Original Research

KNOWLEDGE, ATTITUDE, AND PRACTICE OF ANTIBIOTIC USE AND ANTIBIOTIC RESISTANCE AMONG THE GENERAL POPULATION OF MALAYSIA

Ayham Khaled , Muhammad Hafizul Iman Bin Amir , Nurul Izzah Binti Ngah , Anis Farhana Binti Khairul Anuar & Mohammed A. Abdalqader

Faculty of Medicine, University of Cyberjaya, Cyberjaya, 63000, Malaysia

* Corresponding author: mohamed.aj@cyberjaya.edu.my

ABSTRACT

Introduction: Globally, antibiotic resistance is a serious issue. Recognizing the impact and importance of antibiotic resistance is the first step in preventing its progression. This study aimed to evaluate knowledge, attitudes, and practices regarding antibiotic use among the general population of Malaysia. A cross-sectional study was conducted involving 177 respondents. **Methods:** Convenience sampling was applied, and we used an online questionnaire. The data were analyzed using descriptive analysis and multiple linear regression. **Results:** A sum of 177 respondents were polled, with 121 (68.4%) being female and 130 (73.4%) falling between the ages of 18 and 29. In the previous year, forty-five point eight percent (81) had used antibiotics more than once. Seventy-six point four percent (136) were found to have good knowledge of antibiotic use and practice. However, more than half of respondents believe that antibiotics help them to recover quickly from fever. More than half of the respondents (59.88%) thought that or were not sure that Antibiotic resistance affects only those who take antibiotics regularly. Additionally, almost half (49.7%) of the respondents never discard their remaining antibiotics. We found that good practice of antibiotic use is associated with increasing age ($p=0.046$), good knowledge ($p=0.050$), and good attitude ($p<0.001$) towards antibiotic use and its resistance. **Conclusion:** Despite the generally favorable results, more interventional measures should be taken into consideration for the future improvement of the general public's understanding of antibiotic usage and practice, especially in schools, colleges, and universities.

Keywords: Antibiotic Use, Antibiotic Resistance, Knowledge, Attitude, Practice

Introduction:

Antibiotic resistance is when a bacterium develops a mechanism against the antibiotics administered (World Health Organization: WHO, 2021). Antibiotic Resistance bacteria are emerging globally and are becoming a worldwide problem (World Health Organization: WHO, 2017). In 2021, Antibiotic resistance is still in the top ten threats identified by WHO. Antibiotic resistance, a subset of antimicrobial resistance (AMR), is a pressing global health concern threatening the efficacy of antibiotics, essential for treating bacterial infections in humans. The World Health Organization (WHO) emphasizes that antibiotic resistance occurs when bacteria evolve mechanisms to withstand the effects of antibiotics, rendering these drugs ineffective in controlling infections. Now solving the common frequent use of antibiotics, respective countries are planning to practice national action plans on AMR collaborating with WHO's Global Action Plan (GAP) on the issue and danger of Antimicrobial Resistance. The WHO highlights the need for effective infection prevention and control measures, including hand hygiene, sanitation, and vaccination, to limit the transmission of antibiotic-resistant pathogens in healthcare facilities.

A study done in Europe has investigated outpatient antibiotic use and its association with antibiotic resistance. Utilizing a cross-national database, the researchers analyzed data on antibiotic consumption and resistance patterns across various European countries. The study revealed significant variations in outpatient antibiotic use among European nations, with higher consumption rates observed in southern and eastern European countries compared to northern and western European counterparts. Moreover, the researchers found a clear association between high levels of antibiotic consumption and increased rates of antibiotic resistance, particularly for common bacterial pathogens such as Streptococcus pneumoniae and Escherichia coli, which could be attributed to faulty use of antibacterial drugs and uninformed consumer's education by Doctors/Pharmacists (Goossens et al., 2005).

Irrational use of antibiotics leads to antibiotic resistance, failure to treat, a lengthy period of hospitalization, stress on economic and health care, and death. Misuse is caused by poor knowledge, non-compliance to medication, self-medication, buying from over the counter, and the spread of misinformation (Ricciardi et al., 2016). Repeated antibiotic usage for a lengthy phase of time puts demanding stress on specific bacteria by eradicating vulnerable bacteria, authorizing antibiotic-resistant bacteria to survive and grow more antibiotic-resistant bacteria. The bacteria can develop mechanisms for resistance to antibiotic effects with the help of DNA (deoxyribonucleic acid). One mechanism that the bacteria has is an efflux pump that gets rid of a drug that enters the bacteria. The other way is to create an enzyme that breaks down the drug. According to the Malaysian Action Plan for Educating about Antimicrobial Resistance (MyAp – AMR) (2016), the popularity of antibiotic resistance is high in Malaysia. In Malaysia, Escherichia coli has increased in resistance to cefotaxime from 15% in 2010 to 23.4% in 2016. Also, Streptococcus pneumoniae, the commonest bacteria to cause community-acquired pneumonia, is now 31% resistant to erythromycin, which is one of the popular antibiotics used in primary care in treating respiratory tract infection cases. Moreover, Salmonella sp, a prevalent foodborne pathogen, resistance to ciprofloxacin increased from 1.9% in 2013 to 3.4% in 2016, and

resistance to ampicillin reached 25% in 2016. For that reason, This study aimed to evaluate knowledge, attitudes, and practices regarding antibiotic use among the general population of Malaysia.

Methods

This study is a cross-sectional study. The study was conducted in every single one of the 13 states and 3 federal territories of Malaysia. The study was conducted from the 1st of March 2022 to the 31st of March 2023 on the general population of Malaysia. Our inclusion criteria are Malaysians, 18 years of age and above during the stated period, Having access to Google Forms, and Literacy in Bahasa Malaysia or English.

The sample size was calculated using G Power software. With the effect size, f2 is 0.15 (medium level), the alpha level at 5%, the power of study at 80%, and number of predictors of 8 variables, the required minimum sample size is 109. However, considering that our study is nationwide, the ideal sample number will be as many as possible.

Convenience sampling was used. The online Google Form questionnaire was distributed via social media platforms (WhatsApp, Instagram, Facebook, Twitter) and the university email list. We tried to reach out to our acquaintances from every state of Malaysia to distribute our questionnaire to respondents across Malaysia until we reached more than our desired sample size (n = 109).

Study tools

An online dual language validated questionnaire in Bahasa Malaysia and English via Google Forms was used. The validated questionnaires for frequency of antibiotic use, attitude on antibiotic use and antibiotic resistance, and practice on antibiotic use were obtained from two previous studies, which they modified from previous studies and it was reviewed by subject experts. The validated questionnaire for knowledge regarding antibiotic intake and antibiotic resistance was obtained from more recent research and was evolved based on an analysis of validated questionnaires from earlier research before it was investigated thoroughly by an expert panel and senior pharmacists for content validity.

The concluding questionnaire consists about five sections.

Section A: Sociodemographic Characteristics

This section consists of 6 items on sociodemographic variables which are age, gender, education level, monthly household income, geographic area, and state of residency.

Section B enquires about respondents' frequency of antibiotic use in the past year.

Section C consists of 14 questions linked to knowledge and understanding of antibiotic consumption (eight questions) and antibiotic resistance (eight items). The questions contain a combination of true and false proclamations concerning antibiotics. For every right response, one point will be awarded; if the respondent chooses the "Not sure" option or provides an incorrect response, they will receive zero points. For the knowledge section, the lowest and maximum points are 0 and 20, respectively.

Section D consists of five questions to assess answerers' attitudes on antibiotic use and antibiotic resistance.

Lastly, section E consists of eight items related to the practice of antibiotic use, using "always", "sometimes" and "never" options. Two points will be given to each good practice, one point for "sometimes" and zero points for each bad practice. The total score will then be converted into dichotomous: good (> 60%) or poor (≤60%)?

Data Analysis

Upon obtaining data, statistical analysis was conducted using Jeffrey's Amazing Statistics Program (JASP), a statistical analysis software. Statistical tests that will be used to analyze the data are descriptive analysis, multiple linear regression, and contingency table. We have decided to use JASP due to its reproducible and interactive features, allowing us to navigate through the needed statistical tests more efficiently. Furthermore, the program is also available for us to use for free, which is easier for the research. The factors associated with the practice of antibiotic use with a p-value less than 0.05 with a 95% confidence interval are deemed statistically significant.

Ethical Approval

Acceptance and evaluation of this study are done and concluded by the University of Cyberjaya Research Ethics Review Committee (CRERC) electronically before this research. All participants were provided with informed consent before the acquisition of data. Participants were not named in subsequent write-ups. The participant was required to answer all 26 questionnaires given within the targeted duration which is 15 minutes. The data analysis, the data was divided into certain categories with assisted software and Microsoft Excel.

The research poses no potential risks to the well-being of the participants as the data will be maintained and used only for study purposes. To ensure the confidentiality of the respondent, all obtained data will be written in Microsoft Excel and stored in the hard drive of the group and the data will be archived only for this duration of the study. Each of the international and national standards for ethical research was approved and adhered to.

Results

Overall, 177 respondents completed the questionnaires, which makes up more than a 100% response rate. The majority of the respondents (53.7%) come from the western zone. The majority of the respondents are distributed between ages 18-29 (73.4%), female (68.4%), received tertiary education (93.8%), belong to the B40 group (40.1%) in terms of monthly household income, live in an urban area (77.4%), and resides in the west zone (53.7%).

For the frequency of antibiotic use in the past year, over half of the respondents (54.2%) had taken antibiotics only once in the preceding year. The majority of respondents (53.33%) in the age group of 60 and above took antibiotics for more than one course in the past year, while the age group with the least number of frequent (≥1) antibiotic users is 50-59 years old (28.6%). In terms of gender, 60.7% of males took frequent antibiotics, compared to 38.8% of females.

The average respondent's score on knowledge of antibiotic use and resistance is 13.25 out of 20. However, nearly half of the respondents (49.71%) thought that antibiotics have the ability to treat viral infections. Moreover, more than half of respondents (59.88%) thought that or not sure about antibiotic resistance is only a problem for people who take antibiotics regularly. Females and the age group of 60 years old and above scored the highest for knowledge in their category (79.3% and 80% respectively).

Table 1: Attitude on Antibiotic Use and Antibiotic Resistance

		Respondent's Answer, N (%)		
		Agree	**Disagree**	**Not sure**
1	When I have a cold, I should take antibiotics to prevent getting a more serious illness.	58 (32.8)	106 (59.9)	13 (7.3)
2	When I get a fever, antibiotics help me to get better more quickly.	83 (46.9)	82 (46.3)	12 (6.8)
3	When I take antibiotics, I contribute to the development of antibiotic resistance.	81 (45.8)	46 (26.0)	50 (28.2)
4	Skipping one or two doses of antibiotics does not contribute to the development of resistance.	35 (19.8)	101 (57.0)	41 (23.2)
5	Antibiotics are safe and can be used commonly	72 (40.7)	80 (45.2)	25 (14.1)

Table 1 shows that The mean attitude score towards antibiotic use and resistance is 2.54 out of 5. The majority of respondents (46.9%) stated that antibiotics helped them recover faster from a fever, although the majority (57.0%) agreed that skipping antibiotic doses contributes to the development of resistance.

90.4% of responders usually visit a doctor before starting antibiotics, and 76.3% always finish the entire course of antibiotics. However, interestingly, most of them (49.7%) never discard the remaining antibiotics, if any.

Table 2: Factors Associated with Good Practice of Antibiotic Use

Coefficients[a]								
Model		Unstandardized coefficients		Standardized coefficients	t	P value	Collinearity statistics	
		B	Std. error	Beta			Tolerance	VIF
1	(Constant)	16.949	2.145		7.900	0.000		
	Age	0.028	0.014	0.147	2.014	0.046	0.840	1.191
	Knowledge score	0.095	0.048	0.153	1.971	0.050	0.757	1.321
	Attitude score	0.472	0.127	0.292	3.702	0.000	0.732	1.366
[a]Dependent variable: Practice score								

$Y = 16.949 + 0.028(X^1) + 0.095\ (X^2\ score) + 0.472(X^3)$

Interpretation:

Practice score = 16.949 + 0.028(Age) + 0.095 (Knowledge score) + 0.472(Attitude score). There is a significant linear relationship between age and practice score (P=0.046). Those with a 1-year increase in age have a practice score increase of 0.028. There is a substantial linear link between knowledge and practice scores (p=0.050). Those with a 1-point increase in knowledge score have a practice score increase of 0.095. There is a substantial linear link between attitude and practice scores (P<0.001). Those with a 1-point increase in knowledge score have a practice score increase of 0.472. However, there is no significant correlation between education level and practice score.

Discussion

Our study found that more than half of respondents (54.2%) had only taken antibiotics once in the preceding year. This is strikingly comparable to research done in Malaysia, where (55.9%) received antibiotics for no more than one course the previous year (Islahudin et al., 2014). This result may correlate to the fact that on average, our respondents scored generally good in knowledge, attitude, and practice of antibiotic use and resistance, although frequency of antibiotic use does not significantly affect good practice (p>0.05). The level of knowledge among the general Malaysian population is adequately good, where around 94% of respondents were acquainted with the fact antibiotics are used to kill bacteria. This is quite similar to a recent study done among nursing students in IIUM where 97% of respondents are aware of this fact (Kong et al., 2021). This may be explained because most of the respondents in both their and our studies received or are receiving tertiary education. However, it is of concern that almost half of the respondents (49.71%) thought that or were not sure about if antibiotics

are capable of treating viral infections. Moreover, more than half of respondents (59.88%) thought that or not sure about antibiotic resistance is only a problem for people who take antibiotics regularly.

Over 85% of our respondents believed that consuming less antibiotic than what was prescribed is the ideal decision than consuming the full dosage and frequency prescribed. However, close to 50% of the respondents believed that or didn't know if antibiotics can be used to treat viral infections. This is a common confusion or misconception surrounding this information. On the threat of antibiotic resistance, 74% of people taking part in our study knew that antibiotic resistance is a threat to them and their families. This result is similar to another study where more than half of them were also aware that antibiotic resistance is a threat and can affect about 68.9% of their family's health (Kong et al., 2021). On the other hand, More than half of our respondents (59.88%) believed or were unsure whether antibiotic resistance was only a concern for persons who used antibiotics regularly.

On the aspect of attitude, the result of the respondent showed poor attitude. The majority of respondents (46.9%) stated that antibiotics helped them recover faster from fevers. This means many antibiotic users have a promising wish for their conditions to just disappear so they can carry on feeling well. Importantly, most of them (57.0%) agreed that skipping doses of antibiotics contributes to the development of resistance.

Furthermore, approximately 14% of our respondents would stop taking the prescribed antibiotic after their symptoms subdue. This finding is also similar to a study done on nursing students in IIUM where 14% admitted this (Kong et al., 2021). This result is supported by another research of ten percent of them declared that they stopped taking the antibiotics earlier as soon as the symptoms showed improvements (Raupach-Rosin et al., 2019). Thus, our findings conclude that early discontinuation of antibiotic therapy is a bit more prevalent than the general population in Germany, but this could be due to not enough information on antibiotic resistance given by the doctors they visit.

Our study highlighted that increasing age is one indicator of good practice score. There was a significant linear relationship between age and practice score (P=0.046). This finding aligns with results from other studies (Wong et al., 2021)(Aljayyousi et al., 2019)(Gebeyehu et al., 2015)(Geta & Kibert, 2021). This suggests that interventions targeting antibiotic use should prioritize individuals of a younger age. Also, a high knowledge score is connected with good practice proved in our study. This is consistent with other studies (Wong et al., 2021)(Karuniawati et al., 2021).

Moreover, a study done in Indonesia reveals a strong correlation between facets of knowledge to practices (Wong et al., 2021). Our study also proved high attitude scores and practice scores are supportive of each other, which is consistent with studies in northwest Ethiopia, Egypt, and Indonesia (Karuniawati et al., 2021)(Geta & Kibret, 2021) (Iosr & Shimmaa, 2015).

Our research effort has several limitations. Firstly, the cross-sectional is not an ideal method for determining the causal link between KAP and the independent variables. On top of that, this questionnaire was conducted electronically, and electronic questionnaires may sometimes lack good accuracy in providing good information. However, this is the most practical form of data collection for us. Secondly, Because the individuals were picked using convenience sampling, the results are biased and cannot apply to the general population. Although our findings cannot be generalized to the entire population, they can be used as preliminary evidence of the general population's KAP for developing relevant public health initiatives. Many groups of people were underrepresented like elders, education level lower than tertiary, and residents in East Malaysia. The internet-based questionnaire may have caused selection bias because only internet users were invited. to participate in the study. However, it may partly explain the under-representation of the elderly in the study. The majority of our respondents are residing in the West of Malaysia because we spread our survey from there. However, we tried to our effort to spread surveys to other regions in Malaysia by different means and help.

Conclusion

Our findings indicate that the general public's understanding in Malaysia regarding antibiotic use and antibiotic resistance is considerably satisfactory. However, half of the people were not sure about the antibiotic's action against viral infection. Antibiotics are ineffective against viral infections, and their use during a viral illness can exacerbate the issue by promoting bacterial resistance to them. Our respondents have an insight regarding the problem antibiotic resistance has on the community. Our respondents showed a poor attitude regarding antibiotic use and its efficacy. A considerable number of responders believed that antibiotics could swiftly lower fever. Our research revealed that elderly persons appear to have more correct knowledge than younger people. Given the study's limitations, the primary findings may assist significant organizations develop measures and strategies to combat antibiotic resistance and lessen its impact. The results provided would help in increasing KAP of antibiotic use and antibiotic resistance through specific propagation methods towards the Malaysian population.

Acknowledgments

The authors wish to thank all the participants who supported the research.

Conflicts of Interest

The authors declare no conflicts of interest.

References (should arranged alphabetically)

- World Health Organization. (2021). Antimicrobial resistance. Retrieved January 11, 2022. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance
- World Health Organization. (2017). Global action plan on antimicrobial resistance. https://www.who.int/antimicrobial-resistance/publications/global-action-plan/en/
- Goossens, H., Ferech, M., Vander Stichele, R., & Elseviers, M. (2005). Outpatient antibiotic use in Europe and association with resistance: a cross-national database study. The Lancet,365(9459), 579-587. https://doi.org/10.1016/S0140-6736(05)17907-0

- Ricciardi, W., Giubbini, G., & Laurenti, P. (2016). SURVEILLANCE AND CONTROL OF ANTIBIOTIC RESISTANCE IN THE MEDITERRANEAN REGION. Mediterranean Journal and Infectious Diseases, 8, 2016036. of Hematology https://doi.org/10.4084/mjhid.2016.036
- Ministry of Health Malaysia: Malaysian Action Plan on Antimicrobial Resistance (MyAPAMR) 2017-2021 First Edition 2017. ISBN: 978-967-2173-21-2
- Islahudin, F., Tamezi, A. M., & Shah, N. M. (2014). Knowledge, attitudes and practices about antibiotic use among the general public in Malaysia. The Southeast Asian journal of tropicalmedicine and public health, 45(6), 1474-1482.
- Kong, L. S., Islahudin, F., Muthupalaniappen, L., & Chong, W. W. (2021). Knowledge and expectations on antibiotic use among the general public in Malaysia: A nationwide cross-sectional survey. Patient Preference and Adherence, Volume 15, 2405-2416.https://doi.org/10.2147/ppa.s328890
- Raupach-Rosin, H., Rübsamen, N., Schütte, G., Raschpichler, G., Chaw, P. S., & Mikolajczyk, R. (2019). Knowledge on antibiotic use, self-reported adherence to antibiotic intake, and knowledge on multi-drug resistant pathogens -results of a population-based survey in lower saxony, Germany. Frontiers in Microbiology, 10(APR), 1–8. https://doi.org/10.3389/fmicb.2019.00776
- Wong, L. P., Alias, H., Husin, S. A., Ali, Z. B., Sim, B., & Ponnampalavanar, S. S. L. S. (2021).Factors influencing inappropriate use of antibiotics: Findings from a nationwide survey of the general public in Malaysia. PLoS ONE, 16(10 October 2021), 1-12. https://doi.org/10.1371/journal.pone.0258698
- Karuniawati, H., Hassali, M. A. A., Suryawati, S., Ismail, W. I., Taufik, T., & Hossain, M. S. (2021). Assessment of knowledge, attitude, and practice of antibiotic use among the population of boyolali, indonesia: A cross-sectional study. International Journal of Environmental Research and Public Health, 18(16). https://doi.org/10.3390/ijerph18168258
- Geta, K., & Kibret, M. (2021). Knowledge, attitudes, and practices of animal farm owners/workers on antibiotic use and resistance in Amhara region, north western Ethiopia. Scientific Reports, 11(1), 1–13. https://doi.org/10.1038/s41598-021-00617-8
- Iosr, J., & Shimmaa, M. M. M. (2015). Study of Maternal knowledge, Attitude and Practice on Antibiotic Use for Acute Upper respiratory Tract Infection in Children. *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*. https://doi.org/10.6084/m9.figshare.1520422.v1
- Aljayyousi, G. F., Abdel-Rahman, M. E., El- Heneidy, A., Kurdi, R., & Faisal, E. (2019). Public practices on antibiotic use: A cross-sectional study among Qatar University students and their family members. *PLoS ONE*, 14(11), 1–22. https://doi.org/10.1371/journal.pone.0225499
- Gebeyehu, E., Bantie, L., & Azage, M. (2015). Inappropriate use of antibiotics and its associated factors among urban and rural communities of Bahir Dar city administration, northwest Ethiopia. *PLoS ONE*, 10(9), 1–14. https://doi.org/10.1371/journal.pone.0138179