis investigated the relationship between knowledge, attitudes, and practices. Following the results of the correlation analysis, a linear regression analysis was performed to determine the strength of the influence and causality relationship. The impact of demographic factors was determined using a multivariable ordinal logistic analysis. In the study, a significance level of 0.05 was used.

Ethical clearance

This research has passed the ethical review with certificate No.07/LE/2020 issued by the Research Ethics Commission of the Faculty of Pharmacy, Universitas Airlangga, on February 14, 2020.

Results

Demographic characteristics

The distribution of the respondents' age, sex, education, and occupation is further shown in Table I. Antibiotics, vitamins, analgesics, and antipyretics were the drugs mostly kept by the respondents (26.3%).

Table I shows significant differences in knowledge scores based on gender and job level ($p < 0.05$). The results showed no significant differences in the knowledge, attitudes, and practice scores based on age and education level.

Knowledge, attitude, and practice of antibiotic use and disposing

The level of knowledge, attitudes, and practices of the respondents are shown in Table II. The results show that most respondents have good knowledge (n=169; 71,6%), have a positive attitude (n=231; 97,9%), and have good practice (n=184; 78%).

Demographic factors and level of knowledge

Table III displays the results of the ordinal logistics analysis. The ordinal logistic regression model showed that female respondents had the opportunity to have twice the level of knowledge as men [OR= 2.62, 95% CI (0.340; 1.569), $p < 0.05$]. Students have twice the chance of knowledge level compared to other job categories associated with a better level of knowledge [OR= 2.42, 95% CI (-0.620; 1.832), $p < 0.05$].

Table I: Respondents' demographic and scores of knowledge, attitude, and practices toward antibiotic use and disposal (n=236)

Characteristics	Frequency (n)	Percentage (%)	Knowledge		Attitude		Practice	
			Mean rank	*p*-value	Mean rank	*p*-value	Mean rank	*p*-value
Gender								
Male	62	26.3	102.61	**0.031****	115.97	0.339	122.65	0.118
Female	174	73.7	124.16		125.60		106.86	
Age								
18-25	128	54.2	119.09	0.737	110.23	0.135	108.52	0.132
26-35	36	15.3	111.68		129.75		121.74	
36-45	31	13.1	111.69		117.39		137.65	
46-55	40	16.9	128.99		133.10		132.93	
>65	1	0.4	79.50		222.00		108.50	
Education								
Junior high school	4	1.7	38.88	0.681	109.38	0.789	84.38	0.122
Senior high school	87	36.9	118.00		115.76		108.57	
Diploma	14	5.9	115.43		115.29		131.57	
Bachelor's degree	106	44.9	116.56		118.27		131.36	
Master's degree	19	8.1	133.32		124.08		154.37	
Doctoral degree	6	2.5	173.33		158.25		126.58	
Occupation								
Private	70	29.7	93.66	**0.0001****	114.21	0.560	111.36	0.313
Self-employed	18	7.6	114.53		108.19		129.47	
Public employee	23	9.7	140.41		140.02		143.87	
Students	99	41.9	138.40		118.54		117.66	
Others	26	11.0	92.98		118.00		110.90	

Note: **significant influence at $p < 0.05$ (2-tailed)

Table II: Respondents' level of knowledge, attitude, and practice (n=236)

Variables	Level	Frequency (n)	Percentage (%)
Knowledge	Low	13	5,5
	Moderate	54	22.9
	Good	169	71.6
Attitude	Negative	5	2.1
	Positive	231	97.9
Practice	Low	0	0
	Moderate	52	22.0
	Good	184	78.0

Table III: Multivariable logistic ordinal regression between demographic factors and level of knowledge

Demographic factors	Level of knowledge			
	Odds Ratio (OR)	*p*-value	Confidence Interval 95% (CI)	
			Lower bound	Upper bound
Gender=1][a]	2.620	0.002**	0.340	1.586
Gender=2[a]	1	.	.	.
Occupation=1[b]	0.866	0.762	-1.075	0.788
Occupation =2[b]	1.512	0.535	-0.893	1.720
Occupation =3[b]	2.699	0.138	-0.320	2.306
Occupation =4[b]	2.423	0.067**	-0.620	1.832
Occupation =5	1	.	.	.

[a]) Gender: 1 Female; (2) Male
[b]) Occupation: (1) Private; (2) Self-employed; (3): Public Employee; (4);Students; (5) Others
**Significant influence at $p < 0.05$ (2-tailed)

The correlation between knowledge, attitude, and practice

The Spearman's rho correlation results showed a positive correlation between the respondents' knowledge and practice of antibiotic management (r = 0.568; $p < 0.01$). The results also showed a relationship between knowledge and attitude(r = 0.154; p = 0.018), also attitude and practice (r = 0.146; p = 0.025). A linear regression test further analysed the relationship between knowledge and practice. The results of the linear regression tests in Table IV shows a significant positive correlation between knowledge and practice of antibiotic use and management (R= 0.592; R^2 = 0.350; = 0.592; 95% CI (1.488; 2.121); $p < 0.05$).

Table IV: Linear regression results between knowledge and practice

IV	DV	UC		SC	*t*	*p*
		B	SE	ß		
(Constant)	Knowledge	29.114	1.311	-	22.211	0.0001
Practice		1.805	0.161	0.592	11.225	0.0001

IV= Independent Variable; DV= Dependent variable UC= Unstandardised Coefficient; SE= Standard Error; SC= Standardised coefficient

Discussion

The study results showed differences in the knowledge scores based on the gender and occupation of the respondents ($p < 0.05$), with a higher knowledge score in the female group. In most developing countries, women are responsible for the care of family members, including the use of drugs; good knowledge is expected to contribute to the control of antibiotic resistance (Nepal *et al*., 2019).

The majority of respondents strongly agree with the statement that improper disposal of antibiotics can pollute the environment (n=137, 58,1%). Studies in Vietnam have shown that antibiotics collected in aquatic systems exacerbate the incidence of resistance and affect the virulence of microorganisms.

Most respondents strongly agreed that the community needed a particular program to dispose of antibiotics and other residual drugs (n=163; 69.1%). The survey in Kabul stated that most respondents (60.8%) chose the government as the party that plays a role in shaping public awareness of managing and disposing of residual or expired drugs (Bashaar *et al*., 2017).

Respondents demonstrated good antibiotic management practices in the survey. Most respondents never disposed of antibiotics directly in the trash (33.1%). This result differs from studies in Eutopia that show that most respondents destroy drugs by throwing them in the trash (Kahsay *et al*., 2020). The survey results also indicate that killing antibiotics is not good. Disposal of antibiotic drugs must first be mixed with soapy water to avoid environmental pollution. Some respondents (50%) never dissolved antibiotics with soapy water before throwing them into the sink or drains. Public awareness about the impact of improper disposal of antibiotics is needed to prevent antibiotic resistance (Azmi & Shakeel, 2020).

Knowledge-Attitude-Practice (KAP) theory states that knowledge, attitude, and practice are interrelated and directly influenced by knowledge and attitude (Rav-Marathe *et al*., 2016). The correlation analysis showed a relationship between knowledge and practice of using and managing antibiotics in the family (r = 0.568; $p < 0.05$). This relationship suggests that better understanding will go hand in hand with good antibiotic use and disposal practices.

The study shows that although the knowledge, attitudes, and practices possessed by the majority of respondents are good, there are still unsatisfactory results, especially in the proper disposal of antibiotics. Take-back programs have been carried out in several countries, such as Australia and America. Because pharmacies are easily accessible to the community, the implementation of the drug return program is primarily done in them. According to the scoping review study, the number of drugs returned demonstrated the community's enthusiasm for participating in the program (Rahmadani & Kristina, 2021). This indicates that the drug return program could be a viable solution to the community's need for a specialised drug waste management program.

The regression analysis results show that knowledge and practice have a strong relationship (r = 59.2%; $p <$ 0.05). The results also show that knowledge affects antibiotic management and disposal by 35%, while the other 65% is influenced by factors not included in the model or not observed in the study (R^2 = 0.350; $p <$ 0.05). Behaviour change is not only influenced by knowledge and attitudes but also by barriers, social support, and the ability to realise the desired practice (Rav-Marathe *et al*., 2016). These results indicate that a good public understanding of the use of antibiotics will not be sufficient to control antibiotic resistance. Community collaboration with government and health workers is also needed to prevent and control antibiotic resistance.

This study is the first survey conducted in Surabaya to identify knowledge, attitudes, and practices of using and managing antibiotics in families. There are several limitations in the study, such as collecting data using accidental sampling, so the study results cannot be

generalised to all people in the city of Surabaya. In this study, the respondents' background was also unknown, whether they were workers/students in the health sector or if there were family members with health backgrounds so differences in knowledge, attitudes and practices of respondents could be due to differences in their knowledge family backgrounds.

Conclusion

The findings revealed that most respondents had good knowledge, a positive attitude, and good practice when using and managing antibiotics. The government, professional organisations, and health workers can use the findings of this study to provide appropriate health education and promotion to raise public awareness of antibiotic use, eradication, and resistance. Antibiotics and other expired drugs must and disposed of properly to maintain good knowledge, attitudes, and practices. Special drug waste disposal programs, such as take-back programs, must be developed to assist the community in managing drug waste. Communities with good knowledge, attitudes, and practices are expected to become cadres in the surrounding environment to increase active community participation in antibiotic resistance prevention efforts.

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