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Knowledge and Beliefs about the Use of Antibiotics in Society:A Questionnaire Study of Gorontalo Province, Indonesia

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ABSTRACT: A lack of public understanding of the use of antibiotics has the potential to cause inappropriate use of antibiotics. The research aims to obtain information about the knowledge and beliefs of respondents regarding the use of antibiotics in Gorontalo Province. The research was conducted in various public places in four regions in Gorontalo Province with a population of 907,389 people. Sampling was carried out randomly (n=384), with inclusion criteria namely being over 18 years old, having used antibiotics in the last year, and being willing to take part in the research. Respondents who were unable to communicate in Indonesian were excluded from this study. The instruments used were demographic characteristics data collection sheets, knowledge and belief questionnaires.ata was collected using a questionnaire and the results were analyzed using descriptive statistics. Of the 384 respondents, 55.99% of respondents knew that antibiotics must be purchased with a doctor's prescription and that various types of antibiotics can be used for one type of bacterial infection (70.31%), antibiotics could be taken twice at the next dose (63.80%), accelerated recovery (60.16%), its use was stopped when symptoms disappeared (56.25%), the method of use was the same as other drugs (52.86) and effectively treated viruses (51.82). %), antibiotics can cause allergies (52.34%), resistance (59.38%), and bacterial resistance can increase if their use is not appropriate (48.96%). The results of the correlation analysis showed that there was a significant and unidirectional relationship between the two (rho=0.467). Respondents have adequate knowledge about antibiotics, resistance, and side effects but have inaccurate knowledge about the effectiveness of antibiotics for viral infections. Respondents have sufficient confidence that antibiotics cannot be obtained without a prescription, do not treat all diseases, and can cause resistance and side effects..

Keywords: **knowledge; belief; use of antibiotics.**

Introduction

Public misconceptions about antibiotics may potentially lead to inappropriate self-medication with either prescription or non-prescription antibiotics. Inappropriate use of antibiotics for the treatment of infectious diseases, overuse of antibiotics in the food production industry, and misbehavior of patients have led to the selection of multiresistant microorganisms. A review on the use of antibiotics in developing countries reported that people believed antibiotics as a powerful medicine that can prevent and cure disease with any symptoms [1,2]. Misconceptions and lack of basic knowledge about the use of antibiotics have also been reported by several studies across populations in both developed and developing countries [3–6]. This has certainly increased antibiotic resistance on a global scale and has resulted in many communicable diseases becoming untreatable, accompanied by a considerable increase in treatment complexity, side effects, disability, and death [7,8]. Patients' demand for antibiotic prescription and the practice of using antibiotics without prescription by community members is influenced by such misconceptions [1,9–11]. Knowledge and beliefs are considered social cognitive factors at the individual level that influence health-related behavior, including the behavior of using antibiotics.

The inappropriate use of antibiotics in society has become a significant problem in both developed and developing countries [12–14]. Southeast Asia is the region with the highest cases of antibiotic resistance in the world [15–18]. Related studies regarding resistance in Indonesia indicated that of 781 patients infected with *Escherichia Coli* bacteria, there was 73% resistance to ampicillin, 56% resistance to co-trimoxazole, 43% resistance to chloramphenicol, 22% resistance to ciprofloxacin and 18% resistance to gentamicin [19]. According to the report of the Ministry of Health of the Republic of Indonesia in 2011, cases of

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resistance in the community were caused by the ease of obtaining medicines without a doctor's prescription. Thus, it was reported that more than 50% of patients failed to consume the medicine in the right manner [19–21]. The Indonesian government has developed The Smart Community Movement Using Drugs (known as GEMA CERMAT in Indonesia) as an effort to reduce the number of resistances to antibiotics [22]. This movement aims to increase public awareness, understanding, and good practices regarding the use of drugs, including antibiotics [22,23]. Knowledge has an important role in shaping one's beliefs and attitudes about certain behaviors. Belief is a subjective attitude that something or a proposition is true. So that inappropriate knowledge about the use of antibiotics has the potential to cause misunderstandings about the use of antibiotics. This study was conducted to examine the level of knowledge and beliefs regarding the use of antibiotics in the province of Gorontalo. This study was also used as material for evaluating the effectiveness of government programs in dealing with antibiotic abuse, especially in the province of Gorontalo.

Methods

Type of the Study

This research is a descriptive study that examines the provision of non-prescription antibiotics in pharmacies in Gorontalo Province, Indonesia. This research was conducted in 4 regions in Gorontalo Province, Indonesia with a population of 907,335 people [24]. The sample size was calculated using the Raosoft.com sample size calculator application with a 95% confidence level, 5% margin of error, and 50% response distribution. The number required is 384 samples. This cross-sectional population-based survey involved respondents aged over 18 who were randomly selected using the cluster random sampling method. Confidence questionnaire about antibiotics used in adoption based on Widayati's article [13].

Instrument of the Study

The instrument used by the researcher was a knowledge questionnaire that had been tested for validity with a Crobanch alpha > 0.600 and a reliability R < 0.312. The questionnaire consisted of three parts, including questions about respondents' characteristics, questions about respondents' knowledge of antibiotics, and questions to examine respondents' beliefs. Knowledge-related questionnaires were made on the Guttman scale with "Yes" and "No" answer choices [25] . The correct answer would be given a score of 1 and the wrong answer would be given a score of 0. The answer choices for the respondent's beliefs consisted of: strongly agree, agree, neither agree nor disagree, disagree and strongly disagree.

Assessment of Questionnaire Results

Participants were first asked to complete a consent form and demographic information and then proceeded to complete the questionnaire. The criteria for knowledge about antibiotics were referred to on the Guttman scale, which was made into two categories, namely (a) the highest score of the respondent's answer (X) = the number of questions x the highest answer score, (b) the lowest score of the respondent's answer (Y) = the number of questions x the lowest answer score. The number of criteria used (K) and the score calculation results for the criteria were rounded to the nearest number.

Data Analysis

The research data obtained were then analyzed using SPSS (Statistical Package for the Social Sciences) version 22. The correct knowledge item responses were "Yes" for K1, K2, K8, K9, K10 and "No" for K3, K4, K5, K6, K7. The total correct responses were calculated to represent an overall knowledge score (ranging from 1 to 10). The level of knowledge was categorized into three, including poor (below the median), moderate (at the median), and adequate (above the median) levels of knowledge. Regarding the belief items, scores of 1, 2, 3, 4, and 5 were assigned respectively for each option: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. Answers choosing to agree on belief items (B1 to B4) were considered inappropriate beliefs. The overall belief score was approximated using the total score of the four belief items (range 4 to 20). The level of belief was stated as appropriate if the score was below the median line, as moderate if it was at the line, and as inappropriate if it was above the line. Data on the demographic and socioeconomic characteristics of the respondents were presented in percentages and median. These characteristics included gender, age, education, occupation, and family income level. The results of the Kolmogorov-Smirnov normality test stated that the data was not normally distributed with an exact sig-2 value = 0.000 < 0.05. The correlation of demographic characteristics with the level of knowledge and confidence was analyzed using Spearman's Rho. Correlation analysis was conducted to examine the relationship between knowledge and beliefs. The strength of the correlation was stated as weak at rho = 0.10 to 0.29; moderate on rho = 0.30 to 0.49; and strong at rho = 0.50 to 1.0 using a 95% confidence level ($p < 0.05$).

Ethical Approval

The study permit recommendation was issued by the Gorontalo Provincial Government, Indonesia (Licensing Service for the Head of the Gorontalo National Unity and Political Unity Agency: 070/KesbangPol/1036/V/2022) and ethical approval was granted by the Health Research Ethics Committee at Mawardi Hospital, Solo (EC No. 983/VII/HREC/2022).

Result and Discussion

Based on the results of the study, out of 384 respondents, the majority of respondents were women (70.05%), with a median age of 38 years (range: 36-45 years). Most of them had completed high school (42.71%), worked in the private sector (41.41%), and had an income level of 2.1 – 4.0 million per month (34.11%). More than half of the respondents had insurance coverage (80.47%). The demographic characteristics of the respondents are presented in Table 1.

Types of questions to determine the level of knowledge and belief of respondents can be seen in Table 2.

As explained in Figure 1, most of the people in this study were aware that purchasing antibiotics had to be prescribed by a doctor (55.99%) and were aware that more than one type of antibiotic could be used or indicated to treat one type of infectious disease (70.31%). More than half of the respondents had minimal knowledge of how to use antibiotics: a) When they forgot to take their medicines, they would then take the medicine together with the next dose (63.80%); b) taking more than one type of antibiotic at the same time for one type of disease would result in a speedy recovery (60.16%); c) the use of antibiotics could be stopped if the symptoms of the disease disappeared (56.25%); d) the use of antibiotics was the same as the use of medicine, in general, such as pain relievers (52,86%); and e) antibiotics could be used to treat viral infections (51.82%). Furthermore, most of the respondents were able to answer correctly that antibiotics could cause

Table 1. Demographic and socioeconomic characteristics of respondents

Characteristic	Category	N=384	
		Frequency	%
Gender	Male	115	29.95
	Female	269	70.05
Age	17-25	56	14.58
	26-35	98	25.52
	36-45	129	33.59
	46-55	66	17.19
	56-65	30	7.81
	>65	5	1.30
Education	Elementary School	14	3.65
	Junior High School	68	17.71
	Senior High School	164	42.71
	Diploma/Bachelor	138	35.94
Occupation	College Students	18	4.69
	Civil servants	131	34.11
	Non-Civil servants	159	41.41
	Unemployed	76	19.79
Government Insurance	Yes	309	80.47
	No	75	19.53
Income per Month	<2 million	81	21.09
	2.1- 4 million	131	34.11
	4.1- 6 million	127	33.07
	>6 million	45	11.72

Table 2. Questionnaire items of knowledge and beliefs of respondents

Code	Knowledge
K1	Antibiotics should be purchased with a doctor's prescription
K2	More than one type of Antibiotics can be used/indicated to treat one type of bacterial infectious disease
K3	Antibiotics can be taken twice at the next dose
K4	Consuming various antibiotics at the same time may lead to a speedy recovery
K5	The use of antibiotics can be stopped when symptoms disappeared
K6	The use of antibiotics is the same as other medicines
K7	Antibiotics may be effective in treating viruses infections
K8	Antibiotics can cause allergies
K9	Excessive use of antibiotics may result in antibiotic resistance
K10	Inappropriate use of antibiotics can cause bacterial resistance to increase
	Belief
B1	I believe antibiotics can be purchased without a doctor's prescription
B2	I believe that antibiotics can treat any disease
B3	I believe that the use of non-prescription antibiotics does not cause any resistance
B4	I am sure that antibiotics have no side effects

allergies (52.34%), and they were aware that excessive use of antibiotics could cause antibiotic resistance (59.38%). Less than half of the respondents (48.96%) answered correctly that inappropriate use of antibiotics might lead to increased bacterial resistance. The median of the overall knowledge score was 5; ranging from 0 to 10 (maximum potential: 10). Regarding the level of knowledge, 26.82% of the respondents were at a poor level of knowledge, 30.47% had a moderate level of knowledge, and 42.71% had adequate knowledge.

The level of people's beliefs about antibiotics can be seen in Figure 2.

As explained in Figure 2, respondents believed that antibiotics could be obtained without a doctor's prescription (27.35%), antibiotics could treat any disease (25.52%), and the free use of antibiotics did not cause resistance (25.79%), and antibiotics did not lead to any side effects (32.81%). However, those who neither agree nor disagree with these beliefs ranged from 29.95 - 41.15%. The median of the overall score of beliefs was 13; ranging from 4 to 20 (a potential range of 4 to 20). Knowledge and belief indicated a fairly strong correlation, sig = 0.000, n = 384, $p < 0.01$; correlation coefficient = 0.467, meaning that the better the knowledge possessed, the better the level of belief of the respondents

This study described the situation of the use of antibiotics in society. Various studies have shown that the misuse of antibiotics was associated with public knowledge about antibiotics [4]. Inaccurate knowledge about the use of antibiotics could lead to various misunderstandings.

Most of the people in this study were aware that purchasing antibiotics had to be prescribed by a doctor (55.99%) and were aware that more than one type of antibiotic could be used to treat one type of infectious disease (70.31%). The results of a study conducted in Saudi Arabia showed that sales of non-prescription antibiotics ranged from 63% to 82% [26]. Other countries in the Middle East have also reported such behavior [27]. Despite knowing that purchasing antibiotics had to be done with a doctor's prescription, respondents were likely able to get antibiotics without any prescription, and it was still considered illegal action. Pharmacy staff was regarded as the major actor facilitating the sale of antibiotics to various customers, including providing advice on which medicines the customer should consume. In this matter, the motives for such malpractice usually vary from place to place, which is mainly due to the differences in the regulatory, economic and other socio-cultural factors in different countries. This situation suggests that policies and regulatory enforcement should be established to prevent the use of antibiotics without a prescription, by increasing public awareness and knowledge. This contrasts with the results of a study in Sweden, which showed a low prevalence of acquiring antibiotics without a prescription in the Swedish population. One of the contributing factors was the high level of public belief in the healthcare system or health workers [28]. A trustworthy health system will lead people to make full use of the facility. High beliefs

tend to influence patients to accept the doctor's decision not to prescribe antibiotics. This will lead people to become medically motivated to obey doctors. This belief may reduce the demand for non-prescription antibiotics. Furthermore, respondents also have the perception that healthcare facilities are jointly responsible for overcoming the problem of antibiotic resistance. The relationship between disbelief in the health care system and the use of non-prescription antibiotics was complex. Overall disbelief and skepticism of the health system may result in a variety of negative consequences, including lower utilization of health services [29] so that people do self-medication such as using non-prescription antibiotics according to their understanding. Community pharmacies should refuse to provide non-prescription antibiotics with the simplest explanation that "antibiotics can only be given by prescription", followed by a brief explanation of the symptoms of diseases that do not require treatment with antibiotics to build public knowledge about antibiotics [11]. They should not only refuse requests for antibiotics, but it is more important to motivating people not to obtain antibiotics freely.

More than half of the respondents (63.80%) had inaccurate knowledge about the use of antibiotics. The antibiotic they forgot to take could be taken twice at their next dose, in line with previous studies reporting the same [29,30]. More than half of the respondents (60.16%) stated that using many types of antibiotics at the same time for one type of disease would help a speedy recovery. This was also reflected by 56.25% of respondents who perceived that the use of antibiotics could be stopped immediately if the symptoms of the disease had disappeared. Another study also reported that less than half of respondents stopped taking their antibiotics after symptoms subsided [30].

Many people still believed that antibiotics could be consumed the same as medicine in general, such as pain relievers (52.86%). These results revealed the fact that people still perceived that the use of antibiotics could be stopped when symptoms had started to disappear [3]. People believed that antibiotics might result in speedy recovery or reduce symptoms of the common cold and influenza. This indicates a knowledge gap in the proper use of antibiotics [31,32]. They were not aware of the individual and social consequences of the inappropriate use of antibiotics for common colds/coughs [33]. Inappropriate use of antibiotics was found among the people of Indonesia [34,35]. Similar findings cited in a study from developing countries also reported the use of antibiotics for the treatment of various diseases [36–38]. Lack of knowledge and awareness about antibiotics often leads to excessive use of antibiotics. A positive mindset, appropriate information, and professional practice are regarded as important factors in the appropriate and limited use of antibiotics [39,40]. More than half of the respondents perceived that antibiotics were effective in treating viral infections (51.82%). This misconception may be due to respondents not understanding the difference between viral and bacterial infections and the indications for antibiotic treatment. A study conducted by Hijazi et al. (2021) in Lebanon, showed that 60.4% of respondents believed that antibiotics were effective against viruses [41]. Likewise, studies in China and the United States revealed that 79% of respondents in China and 57% of respondents in the United States believed that antibiotics were able to cure viral infections [42,43]. Moreover, many people were

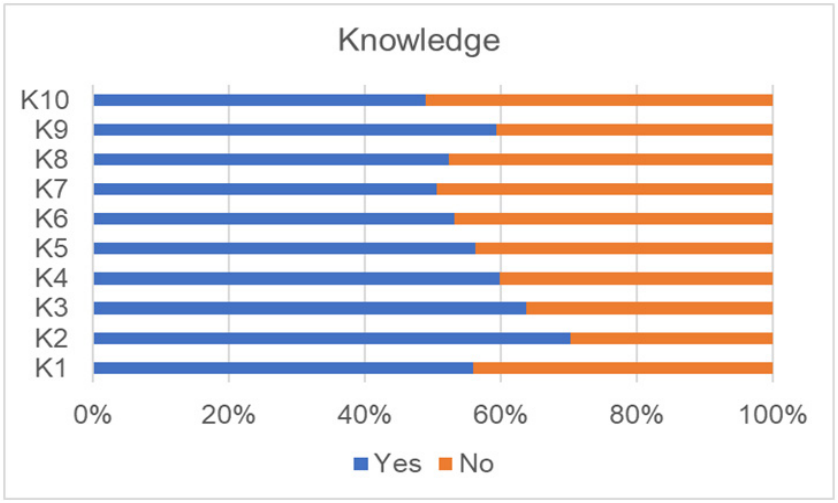

Figure 1. Respondents' knowledge of antibiotics

unable to differentiate between bacteria and viruses. As a result, people assumed that antibiotics could be used to treat viral and bacterial infections [44]. Such a practice is coherent with reported results from studies in the Euro-Mediterranean region and developing countries [6,27]. Many studies had focused on public knowledge about antibiotic use and antimicrobial resistance, indicating that there were many knowledge gaps about the effectiveness of antibiotics for viral infections [45–47]. 52.34% of respondents had good knowledge that antibiotics might cause allergies and side effects, which is in line with studies conducted by several other researchers [5,48].

Most of the respondents were aware that excessive use of antibiotics could lead to antibiotic resistance (59.38%). However, on the other hand, only 48.96% of respondents were aware that inappropriate use of antibiotics may increase bacterial resistance rapidly. Adequate knowledge related to the use of antibiotics can prevent irrational use of antibiotics and can help reduce antibiotic resistance [49,50]. Increased consumption of antibiotics not only results in greater resistance at the individual patient level but can also generate greater resistance at the community, country, and regional levels, which can harm individual patients [51]. Respondents conceptualized antibiotic resistance as resistance to antibiotics [33].

Based on the respondent's level of belief (Figure 2), it is known that more respondents believed that antibiotics cannot be obtained without a doctor's prescription, although they could still obtain non-prescription antibiotics freely. 25.52% of respondents (strongly agree and agree) believed that antibiotics can treat all kinds of diseases and as many as 38.28% chose neutral. These results indicated that public belief about 'antibiotics that can treat all kinds of diseases may lead to an increase in the use of antibiotics for self-medication. There were 25.79% of respondents (strongly agree and agree) who believed that the free use of antibiotics did not cause any resistance and 33.07% believed that antibiotics might cause resistance. Community doubts that antibiotics could cause resistance can be seen in the high number of respondents who chose neutral (41.15%). There were 32.81% of respondents (strongly agree and agree) believed that antibiotics had no side effects, 32.64% chose neutral, and 32.55% (strongly disagree and agree) believed that antibiotics caused side effects, and the number of respondents who agreed and disagreed was balanced.

Overall, respondents fairly believed that antibiotics could treat any disease, the use of non-prescription antibiotics did not cause any resistance and had no side effects. Appropriate beliefs about the use of antibiotics could make people become more aware of the disadvantages of the inappropriate use of antibiotics. Individual health behaviour is influenced by knowledge and beliefs, according to the theory of the Health Belief Model (HBM), which states that Knowledge is a factor that influences a person's beliefs and will shape a person's behaviour.

Based on the statistical test results in table 3, it shows that there was a relationship between education and level of knowledge, $p = 0.047 < 0.05$ with a very weak correlation: rho = 0.101 (0.00 – 0.25). The higher the level of patient education, the better the patient's knowledge of antibiotics [24,52]. The characteristics of other demographic aspects, such as age, gender, income, and social security did not show any relationship with the level of knowledge. Likewise with the relationship between demographic characteristics and beliefs. Only 'gender' indicated a relationship with the level of belief, $p=0.010 < 0.05$ with a very weak correlation: rho=0.131 (0.00 – 0.25). However, several studies had concluded that there was no significant

Table 3. Distribution of relationships between variables

Variable	Knowledge		Belief	
	Correlation Coefficient	P value	Correlation Coefficient	P value
Gender	0.010	0.849	0.131	0.010*
Age	0.092	0.071	-0.027	0.593
Education	0.112*	0.029	0.028	0.588
Occupation	-0.049	0.338	-0.037	0.465
Income	-0.002	0.975	-0.060	0.244
Insurance	0.087	0.089	0.046	0.364
Knowledge			0.467	0.000*

Spearman Rho Test
*There was a correlation based on the Spearman Rho statistical test

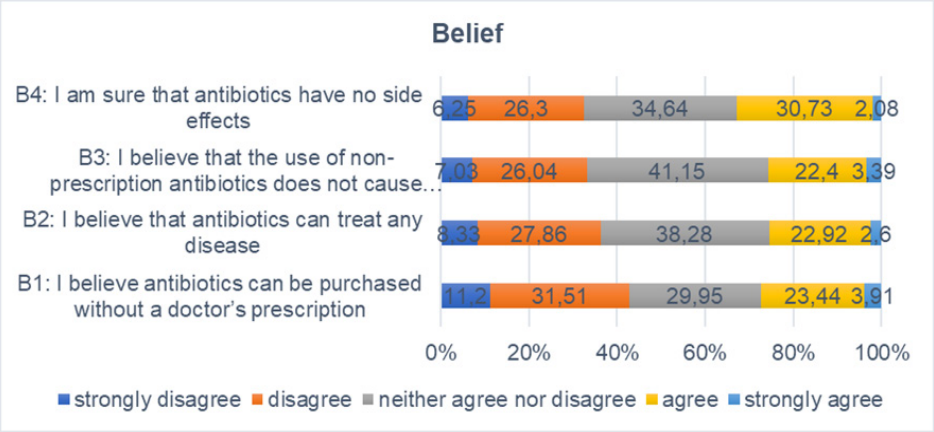

Figure 2. Respondents' beliefs about antibiotic use

relationship between patient beliefs about antibiotics and age, gender, and income [52,53]. Meanwhile, there was a correlation between knowledge and belief with a p-value = 0.000 <0.05, with a moderate correlation of 0.467 (0.26-0.50). Someone with good knowledge will have a better level of understanding and awareness that will influence good behavior [54]. Appropriate beliefs about the use of antibiotics could make people become more aware of the disadvantages of the inappropriate use of antibiotics. Individual health behaviour is influenced by knowledge and beliefs, according to the theory of the Health Belief Model (HBM), which states that knowledge is a factor that influences a person's beliefs and will shape a person's behaviour.

Based on the findings of this study, there are some suggestions provided by researchers: 1) further studies are suggested to conduct similar studies in rural areas of Indonesia, as this present study represents the urban people in northern Indonesia; 2) a better understanding is needed to the extent to which beliefs can influence people using antibiotics in inappropriate ways; for example using antibiotics without medical consultation; and 3) a sustainable intervention program is highly required to be developed to reduce misconceptions of antibiotic use, to increase public's awareness about the risks of inappropriate use of antibiotics, and to help healthcare professionals communicate that information.

The limitations of this study are potentially related to the respondents who are not entirely the general population. this study involved residents living in urban areas/district cities in Gorontalo province, who are mostly literate and may have received more information about antibiotics than those in rural areas. Second, a recognized source of error in studies involving the use of antibiotics involving lay people may be due to misinterpretation of questions especially those related to antibiotic resistance. Antibiotic use and antibiotic resistance should use clearer terminology – use "antibiotic-resistant infection" or "antibiotic-resistant bacteria" rather than simply "antibiotic resistance."

Conclusion

This study showed that most of the respondents had adequate knowledge about the use of antibiotics. The public was also aware of the risks of using antibiotics; for example, antimicrobial resistance, allergies, and possible side effects. Antibiotics are effective for bacterial infections, but there was inadequate knowledge about the effectiveness of antibiotics for viral infections. In terms of beliefs about the use of antibiotics, respondents fairly believed that antibiotics cannot be purchased without a doctor's prescription, nor are they used to treat all kinds of diseases. These findings may be useful to help develop appropriate interventions in order to reduce misconceptions about the use of antibiotics and to increase public knowledge.

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