ASSESSMENT OF ANTIMICROBIAL RESISTANCE AWARENESS AMONG RESIDENTS IN KELANTAN, MALAYSIA

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Assessment Of Antimicrobial Resistance Awareness Among Residents in Kelantan, Malaysia

By

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ASSESSMENT OF ANTIMICROBIAL RESISTANCE AWARENESS AMONG RESIDENTS IN KELANTAN, MALAYSIA

ABSTRACT

An abstract of the research paper presented to the Faculty of Veterinary Medicine, Universiti Malaysia Kelantan, in partial requirement on the project DVT55204 - Research Project

Abstract : Antimicrobial resistance (AMR) has emerged as a critical global health challenge, demanding a nuanced understanding of public awareness for effective mitigation. This study aims to assess the level of AMR awareness among residents of Kelantan, Malaysia. A cross-sectional questionnaire-based survey was conducted from the seven districts of Kelantan, namely Kota Bharu, Pasir Mas, Tumpat, Bachok, Tanah Merah, Jeli, and Gua Musang. Data were collected using a validated self-administered using Google Form links shared through WhatsApp and Facebook. Pearson Chi Square was used to determine the association between level of awareness of antimicrobial resistance and the sociodemographic profile of the respondents. The study unveils a noteworthy high awareness level (87.5%) among participants, highlighting the pivotal role of public comprehension in addressing the escalating threat of AMR. Beyond mere awareness assessment, this research scrutinizes the interplay between sociodemographic factors and AMR awareness, offering valuable insights into potential disparities and areas for targeted educational interventions. The outcomes of this study not only contribute to the existing body of knowledge on AMR but also serve as a resource for policymakers, healthcare practitioners, and educators in crafting effective strategies to enhance awareness and combat the multifaceted challenges posed by AMR on a global scale.

Keywords *: Antimicrobial resistance(AMR), Kelantan, Sociodemographic, Awareness, Association*

PENILAIAN TAHAP KESEDARAN MENGENAI RINTANGAN ANTIMIKROBIAL DALAM KALANGAN MASYARAKAT KELANTAN, MALAYSIA

ABSTRAK

Abstrak kertas penyelidikan yang dibentangkan kepada Fakulti Perubatan Veterinar, Universiti Malaysia Kelantan, sebagai keperluan sebahagian daripada projek DVT55204 - Projek Penyelidikan

Abstrak : Rintangan antimikrobial (AMR) telah muncul sebagai cabaran kesihatan global yang kritikal, menuntut pemahaman yang bernuansa tentang kesedaran awam untuk mitigasi yang berkesan. Kajian multidimensi ini menyelidiki selok-belok kesedaran AMR di kalangan 104 responden di Kelantan, Malaysia, yang mewakili pelbagai kumpulan umur dan daerah. Menggunakan pendekatan berasaskan soal selidik keratan rentas, pengumpulan data merangkumi tujuh daerah, iaitu Kota Bharu, Pasir Mas, Tumpat, Bachok, Tanah Merah, Jeli, dan Gua Musang. Data telah dianalisis dengan menggunakan perisian Google Sheets dan IBM SPSS untuk menentukan perkaitan antara tahap kesedaran tentang rintangan antimikrob dan juga profil sosiodemografi responden. Kajian itu mendedahkan tahap kesedaran tinggi yang patut diberi perhatian (87.5%) di kalangan peserta, menonjolkan peranan penting kefahaman awam dalam menangani ancaman AMR yang semakin meningkat. Di luar penilaian kesedaran semata-mata, penyelidikan ini meneliti interaksi antara faktor sosiodemografi dan kesedaran AMR, menawarkan pandangan berharga tentang potensi jurang dan bidang untuk campur tangan pendidikan yang disasarkan. Hasil kajian ini bukan sahaja menyumbang kepada badan pengetahuan sedia ada tentang AMR tetapi juga berfungsi sebagai sumber untuk penggubal dasar, pengamal penjagaan kesihatan dan pendidik dalam merangka strategi berkesan untuk meningkatkan kesedaran dan memerangi pelbagai cabaran yang ditimbulkan oleh AMR pada skala global.

***Kata kunci** : Rintangan Antimikrobial, Kelantan, Sosiodemografi, Kesedaran, Perkaitan*

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ABBREVIATIONS

ABBREVIATIONS	DEFINITION
AMR	Antimicrobial Resistance
DVS	Department of Veterinary Services
My-AP-AMR	Malaysian Action Plan on Antimicrobial Resistance
MOH	Ministry of Health
MOA	Ministry of Agriculture
UMK	Universiti Malaysia Kelantan
UPM	Universiti Putra Malaysia

CHAPTER 1

INTRODUCTION

Antimicrobial is defined as destroying or inhibiting the growth of microorganisms, especially pathogenic microorganisms (Merriam-Webster, 2018). Antimicrobial resistance (AMR) occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness and death (World Health Organization., 2021). Antimicrobial Resistance is a one health issue and interdisciplinary coordination between all sectors of humans including health, food and animal health is required as it threatens the treatment of infectious diseases. It has been known to escalate continuously and be misused or overused in various fields (Naeemmudeen *et al*., 2021). In 2015, the 68th World Health Assembly urged all member states to adopt the global action plan and in response to this public health issue. Therefore, Malaysia has undertaken an initiative to help tackle the matter by implementing the Malaysian Action Plan on Antimicrobial Resistance (MyAP-AMR) in 2017-2021.

Increasing public awareness and understanding of AMR stands as a pivotal imperative. When the public possesses heightened awareness, particularly regarding adverse effects of AMR on global health, we play an important role in combating the issue by having behavioural adjustments. There is clear evidence that there exists a substantial degree of

misunderstanding surrounding the appropriate use of antibiotics accentuating urgency in the need to rectify this gap of awareness (Zailani et al., 2022).

Therefore, this study is conducted to determine the awareness level of antimicrobial resistance among the residents in Kelantan, Malaysia to ensure a better understanding on the related topic.

1.1 Problem Statement

Antimicrobial resistance (AMR) is a global one health problem. It was initially observed in *Staphylococci, Streptococci* and *Gonococci,* after penicillin was introduced in 1941 and penicillin-resistant *S.aureus* emerged in 1942. Malaysia is not spared from this issue. Due to this, Malaysia has come up with an action plan (MyAP-AMR) to create public awareness and educate the public regarding AMR.

As previous study has shown most respondents (n=124, 52%) living in the urban area showed a higher level of awareness of antibiotic resistance as compared to respondents living in the rural (n= 72, 30%) and suburban (n= 65, 27%) areas (Zailani *et al.,* 2022). Several studies have been conducted to assess the level of awareness of AMR among residents of various states in Malaysia. These studies reported various levels of awareness, with those in urban areas having a better level of awareness. Despite these studies conducted in most states of Malaysia, no study was done to assess the level of awareness among the residents of Kelantan, which is reported to have the lowest rate of urbanization in Malaysia with only 44.1% of its

population living in urban areas(Department of Statistics, 2022). Therefore, this study aims to assess the awareness of AMR in residents in Kelantan. The data collected is vital in assessing the knowledge and understanding of the residents regarding AMR.

1.2 Research Question

- What is the level of awareness for antimicrobial resistance (AMR) among residents in Kelantan, Malaysia?
- What are the factors influencing residents of Kelantan's knowledge and awareness of antimicrobial resistance (AMR) among the residents of Kelantan?

1.3 Research Hypothesis

- There is a significant difference in the level of antimicrobial resistance (AMR) awareness among different demographic groups in Kelantan, Malaysia.
- The socio-demographics mainly influence the knowledge and awareness regarding antimicrobial resistance (AMR) among the residents of Kelantan, Malaysia.

1.4 Research Objective

- To assess the awareness level of antimicrobial resistance (AMR) among the residents of Kelantan, Malaysia
- To identify the demographic factors associated with the knowledge and awareness of antimicrobial resistance (AMR) among the residents of Kelantan, Malaysia.

CHAPTER 2

LITERATURE REVIEW

2.1 Antimicrobial Resistance

The escalating phenomenon of antimicrobial resistance (AMR) stands out as a prominent and urgent public health challenge in the 21st century, posing a formidable threat to the effective prevention and treatment of an increasingly diverse spectrum of infections caused by bacteria, parasites, viruses, and fungi. This issue is particularly pressing in the context of antibiotic resistance in bacteria, where, over the course of several decades, bacteria responsible for both common and severe infections have exhibited varying degrees of resistance to each successive antibiotic introduced to the market. Confronted with this daunting reality, there arises an imperative need for proactive measures to avert the unfolding global crisis in healthcare (Prestitnaci *et al,* 2015).

Determining the consequences of antibiotic resistance in both mortality rates and the associated public health costs proves to be a complex undertaking, marked by a scarcity of comprehensive studies delving into this critical matter. According to conservative estimates by the US Center for Disease Control and Prevention (CDC), the United States grapples with an annual toll exceeding two million individuals affected by infections resistant to antibiotics, resulting in a minimum of 23,000 fatalities attributed to these resistant infections. The intricacies surrounding

the impact of antibiotic resistance underscore the imperative for further in-depth investigations and a comprehensive understanding of the multifaceted consequences on public health and mortality(Centre for Disease Control and Prevention, 2013).

2.2 Antimicrobial Resistance Situation in Malaysia : Human Health, Animal Health and Food/Livestock

The Malaysian Ministry of Health has published an action plan through a collaborative effort between the Ministry of Health and Ministry of Agriculture and Agro-Based Industry. A variety of strategies and plans have been initiated to control and restrain the dissemination and reduce the risk of antimicrobial resistance (AMR) including the establishment of "National Surveillance of Antibiotic Resistance (NSAR)" program in the government and tertiary teaching hospitals (Mariappan *et al.,* 2021). Antimicrobial stewardship has been initiated in the hospitals as a direct response to the rise in antimicrobial resistance. It consists of a set of coordinated interventions to enhance the optimal use of antimicrobials and prevent the spread of infections by multi-resistant organisms, which should be administered by a team of multidisciplinary experts, including infectious disease physicians, clinical pharmacists, clinical microbiologists, and infection control practitioners (Yow, 2020).

2.3 Socio-Demographic Characteristics of Respondents Knowledgeable to Antimicrobial Resistance

The socio-demographic factors associated with antibiotics resistance are education levels. Those with college qualification and above had 2.663 times higher knowledge scores than those with lower education levels ($p < 0.001$). Similarly, participants with high-income possessed more knowledge than low-income respondents ($p= 0.024$). Students(p= 0.052) , non-skilled workers(p= 0.150), skilled workers(p= 0.732), and professionals and managers(p= 0.393) which had lower practice scores than the unemployed group, respectively ($p < 0.001$) (Di K. N. et al., 2022).

A similar case study was conducted in Selangor Malaysia by using a cross-sectional, questionnaire-based study. Most respondents (n= 124, 52%) living in the urban area showed a higher level of awareness of antibiotic resistance as compared to respondents living in the rural (n= 72, 30%) and suburban (n= 65, 27%) areas. It is also noted that respondents with a higher level of education (Masters/Professional Certificate and Doctorate) mostly scored a high level of awareness (Zailani *et al.,* 2022)

2.4 Factors Influencing Knowledge and Awareness regarding Antimicrobial Resistance

There are 5 distinct factors, namely education, policy, media, trust and culture that influence the use of antibiotics and knowledge about antibiotic resistance (Mohrs S et al.,

2015). The factor that was most strongly associated with knowledge of antibiotics and AMR was education level (permutation importance was 1.0 in all datasets for both). Knowledge of antibiotics was strongly associated with the frequency of internet use (permutation importance was 0.62, 0.49, and 0.35 in each dataset). Exposure to primary information was strongly associated with motivation to make appropriate behavioural changes (permutation importance was 1.0, 0.86, and 1.0 in each dataset). (Tsuzuki *et al.,* 2020).

CHAPTER 3

MATERIALS AND METHODS

This is a cross-sectional questionnaire-based study conducted among the residents of Kelantan.

3.1 Study Area

The study area will be divided into urban and non-urban districts in Kelantan. The urban districts are Kota Bharu, Pasir Mas, Tumpat, Pasir Puteh, Bachok, and Tanah Merah while the non-urban districts are Kuala Krai, Machang, Jeli and Gua Musang(Department of Statistics, 2022).

3.2 Study Population

The study population will be the residents of Kelantan ranging between 18-70 years old. The sample size was determined by using Cochran sample size formula .The confidence level was set at 95% and error margin of 0.05 (Zailani *et al.,* 2022). Therefore, the required sample size calculated was 359 respondents.

3.3 Selection Criteria

Respondents consist of only residents of Kelantan who are willing to participate and consented in participation in this study. They must also have means to access the self-administered online questionnaire.

3.3.1 Inclusion Criteria

Respondents' criteria include possessing Malaysian citizenship, residing specifically in Kelantan, falling within the age range of 18 to 70 years old, demonstrating fluency in either Malay or English and having the capability to access the internet

3.3.2 Exclusion Criteria

Respondents are excluded if they are below the age of 18 or exceeding the age 70 years old, those who possess Malaysian citizenship but reside outside the region of Kelantan, individuals lacking proficiency in Malay or English and those without access to the internet.

3.4 Ethical Considerations

Ethical considerations play a pivotal role in any research or professional undertaking, and obtaining informed consent is a fundamental component of ethical practice. In order to achieve that, an informed consent form was available at the

first page of the Google Form. To add on, the participants were made aware that they will remain anonymous throughout the research process.

3.5 Study Questionnaire

The questionnaire items were formulated to capture, assess and evaluate the respondents'' awareness and knowledge of antimicrobial usage and antimicrobial resistance, which some are adopted from previous studies(Zailani *et al*., 2022 and Kosiyaporn *et al*., 2020) Some of the items are self-designed questions. A total of 22 items were created and categorized and divided into three sections, each gathering distinct sets of data.

The first section consists of six questions related to the socio-demographic attributes of the respondents (gender, age, race, residential area, highest education level and occupation). The names of the respondents were purposefully not included to maintain confidentiality and as respect in relation to them.

The purpose of the questionnaire's second section is to gauge and assess participant's awareness and understanding of antimicrobials. This section comprises a set of six items, all of which consists of dichotomous and multiple-choice questions requiring respondents to provide responses that either affirmative or negative.

The content of the third section focused on assessing participants' awareness and knowledge concerning antimicrobial resistance. Within this section, a total of ten

items were presented, all of which consisted of dichotomous and multiple-choice questions.

Points were assigned to the participants' responses. Accurate answers to a question will receive a score of one (1) mark, whereas incorrect answers will be given a score of zero (0) marks. The scores are divided into 3 categories which are low, moderate and high where the participants which have 5 points or lower would be considered as having low awareness on AMR. The participants scoring 6-11 points would be considered moderately aware and points higher than 12 would be considered as having high awareness(Zailani *et al*., 2022) The total score overall is 16 points.

3.6 Data Collection

The starting date of data collection was on 12th October 2023 and it ceased on 12th November 2023. The period of data collection was approximately around 32 days. The questionnaire was designed, distributed and collected through Google Form, an online survey self-administering platform. The form can be referred to in the appendices. The recruitment of the participants was carried out through the utilization of the snowball sampling method, wherein initial participants were identified and then asked to refer and recruit additional individuals to participate in the study creating a networked and expanding sample. In this case, my classmates

from the origin of Kelantan are the initial participants and are required to help expand the sample to their relatives and acquaintances.

3.7 Data Analysis

Frequency and percentage were used for descriptive statistics to summarize the categorical data and analysis was done by utilising Pearson's Chi-square to assess the association between sociodemographic characteristics and level of AMR awareness using IBM SPSS statistical software.. This combination of Google Forms for data collection, Google Sheets for initial organization, and IBM SPSS for statistical analysis reflects a comprehensive approach to understanding the intricacies of the relationship between socio-demographic factors and AMR awareness within the study population.

CHAPTER 4

RESULTS

4.1 Respondent's Sociodemographic Profile

A total of 105 respondents meeting the criteria mentioned in 3.2 were collected. Notably, one of the respondents' inputs were excluded from the dataset due to their involvement by participating in the pilot test of the questionnaire, in accordance with one of the predefined exclusion criteria. Consequently, the study involved the active participation of 104 individuals, representing approximately 28.97% of the targeted sample, in the research endeavours.

Table 4.1 shows that more than half of the respondents were female (n= 67, 64.40%). Majority of the respondents were in the range of 18-29 years old (n= 83, 79.80%). The Malay race was considered as a larger part of the community out of other races and ethnicity in Kelantan (n= 72, 69.20%) and was evidently shown in the table. In terms of residential location, Kota Bharu stands out with the highest count of respondents (n=83, 79.80%) among the districts mentioned above. A greater number of the respondents contains a bachelor's degree (n=58, 55.80%) and were students (n=67, 64.40%) may be due to the fact that the initial participants were the author's classmates of batch 23/24.

Table 4.1 : Respondent's sociodemographic profile

Variables	Number	Percentage (%)
Gender		
Male	37	35.60
Female	67	64.40
Age		
18-29	83	79.80
30-45	9	8.70
46-59	9	8.70
60-70	3	2.90
Race/Ethnicity		
Malay	72	69.20
Chinese	20	19.20
Indian	9	8.70
Others	3	3
Residential area		
Kota Bharu	83	79.80
Bachok	8	7.70
Pasir Mas	7	6.70
Tanah Merah	2	1.90
Gua Musang	2	1.90
Tumpat	1	1
Jeli	1	1
Pasir Puteh	-	
Kuala Krai	-	
Machang	-	
Highest education level		
Masters	3	2.90
Bachelor's Degree	58	55.80
STPM/Matrics/Foundation/Diploma	31	29.80
SPM	11	10.60

Table 4.1(continued) : Respondent's sociodemographic profile

UPSR	1	1
Occupation		
Medical-related	10	9.60
Non-medical related	22	21.20
Student	67	64.40
Unemployed	5	4.80

Note : Total number of respondents, n = 104

4.2 Level of Awareness and Knowledge of Respondents'

In general, most of the respondents scored high level of knowledge (91, 87.5%), while moderate and low-level accounts for 11.54% and 0.96% for the awareness and knowledge relating to antimicrobial resistance respectively.

4.2.1 Level of Awareness and Knowledge of relating to Antimicrobials

Before surging and questioning the respondents about AMR, they were asked a total of 6 questions regarding their knowledge and awareness on the fundamentals of antimicrobials as shown in Table 4.2

Table 4.2 shows the respondents responses towards the questions/statements regarding knowledge relating to antimicrobials. From the data shown in Table 4.2. More than 90% (n=95, 91.3%) answered correctly on the type of antimicrobials by exclusion. Majority of the respondents know where to obtain (n=97, 96%) and the frequency of taking antibiotics (n=92, 88.5%). About 75% (n=78, 75%) of the respondents know that it is wrong to use

antibiotics that were given by relatives/friends even if it treats the same illness. Almost every respondent (n=101, 97.1%) answered correctly and knows that doctors should only prescribe antibiotics when they are needed. However, it should be noted that there are still some of the respondents (n=26, 25%) who believe that the antibiotic should be taken continuously even after all of the antibiotics prescribed by the doctor finishes.

Table 4.2 **:** Respondent's correct/incorrect responses towards questions/statements regarding knowledge relating to antimicrobials

Statement/Questions	Correct (%)	Incorrect (%)
All of these are antimicrobials except	95(91.4)	9(8.6)
How should you obtain antibiotics?	97(96)	7(4)
How often should you take antibiotics?	92(88.5)	12(11.5)
Is it okay to use antibiotics that were given by a relative/friend, as long as they treat the same illness?	78(75)	26(25)
Doctors should only prescribed antibiotics when they are needed	101(97.1)	3(2.9)
Should you continue taking antibiotics when all of the antibiotics have been taken as directed by the doctor?	78(75)	26(25)

4.2.2 Level of Awareness and Knowledge of relating to Antimicrobial Resistance

Based on the information gleaned from the survey, as depicted in Figure 1, it's apparent that a significant portion(n=75, 72.1%) of the total 104 participants, have some awareness of Antimicrobial Resistance (AMR) and its global implications. On the other side, a smaller group(n=29, 27.9%) of

the surveyed individuals, expressed that they haven't come across information about AMR.

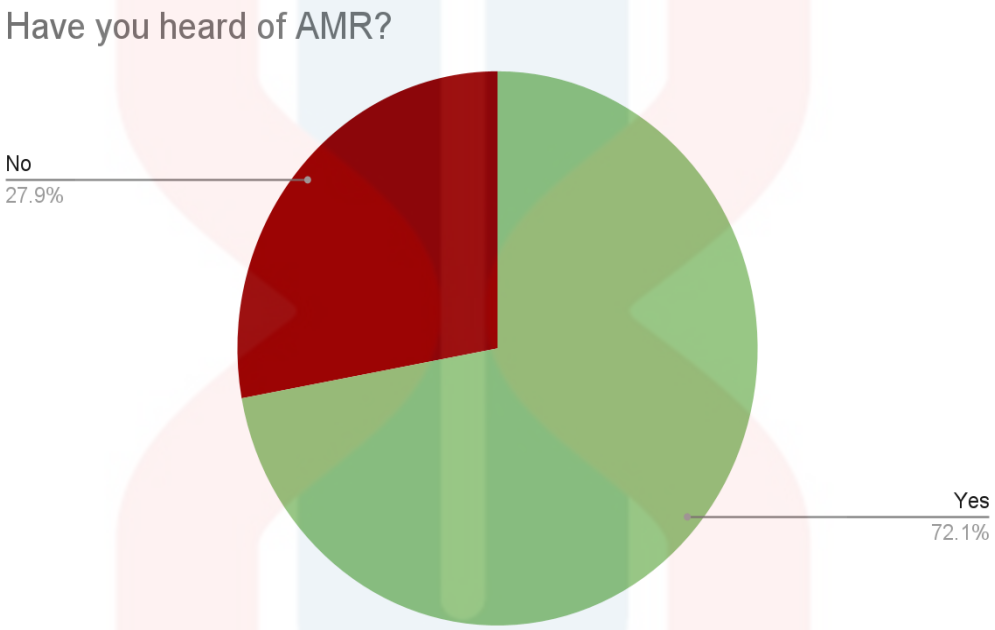

Figure 4.1 : Respondents' awareness of AMR
Note: Respondents' that answered 'Yes' will be asked question as in Figure 4.2

Building upon the earlier inquiries, a subset of 75 respondents who affirmatively responded 'Yes' regarding their awareness of AMR was further questioned regarding the specific platforms through which they acquired this knowledge. Among this cohort, a predominant 56 respondents indicated that they obtained information through educational avenues such as classes or lectures. This may be due to the fact that the questionnaire is based on a snowball sampling method where the author's classmates are the initial

participants. Additionally, 12 respondents mentioned acquiring awareness via social media, while 7 respondents cited the internet as their source of information. A graphical representation of this data is visually presented in Figure 4.2.

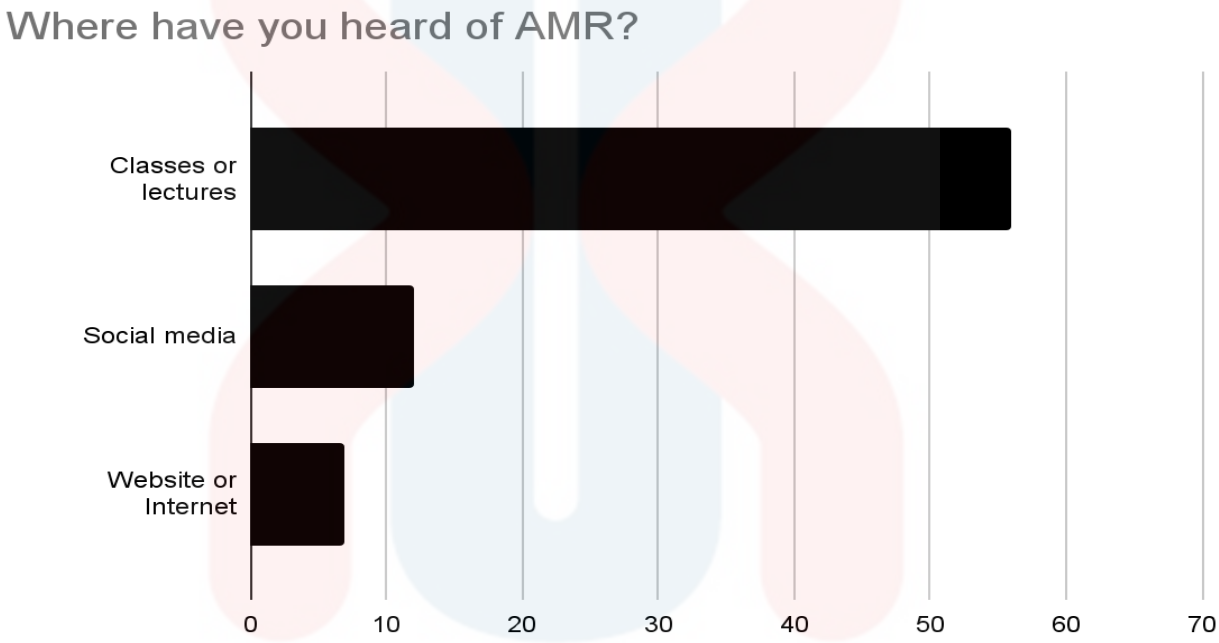

Figure 4.2 : Respondents' source of information regarding to AMR
Note : This question will only be presented if the respondent answered 'Yes' for question on Figure 1.

Analyzing the data presented in Table 4.3, which outlines the respondents' accuracy or inaccuracy in responding to statements and questions related to their knowledge of Antimicrobial Resistance (AMR), it is evident that a substantial majority, comprising more than three-quarters of the total 104 respondents, demonstrated proficiency by providing correct answers to the presented queries.

Table 4.3 : Respondents correct/incorrect responses towards questions/statements regarding knowledge towards AMR

Statements/Questions	Correct (%)	Incorrect (%)
How does AMR occur?	93(89.4)	11(10.6)
Antibiotic resistance is when your body cannot be treated by antibiotics and they no longer work as well.	98(94.2)	6(5.8)
Is it true that many infections are becoming increasingly resistant to treatment by antibiotics?	76(73.1)	28(26.9)
Is antimicrobial resistance an issue/problem related to people only?	87(83.7)	17(16.3)
Is antimicrobial resistance an issue that affects animals?	97(93.3)	7(6.7)
Is antibiotic resistance one of the biggest science problems that the world faces?	89(85.6)	15(14.4)
If bacteria are resistant to antibiotics, can it be very difficult or impossible to treat the infections they cause?	89(85.6)	15(14.4)
Does antibiotic-resistant infections make medical procedures like surgery, organ transplants and cancer treatment much more dangerous?	90(86.5)	14(13.5)

4.3 Association between Sociodemographic Profile and the Level of Awareness for Antimicrobial Resistance

The association between the sociodemographic characteristics of the respondents and their respective levels of awareness regarding antimicrobial resistance has been detailed in Table 4. This table provides a comprehensive exploration of how various sociodemographic factors interrelate with the awareness levels of the surveyed individuals concerning antimicrobial resistance.

Table 4.4 presents an examination of the association between respondents' demographic characteristics and their awareness regarding AMR. Noteworthy findings indicate that there were no discernible associations with gender and age as they have a *p*-value of $p>0.05$. Thus, proving that these two variables are independent from the respondents' awareness. However, substantial and statistically significant associations were observed in relation to race, residential area, highest education level, and occupation. This underscores that factors such as race, residential area, educational attainment, and occupational status play pivotal roles in shaping individuals' awareness levels regarding AMR, as evidenced by the statistically significant associations revealed in the analysis, $p<0.05$. Therefore, providing evidence that these four variables are dependent on the respondents' awareness.

Table 4.4 : Cross-tabulation between respondents' sociodemographic profile and AMR awareness level

Variable	Level of awareness			(Chi-square) χ^2	*p*-value
	Low (%)	Moderate (%)	High (%)		
Gender					
Male	1(2.70)	2(5.41)	34(91.89)	0.161	0.922
Female		10(14.93)	57(85.07)		
Age					
18-29	1(1.20)	8(9.64)	74(89.16)		
30-45		1(11.11)	8(88.89)	10.373	0.110
46-59		2(22.22)	7(77.78)		

Table 4.4(continued) : Cross-tabulation between respondents' sociodemographic profile and AMR awareness level

60-70		1(33.33)	2(66.67)		
Race/Ethnicity					
Malay	1(1.4)	9(12.50)	62(86.10)		
Chinese		2(10.00)	18(90.0)	15.114	0.019*
Indian	2(22.20)	2(22.20	5(55.6)		
Others			3(100.00)		
Residential area					
Kota Bharu		8(9.64)	75(90.36)		
Pasir Mas		3(42.86)	4(57.14)		
Tumpat			1(100)		
Bachok			8(100)		
Tanah Merah			2(100)		
Jeli			1(100)		
Gua Musang	1(50)	1(50)			
Pasir Puteh		-			
Kuala Krai		-			
Machang		-		27.610	0.006*
Highest education level					
Masters			3(100)		
Bachelor's Degree		3(5.17)	55(94.83)		
STPM/Matrics/Foundation/Diploma		4(12.90)	27(87.10)	24.741	0.002*
SPM	1(9.09)	4(36.36)	6(54.55)		
UPSR		7(100)			

Table 4.4(continued) : Cross-tabulation between respondents' sociodemographic profile and AMR awareness level

Occupation				
Medical-related	1(10)	9(90)	27.669	<0.001*
Non-medical related	3(13.64)	19(86.36)		
Student	3(4.48)	64(95.52)		
Unemployed	2(40)	3(60)		

Note : The results with symbol '' shows that it is statistically significant*

Overall respondents' level of awareness are categorised based on their score. Significance value is portrayed by p-value, p = 0.05

CHAPTER 5

DISCUSSION

A cross-sectional study, utilizing a questionnaire as its primary data collection method, was conducted to investigate and evaluate the awareness and knowledge pertaining to antimicrobial resistance among a cohort of 104 respondents hailing from Kelantan, spanning an age range of 18 to 70 years. This study addresses antimicrobial resistance as a one health concern that holds global priority in terms of public health and interdisciplinary significance.

Despite the absence of respondents from three specific districts, namely Pasir Puteh, Kuala Krai, and Machang, this study successfully gathered responses from a diverse sample of 104 individuals of Kelantanese origin, encompassing seven districts, including Kota Bharu, Pasir Mas, Tumpat, Bachok, Tanah Merah, Jeli, and Gua Musang. A total of 79.81% (n=83) were from Kota Bharu, 7.69%(n=8) from Bachok, 6.73% (n =7) from Pasir Mas, 1.92% (n=2) each from Gua Musang and Tanah Merah, and 0.96%(n=1) each from Tumpat and Jeli. From this, we can conclude that the majority of the respondents are from Kota Bharu, Kelantan. This is because an estimated 1.89 million people populated Kelantan in 2019 where Kota Bharu being the most urbanised and populated district with population density of 1219/km^2 (Afiqah *et al.*, 2022) A substantial majority of the participants (n=91, 87.5%) of the respondent pool, demonstrated a commendably elevated level of awareness

concerning antimicrobial resistance. This heightened awareness is particularly significant as it plays a pivotal role in addressing and mitigating this pressing issue.

The examination of the association between the sociodemographic profile of the respondents and their levels of awareness regarding AMR involved the application of Pearson's chi-square test. This statistical method was employed to assess the significance of the relationships between various sociodemographic factors and the awareness levels towards AMR. By utilizing Pearson's chi-square test, the study aimed to ascertain whether observed associations between specific sociodemographic variables and AMR awareness were statistically significant, providing a robust and quantitative evaluation of the relationships within the dataset. Initially, it was determined that there is no discernible association between gender and awareness levels, *p*-value of 0.922 ($p>0.05$). This lack of association was attributed to the prevailing societal paradigm in this era, where both males and females are afforded equal opportunities and privileges in the realm of education(Beatrice *et al*., 2019) Consequently, the absence of a gender-based distinction in awareness levels suggests a shared access to educational resources and information, contributing to a comparable awareness level across genders. This can be further confirmed when a study compares males and females' knowledge regarding AMR contradicts in many studies. It is also stated in the study that the knowledge on antibiotic is heavily related to gender norms and roles that exist within the community and varies between communities (Phuc *et al.,* 2021). Moreover, no association was identified concerning age, indicated by a p-value of 0.110 ($p>0.05$). This no significant association may be attributed to the prevalent

use of electronic devices among the majority of young adults in this era. The ready availability of the internet enables easy participation in the questionnaire, potentially diminishing any age-related disparities in awareness levels. This can be further confirmed by a similar study stating that the current use of social media platforms enable distribution to bigger groups of targeted populations (Zailani *et al.,* 2022). Furthermore, a statistically significant association was observed between race/ethnicity and awareness level, as evidenced by a p-value of 0.019 ($p<0.05$). This outcome can be attributed to the demographic composition of Kelantan residents, which is predominantly composed of individuals belonging to the Malay race. In addition, a significant association was identified between residential area and awareness level, as indicated by a p-value of 0.006 ($p<0.05$). Notably, Kota Bharu emerged with the highest number of respondents exhibiting a high level of awareness. This correlation can be attributed to the city's status as the capital of Kelantan, rendering it the most urbanized locale. This urban setting likely facilitated greater internet accessibility among respondents which was one of the inclusion criteria for this study. A similar case study was conducted in Selangor Malaysia by using a cross-sectional, questionnaire-based study. Most respondents (52%) living in the urban area showed a higher level of awareness of antibiotic resistance as compared to respondents living in the rural (30%) and suburban (27%) areas (Zailani *et al.,* 2022). Besides that, there appears to be a discernible association between the highest education level and awareness level, evident in a p-value of 0.002 ($p > 0.05$). This correlation is likely attributed to the inherent curiosity often associated with individuals of higher educational attainment. Such individuals, having pursued tertiary education, are more prone to

encountering and delving into topics related to AMR within the academic setting. It is also noted that respondents with a higher level of education (Masters/Professional Certificate and Doctorate) mostly scored a high level of awareness (Zailani *et al.,* 2022). Furthermore, a discernible association was identified between occupation and the level of awareness, as indicated by a p-value of 0.000 ($p < 0.05$), signifying a significant correlation. This relationship is likely attributed to the heightened susceptibility of individuals in medical-related occupations to encounter the issue of AMR, a global concern within the medical community. A variety of strategies and plans have been initiated to control and restrain the dissemination and reduce the risk of AMR including the establishment of "National Surveillance of Antibiotic Resistance (NSAR)" program in the government and tertiary teaching hospitals (Mariappan *et al.,* 2021). Additionally, a noteworthy observation is that a substantial proportion of the study participants are students enrolled in tertiary education institutions, where they are more apt to come across the term AMR, contributing to the observed association.

CHAPTER 6

CONCLUSION

In conclusion, the study's thorough exploration of the association between awareness levels regarding Antimicrobial Resistance (AMR) and various sociodemographic factors has yielded valuable insights. The findings indicate that sociodemographic elements such as race/ethnicity, residential area, highest education level, and occupation exhibit significant associations with the awareness levels of the participants. Notably, residents of Kota Bharu, the capital city of Kelantan, demonstrated higher awareness levels, potentially linked to increased urbanization and internet accessibility. Furthermore, individuals with higher education levels, particularly those in medical-related occupations, exhibited heightened awareness, underscoring the influence of educational and professional backgrounds on AMR awareness. These outcomes emphasize the importance of considering sociodemographic factors in designing targeted awareness campaigns and educational initiatives to address the global challenge of antimicrobial resistance effectively.

CHAPTER 7

RECOMMENDATIONS

This research represents the second attempt in Malaysia to evaluate the awareness of Antimicrobial Resistance (AMR) in Malaysia, however it is the first assessment in Kelantan. Nevertheless, it is crucial to acknowledge certain limitations that were observed during the study.

Nevertheless, certain constraints were present in the research methodology, particularly concerning the sampling strategy, which relied on a non-probability sampling approach. The chosen type of sampling, known as snowball sampling, entails the selection of initial participants from the authors' circle of peers, specifically their batchmates who share a common Kelantanese background. It's worth noting that non-probability sampling methods may pose challenges in terms of generalizability, as the sample is not randomly drawn from the entire population. The reliance on a specific subgroup, such as Kelantanese batchmates, might introduce bias and limit the broader applicability of the study's findings. This aspect of the research design raises considerations about the representativeness of the sample and, consequently, the extent to which the results can be extrapolated to the larger population under investigation

To begin with, encountering challenges in obtaining responses from rural areas was a notable difficulty, primarily due to limitations in internet accessibility. Consequently, this

has influenced the composition of the respondent pool, with the majority being residents of Kota Bharu, the capital city of Kelantan. One potential remedy to address this issue could involve implementing the survey through the distribution of physical handouts within the targeted districts, thereby enhancing the feasibility of achieving the study's objectives.

Moreover, the second phase of the study highlighted a need for refinement in the formulation of questions and statements within the questionnaire. It was observed that certain elements lacked clarity and were prone to causing confusion among respondents. Consequently, participants were compelled to provide answers without a thorough comprehension of the study's inquiries. This emphasized the importance of revising the questionnaire to not only eliminate ambiguity but also to facilitate a more nuanced and accurate understanding of participants' perspectives and insights.

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APPENDICES

Tahap Kesedaran mengenai Rintangan Antimikrobial di kalangan penduduk Kelantan/Level of Awareness of Antimicrobial Resistance (AMR) among Kelantanese

Para Responden yang dihormati,

Saya Farah Natasha Ahmad Azizi, seorang pelajar tahun kelima dalam program perubatan veterinar di UMK. Kaji selidik ini merupakan Projek Tahun Akhir saya yang bertajuk "Penilaian AMR: Satu Kajian Kes di Kelantan, Malaysia."

Maklum balas daripada anda amatlah dihargai. Sila pastikan bahawa maklumat peribadi anda akan kekal dirahsiakan dan tidak akan didedahkan. Identiti anda akan kekal anonim.

Terima kasih kerana menyertai kaji selidik ini!

Dear respondents,

I am Farah Natasha Ahmad Azizi, a 5th year student in veterinary medicine UMK. This questionnaire is a Final Year Project by me titled Assessment of AMR : A Case Study in Kelantan, Malaysia.

The responder will remain anonymous.

Thank you for participating!

* Indicates required question

1. Email *

2. Saya akan menjawab semua soalan dengan jujur dan memberikan persetujuan sepenuhnya agar penyelidik boleh menggunakan maklumat ini untuk kajian mereka sendiri. *

   I will answer all the questions with honesty and give full consent in order for the researcher to use these information for their own study.

   Mark only one oval.

   - ◯ Setuju/Agree
   - ◯ Tidak setuju/Disagree

Profil Sosiodemografi/Socio-demographic Profile

Semua maklumat ini akan digunakan untuk kajian kami. Responden akan kekal dirahsiakan.
All of these information will be used for our study. The responder will remain anonymous.

3. Jantina *

   Gender

   Mark only one oval.

   - ◯ Perempuan/Female
   - ◯ Lelaki/Male

4. Umur *

Age

Mark only one oval.

- 18-29
- 30-45
- 46-59
- 60-70

5. Bangsa *

Race/Ethnicity

Mark only one oval.

- Melayu/Malay
- Cina/Chinese
- India/Indian
- Other: _____

6. Tempat tinggal *

Residential area

Mark only one oval.

- Kota Bharu
- Pasir Mas
- Tumpat
- Pasir Puteh
- Bachok
- Tanah Merah
- Kuala Krai
- Machang
- Jeli
- Gua Musang

7. Tahap pengajian tertinggi *

Highest education level

Mark only one oval.

- UPSR
- PMR/PT3
- SPM
- STPM/MATRICS/FOUNDATION/DIPLOMA
- BACHELOR'S DEGREE
- MASTERS
- PHD

8. Perkerjaan *

Occupation

Mark only one oval.

- Berkaitan perubatan/Medical related
- Tidak berkaitan perubatan/Non-medical related
- Tidak berkerja/Unemployed
- Pelajar/student

Pengetahuan dan Kesedaran tentang Antimikrobial/Knowledge and Awareness of Antimicrobials

9. Semua ini adalah antimikrobial kecuali

All of this are antimicrobials except

Mark only one oval.

- Antibiotik/Antibiotic
- Antivirus/Antiviral
- Antifungus/Antifungal
- Antiparasitik/Antiparasitic
- Ubat bius/Anaesthetic

10. Bagaimanakah anda peroleh antibiotik?

How should you obtain antibiotics?

Mark only one oval.

- Shopee
- Farmasi(preskripsi)/Pharmacy (with prescription)
- Saudara dan Kawan/Relatives & friends
- Klinik/clinic

11. Berapakah kekerapan anda patut ambil antibiotik? *

How often should you take antibiotics?

Mark only one oval.

- Sebulan sekali/Once a month
- Seminggu sekali/Once a week
- Apabila sakit(tanpa preskripsi)/Whenever you feel sick (without prescription)
- Apabila sakit (ada preskripsi)Whenever you feel sick (with prescription)

12. Adakah selamat menggunakan antibiotik yang diberikan oleh seorang saudara atau kawan, selagi ianya mengubati penyakit yang sama?

Is it okay to use antibiotics that were given by a relative/friend, as long as they treat the same illness?

Mark only one oval.

- Ya/Yes
- Tidak/No
- Mungkin/Maybe

13. Doktor sepatutnya hanya memberi antibiotik apabila ia diperlukan.

Doctors should only prescribed antibiotics when they are needed

Mark only one oval.

- Ya/Yes
- Tidak/No

14. Adakah anda perlu terus mengambil antibiotik selepas antibiotik yang diberi oleh doktor habis? *

Should you continue taking antibiotics when all of the antibiotics have been taken as directed by the doctor?

Mark only one oval.

- Ya/Yes
- Tidak/No
- Mungkin/Maybe

Pengetahuan dan Kesedaran tentang Rintangan Antimikrobial/ Knowledge and Awareness of Antimicrobial Resistance

15. Adakah anda pernah mendengar mengenai Rintangan Antimikrobial *

Have you heard of Antimicrobial Resistance (AMR)?

Mark only one oval.

- Ya/Yes
- Tidak/No

16. Bagaimana rintangan antikkrobial terjadi? *

How does AMR occur?

Mark only one oval.

- ◯ Apabila mikrob berubah seiring masa dan tidak lagi bertindak balas kepada ubat, ia menimbulkan pelbagai masalah./When microbes change over time & no longer respond to medicine making rise of several problems
- ◯ Antimikrobial merawat penyakit dengan cekap tanpa komplikasi./Antimicrobials treat efficiently in treating the disease with no complications

17. Rintangan antibiotik berlaku apabila tubuh anda tidak boleh dirawat dengan antibiotik dan antibiotik tersebut tidak lagi berfungsi dengan baik. *

Antibiotic resistance is when your body cannot be treated by antibiotics and they no longer work as well.

Mark only one oval.

- ◯ Betul/True
- ◯ Salah/False

18. Adakah benar bahawa banyak jangkitan semakin menjadi lebih tahan terhadap rawatan antibiotik? *

Is it true that many infections are becoming increasingly resistant to treatment by antibiotics?

Mark only one oval.

- ◯ Ya/Yes
- ◯ Tidak/No
- ◯ Mungkin/Maybe

19. Adakah rintangan antimikrobial adalah isu atau masalah yang hanya berkaitan dengan manusia sahaja? *

Is antimicrobial resistance an issue/problem related to people only?

Mark only one oval.

- Ya/Yes
- Tidak/No
- Mungkin/Maybe

20. Adakah rintangan antimikrobial adalah isu yang juga memberi kesan kepada haiwan.? *

Is antimicrobial resistance an issue that affects animal?

Mark only one oval.

- Ya/Yes
- Tidak/No

21. Adakah rintangan antibiotik merupakan salah satu masalah terbesar sains yang dihadapi dunia? *

Is antibiotic resistance one of the biggest science problems that the world faces?

Mark only one oval.

- Ya/Yes
- Tidak/No

22. Di mana anda pernah mendengar tentang rintangan antimikrobial? *

Where have you heard of AMR?

Mark only one oval.

- ◯ TV
- ◯ Laman web/Website
- ◯ Media sosial/Social media (Fb, IG, reddit, twitter, tiktok, etc)
- ◯ Surat khabar/Newspaper
- ◯ Risalah/Flyer
- ◯ Kelas atau Kuliah/Class or Lecture

23. Jika bakteria tahan terhadap antibiotik, adakah sukar atau mungkin mustahil untuk merawat jangkitan yang disebabkannya? *

If bacteria are resistant to antibiotics, can it be very difficult or impossible to treat the infections they cause?

Mark only one oval.

- ◯ Ya/Yes
- ◯ Tidak/No

24. Adakah jangkitan yang tahan antibiotik menjadikan prosedur perubatan seperti pembedahan, pemindahan organ, dan rawatan kanser menjadi jauh lebih berisiko? *

Does antibiotic-resistant infections make medical procedures like surgery, organ transplants and cancer treatment much more dangerous?

Mark only one oval.

- ◯ Ya/Yes
- ◯ Tidak/No

TAMAT/THE END

Terima kasih kerana menyertai kaji selidik ini. Kerjasama anda amat dihargai <3

Thank you for participating in my questionnaire. You are appreciated <3