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KNOWLEDGE, ATTITUDES, AND PERCEPTION ON ANTIBIOTIC USE AND ANTIMICROBIAL RESISTANCE AMONG RESIDENTS OF METRO MANILA, PHILIPPINES

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ABSTRACT

Antimicrobial resistance is a threat to the general population worldwide. This study aims to investigate the knowledge, attitude, and perception of Manila residents aged 21-59 years old. To test the hypotheses, an online survey was distributed using the snowball method among the specified population. The data was analyzed using Descriptive statistics and Inferential tools: ANOVA, Profile Plot Analysis, and multiple comparisons using Bonferroni and Spearman's Rho through SPSS, revealing 63 respondents had moderate levels, 57 had poor levels, and 12 had good levels of knowledge on antimicrobial resistance and antibiotic use. There was an overall agreement to perceived benefit, neutral perception on perceived barrier, overall agreement to perceived threat, and overall agreement on the perception of self-efficacy. A significant difference in the level of knowledge was found according to household income (p-value = <0.001), in the level of attitude to age (p-value = 0.008) and to household income (p-value = <0.001), and between the perception in terms of age (p-value = 0.008) and household income (p-value = 0.035). There is no significant difference in the levels of knowledge, attitude, and perception according to educational attainment. Attitude was found to be negatively related with perceived benefit and barrier. Perceptions were significantly related with age, household income, knowledge, and attitude. This suggests that an increase in the knowledge of the community leads to better attitudes and perception on antibiotic use. Therefore, it must be fronted against disinformation to reduce the occurrence of medicinal ineffectivity due to antimicrobial resistance.

Keywords:

Antibiotic use; Antimicrobial resistance; Knowledge; Attitudes; Perception; Age; Educational Attainment; Household Income

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I. Introduction (Rationale)

Antibiotic resistance has increasingly been recognized as a major health issue in healthcare and the use of Antibiotics is regarded as an important factor in the growth and expansion of Antibiotic resistance (Andre. Et.al., 2010). According to the Center for Disease Control and Prevention, the Antibiotic resistance specifically bacterial microorganisms has risen to into dangerously high levels that has the potential to to cause deleterious effects to people at any stage of life especially those that are involved in the healthcare, veterinary, and agriculture industries, making it one of the world's most urgent public health concerns. Infections caused by Antibiotic resistance are difficult to treat and would require hospitalization, frequent follow-ups, and costly alternative treatment plans (CDC, 2020). Globally, Antibiotic resistance of microorganisms is responsible for at least 700,000 deaths every year because of the increasing drug resistance in illnesses such as bacterial infection, malarial infection, HIV/AIDS, and Tuberculosis. An increase in the financing has been carried for antimicrobial research and development, as well as to reinforce policies regarding antimicrobial resistance in the last few years (Colson, et al., 2021). Antibiotics are among the most widely used class of drugs in hospitals, and they are really important to be used optimally otherwise emerging resistant pathogens will interfere with treatment outcomes. However, their effectiveness and easy access have also led to their overuse promoting bacteria to develop resistance. Resistance occurs when bacteria changes in response to the use of antibiotic medicines (Sadishka Shrestha et. al., 2019)

Antibiotic resistance is also considered as a global public health threat since it threatens the progress of healthcare and the economy. According to the Research Institute for Tropical Medicine (2016), antimicrobial resistance hinders the control of infectious diseases, increases cost of healthcare, and damages a country's economy. Due to the overuse and misuse of antibiotics over a period of time, antibiotic resistance spread has accelerated. Even with the new technologies, medicines, and therapies developed, without a behavioral change, Antibiotic resistance will still remain a major threat (WHO, n.d.). This resistance is unavoidable for bacterial revolution, adaptation, and natural selection, if misuse and overuse of antibiotics is not restricted (Shah, et al., 2021). According to the Department of Health's Reference Laboratory for the Antimicrobial Resistance Surveillance Program, there has been an increasing number of bacterial organisms that has records showing Antibiotic resistance such as Pseudomonas aeruginosa, Neisseria gonorrhoeae, and Methicillin resistant Staphylococcus aureus in the Philippines. According to JAASP, one of the primary factors that causes Antimicrobial resistance (AMR) is the self medication of patients and lack of adequate supervision of a Physician.

The problem of antimicrobial resistance is certainly measurable in the Philippines. There have been a noted increase in antibiotic resistance among pathogenic strains in the country since the late 1990 (Clendenen et al., 1992;Nissinen, et al., 2008) increased antibiotic resistance among environmental bacteria (Ntabugi et al., 2020), increased resistance among *Escherichia coli* (Vital et al., 2018), and others. This problem is further complicated by the misconceptions and ill practice that communities among the country observe (Barber et al., 2017; Tormunkey et al., 2020).

Because of the lack of studies on antimicrobial resistance and the primarily susceptible population residing in Manila City, generally due to the high incidence of self-prescription of

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antibiotics observed from patients received in the hospital (Saito et al., 2018), the quantitative study aims to collate the level of knowledge, attitudes, and perception of adults on antibiotic use and antimicrobial resistance. It seeks to investigate the relationship between the demographic profile of respondents and their line on the misuse and overuse of antibiotics, and explore relevant factors that contribute to such. The study aims to serve as a basis for intervention against the accelerated spread of antibiotic resistance, especially among misinformed and miseducated populations.

Lastly, since antibiotic resistance, brought about by its misuse, overuse, and abuse, has been a growing threat both globally and locally, the study aims to recognize which factors to address when creating physical or concrete approaches to the problem.

Objectives of the Study

The study is intended to assess the knowledge, attitude, and perception on antimicrobial resistance and antibiotic use of the residents of Metro Manila.
Specifically it aims:

1. To determine the demographic profile of the respondents.
2. To determine the level of knowledge, attitude, and perception of adults ages 21-59 years old on antibiotic use and antimicrobial resistance.
3. To determine if there is a significant difference in the level of knowledge, attitude, and perception of the adults classified into age groups, household income, and educational attainment on antibiotic use and antimicrobial resistance.
4. To determine if there is a significant relationship among the demographic profile of the respondents, the level of knowledge, attitude, and perception on antibiotic use and antimicrobial resistance.

Statement of the Problem

The rampant misuse, overuse, and abuse of antibiotics in the country necessitates the analysis and evaluation of the knowledge, attitude, and perception of Filipino adults residing in Metro Manila on antimicrobial resistance with strict regards to their intrinsic conditions among other determinants. The study specifically aims to answer the following:

1. What is the demographic profile of the respondents?
2. What is the level of knowledge, attitude, and perception of adults ages 21-59 years old on antibiotic use and antimicrobial resistance?
3. Is there a significant difference in the level of knowledge, attitude, and perception of the adults classified into age groups, household income, and educational attainment?
4. Is there a significant relationship among the demographic profile of the respondents, level of knowledge, attitude, and perception on antibiotic use and antimicrobial resistance?

Theoretical Framework

The IPO model (Input, Process, Output) is a generally employed approach in research that is based on classic systems theory which suggests that the general structure of a system is a vital

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factor in determining the effectiveness of its function as its individual components. Moreover, the IPO model presents a causal structure in which the resulting outputs are a function of different group processes, which is then also influenced by various input variables. ("Input-Process-Output Model", 2016.)

The IPO Model depicts all of the factors that make up a process, in which in its diagram, all the materials and information needed in the entire process are included. Furthermore, specific details of the process, description of the products and by-products fixed on the process are also included in the IPO diagram (Canonizado, 2021.). The input consists of raw materials which are analyzed, processed and transformed by internal system processes to generate results that serve as the output (American Psychological Association). In the study of Neto (2021) regarding the Impacts of a large scale model of Municipal Solid Waste wherein the input concepts used is the domestic waste used. The study made use of this wastes to segregate (manual sorting) them according to different categories, which then served as the process of the study. The results showed that there were five (5) categories; mechanical, biological, waste to energy, and service, which serves as the output concept. The general IPO Model follows a linear schematic diagram, and is presented below (Figure 1.)

Figure 1. *Graphical representation of the General Input-Process-Output Model*

Conceptual Framework

The study analyzes three significant variables, specifically: the level of knowledge, level of attitudes, and level of perceptions of individuals, particularly individuals residing in Metro Manila, aged 21-59 years old, regarding Antibiotic use and Antimicrobial Resistance. Related factors that influence these variables were also determined, particularly sociodemographic characters of these individuals. Applying the Input-Process-Output Model, the data gathered from the participants would be considered as intrinsic status that the respondent's exhibit which include their sociodemographic profile in terms of Name (Optional), Age, Address, Household Income, and Highest Educational Attainment, and the levels knowledge, attitudes, and perceptions that they exhibited to the topic of Antibiotic Use and Antimicrobial Resistance. The input variables were to be gathered as responses from the respondents.

The responses gathered would go through the workflow process, including the information obtained using a modified set of questions, statistical treatment of data, data analysis, and data interpretation. This approach is under a research design that is descriptive, quantitative, and correlational in discipline. The input and process is necessary to produce the output objectives of the study.

The results show the answers and information produced after undergoing the workflow process, which will serve as the output of this study. The output will include identification of the demographic profile of the participants from Metro Manila, the determined level of knowledge, attitudes, and perceptions regarding antibiotic use, the difference in the level of knowledge,

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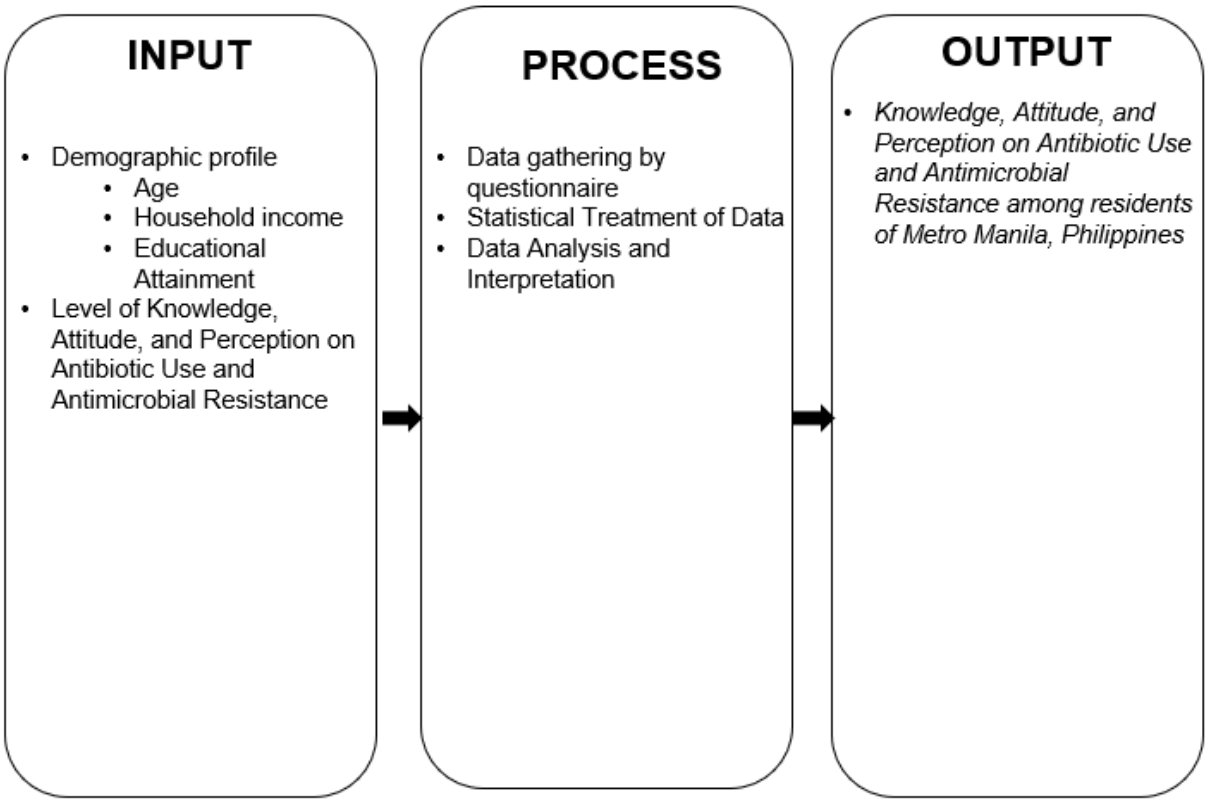
attitude, and perception on antibiotic use and antimicrobial resistance of the respondents classified into age groups, household income, and educational attainment. The output will also show the relatedness between the demographic profile of the participants and the degree of knowledge, attitude, and perception on antibiotic use and antimicrobial resistance. A graphical representation of the Input-Process-Output conceptual framework is shown below(Figure 2).

Figure 2. *A graphical representation of the Input-Process-Output Conceptual Framework of the Study*



II. RESEARCH METHODOLOGY

The chapter on research methods presents an extensive review of the procedure and methods used in the study. This chapter discusses the study design, the respondents/subjects and the study site, the data measurement and consequential instrumentation, the data gathering procedures, the ethical considerations acknowledged, and the data analysis instruments utilized for the statistical treatment and analysis of the responses. The succeeding information provided was obtained from relevant publications, studies, journals, and other well-founded sources that fitted the study.

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Study Design

The study was done with a quantitative, descriptive comparative design which assessed the levels of knowledge, attitudes, and perceptions of the working age population, having 21-59 years of age, towards antibiotic use and antimicrobial resistance. Determined levels were measured for correlation and difference of the demographic profile and the knowledge, attitudes, and perceptions of the working age population, aged 21-59 years old in antibiotic use and antimicrobial resistance.

According to Hussain, et al., (2019), quantitative research methods refer to techniques and strategies that enable the researcher to examine the outcome in a numerical format. There are various research methods available and selection of which depends on the objective of the research method, as well as the associated questions for which one is seeking to answer. For the analysis of the variables acquired from the study, the assessed variables were measured using statistical processes. This would help eliminate the bias and manipulation in the analysis of outcomes, as well to ensure that the findings in the study were generalizable and replicable. Moreover, according to LeTourneau University, quantitative research focuses on gathering numerical data and generalizing it across groups of individuals and/or attempting to explain a specific phenomenon. The input gathered from the respondents were used to determine the relationship of the different variables using statistical instruments in establishing the degree of correlation and difference of the observed variables. In this study, the knowledge, attitudes, and perceptions of the working age population were quantified through a scale. Determining the correlation of the variables, including the sociodemographic profile of the respondents, to the knowledge, attitudes, and perceptions of the working age group can be further used to study the similarities and differences among them, using comparative analysis. This comparative analysis design in this research aids in the discovery of significant association between two or more variables.

Respondent Subjects and the Study Site

The study aimed to obtain significant data from individuals living in Metro Manila. Individuals aged 21 to 59 years old and were living in Metro Manila are the ones who were included in the research process. The study utilized the collected data regarding the participants' sociodemographics to group them according to age, household income, and educational attainment. The address was also collected to ensure that the participants are within Metro Manila. The study site was chosen considering the hindrances brought by the COVID-19 pandemic. The study was conducted in a remote research setting and with limited time and resources.

The suitability of the site would depend on the address provided by the respondent as the scope and limitation of our study is only within Metro Manila. In the questionnaire, the address of the respondent must be provided to determine whether the data could be accepted or rejected. Any sample that is not within the limitations of the study must be rejected.

The participants were free to withdraw anytime since the study was voluntary. The participants may inform the researchers of their withdrawal through the contact details indicated in the informed consent. The data collected from withdrawn participants would be permanently deleted and excluded from the study.

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The study utilized different social media platforms to disseminate the survey questionnaire to target respondents. The study was conducted right after the approval of the online survey questionnaire. The study did not perform any experimental procedures since it could risk the physical and physiological health of the participants. The researchers guaranteed the anonymity and confidentiality of all the data collected from the online survey.

In accordance with our statistician, Raosoft online sample size calculator was used to compute a suitable sample size that can represent the whole population of Metro Manila. The Raosoft calculator is a software used to calculate the sample size required for a research or survey (Project Championz, 2018). The software asked for the margin of error, confidence level, population size, and response distribution to generate the sample size for the study. The common margin of error used is 5%, confidence level is 95%, population size is the current population of Metro Manila for the study, and the response distribution is constant at 50%.

According to Raosoft, the formulas used to calculate for the sample size are the following:

$$X = Z(c/100)^2 r(100-r)$$

$$n = N\,x/((N-1)E^2 + x)$$

$$E = Sqrt[(N - n)x/n(N-1)]$$

wherein N is the population size, r is the fraction of responses that you are interested in, and Z(c/100) is the critical value for the confidence level c.

The total population of Metro Manila in 2021 according to the World Population Review is 14,158,573 individuals. The Raosoft online sample size calculator calculated a minimum of 385 sample size required to properly conduct the study. The researchers disseminated the survey to different social media platforms for respondents to access until the quota was reached. The sampling technique used for this study was snowball sampling. Snowball sampling is a recruitment technique in which the research participants are asked to assist in recruiting additional participants (Oregon State University, 2010). The survey questionnaire was accessed by those individuals known by the researchers and were given with the questionnaire through different social media platforms and the respondents could refer it to their relatives or friends that fits in the criteria of a participant for the study. The participants were assessed regarding their levels of knowledge, attitude, and perception on antibiotic use and antimicrobial resistance with respect to their socio-demographic profile.

Data Measure/Instrumentation

Socio-demographic Section

The purpose of the study was to collect the age, household income, and educational attainment of the respondents. This was done through screening questions at the beginning of the questionnaire where the respondents provided the necessary information. Age will be asked through a fill in the blank question while family income and educational background will be asked through multiple choice-form questions. The inclusion criteria of this study were the following: individuals aged 21 to 59 years old, and residing in Metro Manila. Exclusions to the subject and

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study site were licensed health professionals, whose prior knowledge might skew the results, and vulnerable groups, which include mentally disabled persons, and individuals, who were outside of the targeted age range and were not living in Metro Manila. Study participants who did not provide their informed consent were excluded from the study, as well.

Knowledge Section

To measure the respondents' knowledge on antibiotic use and antimicrobial resistance, the study adapted the questionnaire employed by André, Vernby, Berg, & Lundborg (2010) on the *Survey of public knowledge and awareness related to antibiotic use and resistance in Sweden*, and the questionnaire used by Kim, Moon, and Kim (2011) in their study of the *Public Knowledge and Attitudes Regarding Antibiotic Use in South Korea*. This study employed questions regarding the areas of use and effect of antibiotics taken from the first study mentioned and questions regarding antimicrobial resistance in the second.

The questions were in the form of yes or no statements. The correct and incorrect responses were used to evaluate the respondents' knowledge on antibiotic use and antimicrobial resistance.

For this study, the researchers are concerned with the precision of the questionnaire in determining the knowledge of the Filipino adults regarding antibiotic use and antimicrobial resistance, hence, test-retest reliability was used to assess the reliability of the questionnaire.

Cohen's Kappa measures the degree of agreement between two raters that classifies subjects into *k* categories and takes into consideration the agreements due to chance. This is a commonly used measure for interobserver reliability. However, we can modify this test such that the two observations from an individual rater (test-retest) are assumed to be independent and the test will produce the test-retest reliability of the individual. The Kappa can be computed using the following formula:

$$\kappa = \frac{p_0 - p_e}{1 - p_e}$$

Where $p0$ = proportion of observed agreement and pe = proportion of chance-expected agreement assuming that the null hypothesis is true . The κ can have values between -1 and +1. Lands and Koch (1977) suggested a benchmark in interpreting the values of . The values are presented in table 1..

Table 1. Cohen's Kappa Interpretation

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κ	Strength of agreement
< 0	Poor
0.0 – 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Substantial
0.81 – 1.0	Almost perfect

Table 2 presents the test-retest reliability of the knowledge part of the questionnaire

Table 2. Test-Retest Reliability of the Knowledge on Antibiotic Use and Antimicrobial Resistance Questionnaire

Participant	kappa	p-value	Remark
1	0.223	0.1990	Slight agreement
2	0.444	0.0132*	Moderate agreement
3	0.379	0.0373*	Fair agreement
4	0.225	0.2160	Fair agreement
5	0.706	0.0001**	Substantial agreement
6	0.222	0.2210	Fair agreement
7	0.535	0.0009**	Moderate agreement
8	0.403	0.0256*	Moderate agreement
9	0.133	0.4560	Slight agreement
10	0.841	< 0.0001**	Almost perfect agreement
11	0.856	< 0.0001**	Almost perfect agreement
12	0.492	0.0063**	Moderate agreement
Average	**0.4549**		**Moderate agreement**

**Indicates a significance at 5% alpha; **Indicates a significance at 1% alpha*

Table 2 shows that the estimated individual kappa ranges from 0.133 (slight agreement) to 0.856 (almost perfect agreement) which may indicate that some participants bomb the test while others give consistent answers in the test and the retest. The average kappa of the 12 participants is 0.4549 which indicates a moderate agreement of responses for the test and the retest. Moreover, out of the 12 estimates, 8 of them showed statistical significance at least at the 5% significance level. Overall, the questionnaire was adequate in precisely measuring the knowledge of the individuals over time.

Attitudes Section

The study made use of the questionnaire used by Kim et al. (2011) to measure the attitude of the respondents in regards to antibiotic use. For this study, the questionnaires were transformed

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into a 5-point Likert scale questionnaire measuring the respondent's degree of agreement or disagreement with the statement. The correct and incorrect responses and their degree of certainty was measured to evaluate the respondents' attitude in using antibiotics.

Perceptions Section

The study adapted the questionnaires employed by Setasih et al. (2019) on the knowledge, attitude, and perception of patient caregivers to microbial resistance and antibiotic use. To fit with the intended purposes of this study, the questionnaires were changed into a personal point of view instead of the caregiver perspective that was used in the study. This study also followed the subdivisions of perceived benefit, perceived barriers, perceived threat, and perceived self-efficacy in the questionnaire. The perception section also constructed statements in a 5-likert scale to measure the degree of agreement and disagreement of the respondents.

The subdivision of perceived benefit revolved around the perceived benefit of antibiotic use to the respondent. This subdivision measured the extent to how much the respondent values the antibiotic use for their health or disorder.

The subdivision of perceived barriers were statements measuring the respondents discerned obstacles in taking antibiotics. This involves statements on practices and prohibitions that the respondents exercise that may come into way of antibiotic use.

The subdivision of perceived threat focused on the respondents' perception on the dangers or side effects of antibiotic use. These were statements measuring the respondents agreement or disagreement to the possible side effects and damage antibiotic use may incur especially when used inappropriately. This section also involved some statements regarding the development of antimicrobial resistance due to wrong practices.

The subdivision of perceived self-efficacy focused on the respondents confidence that they can comply with the prescription of the doctor during antibiotic use to produce the best results.

The questionnaire was validated through pilot testing and computation of Cronbach's Alpha. A certified statistician was consulted to interpret the results. Cronbach's Alpha is a validated measure of reliability or consistency of the responses the questionnaire will receive (Bujang, Omar, & Baharum, 2018). In common practice, a Cronbach's alpha coefficient value that is equal or greater than 0.70 is a sufficient measure of the reliability and validity of the instrument (Taber, 2018).

Internal consistency is defined as the degree of the inter-relatedness of a set of questionnaire items that intends to measure a single construct or latent variable (Tavakol, 2011). The most common measure of internal consistency is the Cronbach's alpha coefficient devised by Lee Cronbach in his published paper in 1951. An alpha coefficient is a numerical value between 1 and 0. A value closer to 1 denotes a higher level of internal consistency. The alpha coefficient was computed through the formula:

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$$\alpha = \frac{k}{k-1}\left(1 - \sum_{i=1}^{k} \frac{\sigma_i}{\sigma_t}\right)$$

Where α = Cronbach's alpha coefficient,, σi = variance of the responses in item i, σt= variance and k= number of items of the overall scores.

This study adopted the following scale, presented in table 3, to interpret the values of Cronbach's alpha coefficient.

Table 3. Cronbach's Alpha Interpretation

Cronbach's Alpha	Internal Consistency
$\alpha > 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Table 4. Test for Internal Consistency for the Attitudes and Perceptions on Antibiotic Use and Antimicrobial Resistance

Construct	No. of items	Alpha	Internal Consistency
Attitudes	8	0.77	Acceptable
Perception	38	0.86	Good

Based on table 4, attitudes and perception have estimated alphas that are greater than 0.7. Thus, this indicates that the set of items for attitudes towards antibiotic use and antimicrobial resistance has an acceptable level of internal consistency while the set of items on perception has a good level of internal consistency.

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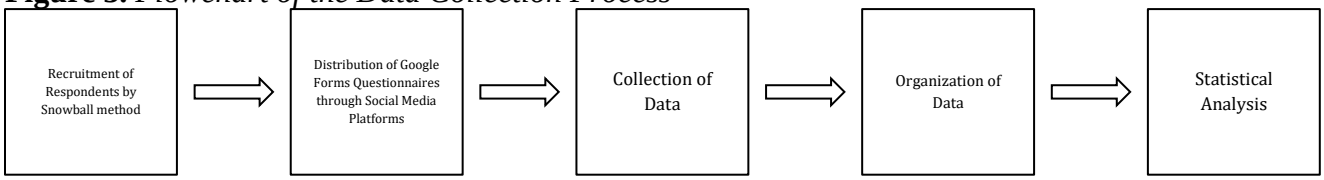
Data Gathering Procedure

Before the questionnaires' dissemination and data gathering, the researchers secured the approval of the ethics committee of the Faculty of Pharmacy of the University of Santo Tomas. The approval of the ethics committee authorized the deployment of the survey questionnaire. The questions were oriented towards the target population and study site, composed of adults aged 21-59 years old living in Metro Manila, respectively. A certified statistician was consulted to compute the sample size, as well as other tools for data analysis. The method of recruitment for the survey was done through the snowball method. The link for the questionnaire integrated to Google Forms was disseminated to individuals known by the researchers through social media platforms such as Facebook, Messenger, and Twitter. The questionnaire contained 68 questions and was answerable within fifteen (15) to thirty (30) minutes (See Appendix A). Informed consent forms were attached to the survey questionnaires, impartially briefing the respondents through a digest of the study's content and the contact information of the researchers. In accordance with the Data Privacy Act of 2012, the information collected was kept confidential inside a secured cloud file storage system that grants access only to the researchers, and is encrypted and protected from undue outside access. The collected data from the survey questionnaires is all stored in a cloud drive storage. All data collected was encrypted with a password known only by the researchers. Upon request, the researchers may grant access to the board of panelists if required for verification purposes. If the study gets to be published, only statistical data would be included with anonymity for the respondents.The data were stored and subsequently deleted until the study is published. Study participants who did not provide their informed consent will be excluded from the study.

Recruitment of Respondents by Snowball Method →Distribution of Google Forms Questionnaires through Social Media Platforms → Collection of Data → Organization of Data → Statistical Analysis

Figure 3. *Flowchart of the Data Collection Process*



Ethical Considerations

Ethical considerations were fully observed in the study. The autonomy of the respondents was considered throughout as they were presented with the option to withhold participation. Likewise, the anonymity of the respondents was strictly kept to safeguard sensitive information from malicious use. The study was also conducted in pursuit of beneficence as it seeks to serve the respondents by addressing misconceptions, health practitioners by aiding in the improvement of antibiotic prescriptions, concerned establishments like the Department of Health by providing essential data for the development of programs in combating antimicrobial resistance in the Philippines, and for future researchers by dispensing concrete dissemination of strengths and weaknesses of the population in the conduction of plans to address the issue. Lastly, the study strictly abides by the standards of non-maleficence through the assurance of preventing unnecessary harm and securing sensitive information to the respondents.

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To preserve the integrity of the study, it is designed and reviewed with complete integrity, quality, and transparency. The study is guaranteed to be free from unlawful practices such as forgery and manipulation of data, infringement of intellectual property rights, data misconstruction, and/or gross dereliction of researcher duties and responsibilities.

The informed consent form was presented to the Ethics Review Committee with the study proposal for approval prior to the deployment of the questionnaire to the targeted participants, which also impartially briefs them through a digest of the study's content. The researchers have also abided by the mandate of Republic Act 10173, known as the "Data Privacy Act of 2012", along with the construction and distribution of the study and questionnaires, respectively. This ensured that all the data input of the respondents will be absolutely safeguarded. Moreover, irrelevant and unnecessarily personal questions are not included as the questionnaire contains items only concerning the knowledge, attitudes, and perceptions of the participants. Likewise, all gathered data and identifiable information provided by the respondents are objectively utilized and discussed by the researchers alone. The certification of approval from the ERC signified the ethical review and qualification of the study protocol. This was sought prior to the data gathering phase of the study.

Responses will only be accepted without missing details. In accordance with the targeted scope of the study, only responses with valid Metro Manila addresses will be accepted. To avoid duplication of responses and verify qualification of the respondents, the email address submitted will be monitored by the researchers.

Adverse events would be a remote occurrence. Nonetheless, the confidentiality, privacy, and anonymity of the participants will be put into priority and complied with as the study progresses as all the data gathered will be stored inside a secured cloud file storage system that grants access only to the authorized team researchers.

In regard to the dissemination of the interpreted data, the study will be published to be accessible to the respondents, general public, policy makers, and other researchers. It also ensures that the interpreted data constitute objective results and without prejudice. Furthermore, the anonymity of respondents will still be strictly followed to adhere to confidentiality.

Data Analysis

Statistical instruments that were used in the study can be delegated as descriptive and inferential statistics. Descriptive statistics are the numerical and graphical techniques which are used to organize, present, and analyze gathered data. (Fisher & Marshall, 2009.) Moreover, the purpose of descriptive statistics is to describe the midpoint of a spread of scores, which is usually termed as the measure of central tendency, and the spread of scores referred to as the dispersion or variance (Fisher & Marshall, 2009.)

Descriptive statistics give the summarization of the gathered data with the goal of showing the description of what happened within the sample. On the other hand, inferential statistics are utilized to give generalization of the findings from a sample to the entire population of interest (Allua & Thompson, 2009). Inferential statistics are used to monitor differences between the

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treatment group which helps to suggest explanations for a given situation or phenomenon (Chin & Lee, 2008).

The data that was gathered from this study were summarized and arranged in tabular form using descriptive statistical tools and inferential statistical tools. The descriptive statistical tools that were used were the frequency and percentage distribution, as well as weighted mean. For inferential statistical tools, the Analysis of One Variance (ANOVA), Profile Plot Analysis, as well as the multiple comparisons using Bonferroni test, and Spearman's Rho were used. All of these were accomplished using the Statistical Package for the Social Sciences (SPSS) software.

Frequency analysis is a descriptive statistical tool that deals with the number of occurrences and deals with three types of measures which are measures of central tendency, measures of dispersion, and percentile values. This tool was used to present responses of the chosen respondents of the study. This was used especially for questions that are multiple choice and sections that are related to knowledge, attitude, and perceptions.

For the first part of the questionnaire, the respondents' knowledge on antibiotic use and antimicrobial resistance was assessed through a 30 item questionnaire with questions that consist of general knowledge about antibiotics, its implications and consequences. All of the questions were answered by a Yes or No statement. An answer key was provided to determine the total score of the respondent. The questionnaire will have a highest possible score of 30 and the lowest possible score of 0. The scores obtained were interpreted through a quantitative analysis, there will be ranges that will correspond to a certain interpretation. For the ranges and interpretations the researchers used the Bloom's cutoff point, which will assign an interpretation for a corresponding score. A 80-100% score was interpreted as good, 60-79.9% was interpreted as moderate, and for scores below 60% was considered as poor.

The second part of the questionnaire was for the assessment of the attitude and perception of the respondents towards antibiotic resistance. 8 questions were utilized for the assessment on attitude while perception has 30 questions split into four parts: perceived benefit, perceived barrier, perceived threat, and perceived self-efficacy. All the questions were graded using a 5-point likert scale. The scores obtained were interpreted through a quantitative analysis. There will be a certain interpretation for the corresponding ranges. A 4.21 to 5.0 score was interpreted as strongly agree, 3.41 to 4.20 was interpreted as agree, 2.61 to 3.40 was interpreted as neutral, 1.81 to 2.60 was interpreted as disagree, and 1.00 to 1.80 was interpreted as strongly disagree.

The determination of the significant differences of the level of knowledge, attitude, and perception of the adults classified into age groups, household income, and educational attainment on antibiotic use and antimicrobial resistance was done through ANOVA. According to Glen (2020), ANOVA is an analysis tool that determines the significance of the results acquired from a survey or experiment. The ANOVA test outputs the F-stat to measure the *p*-value, which indicates a significant difference at 95% confidence interval when *p*-value is less than 0.05. This study used one-way ANOVA to observe if there is a significant difference between the variables. One-way ANOVA has one independent variable (Glen, 2020). It was used to observe if there was a difference between two groups.

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The study also used profile plot analysis to support the results observed in the ANOVA test. According to Penn State Eberly College of Science (n.d.), profile analysis is a multivariate statistical analysis that examines the relative behavior of the variables. In the profile plot analysis, the Pillai's trace was computed to obtain the p-value, wherein a significant difference at 95% confidence interval is concluded when the p-value is less than 0.05.

For the determination of significant relationships among the demographic profile, the level of knowledge, attitude, and perception on antibiotic use and antimicrobial resistance, this study used the Spearman's Rho and the SPSS (Statistical Package for the Social Sciences) software to compute for the correlation coefficient of the different variables. The Spearman's Rho produces the *p*-value, which denotes a significance at 95% when $p = <0.05$, and the r-stat of correlation where r value closer to 1 denotes a perfect correlation, and an r-value closer to 0 denotes a negligible correlation. According to Stats Test (n.d.), Spearman's rho evaluates the strength of the relationship between two variables. The variables should have a monotonic relationship and can be continuous or ordinal. The study adopted the following interpretations, presented in table 5, for the correlation coefficient.

Table 5. Spearman's Rho Correlation Coefficient Interpretation

Size of Correlation	Interpretation
.90 to 1.00 (−.90 to −1.00)	Very high positive (negative) correlation
.70 to .90 (−.70 to −.90)	High positive (negative) correlation
.50 to .70 (−.50 to −.70)	Moderate positive (negative) correlation
.30 to .50 (−.30 to −.50)	Low positive (negative) correlation
.00 to .30 (.00 to −.30)	negligible correlation

III. RESULTS AND DISCUSSION

4.1 Demographic Profile

A total of 132 respondents agreed to participate in the study. Table 6 shows the number of individuals and their percentage in each demographic variable. In the age group, it shows that there are more 22 years old and below in the age group. In the household income, the majority of the respondents belong to the middle-class family. Lastly, in educational attainment, most of the respondents are college undergraduates.

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Table 6. Summary of the Socio-demographic Characteristics of the Respondents ($n = 132$)

Variable	Count	Percentage
Age Group		
22 years old and below	100	75.8%
23 years old and above	32	24.2%
Monthly household income		
< Php 11,000	9	6.8%
Php 11,000 - Php 21,999	19	14.4%
Php 22,000 - Php 43,999	25	18.9%
Php 44,000 - Php 76,999	20	15.2%
Php 77,000 - Php 131,999	24	18.2%
Php 132,000 - Php 219,999	18	13.6%
>Php 220,000	17	12.9%
Highest educational attainment		
College graduate	21	15.9%
College undergraduate	80	60.6%
High school graduate	21	15.9%
Others	10	7.6%

Based on table 6, about 3 out of 4 respondents are 22 years old and below. In fact, about 59% of the respondents or 78 out of 132 respondents are 21 years old. Meanwhile, only 24.2% of the respondents are 23 years old and above. The youngest respondent is 21 years old while the oldest respondent is 56 years old. Meanwhile, the majority of the respondents belong to the lower-middle-income class with an average monthly income of about Php 22,000 to Php 43,999. In total, the middle-income class (Php 22,000 to Php 131,999 average monthly income) comprise 52% of the sample. Lastly, about 6 out of 10 respondents are currently college undergraduates. Only about 16% of the sample are college graduates and another 16% only reached high school education. The results indicate that most of the respondents in the survey are young adults belonging to the middle-income households.

Level of Knowledge, Attitude, and Perception

This section shows the level of knowledge, attitude, and perception of the respondents included in the study. The level of knowledge was subdivided into three tables that shows the level of knowledge of the respondents with regards to their demographic profile. Then, the level of attitude was evaluated through the respondents' attitude scores. Lastly, the level of perception was evaluated in each subdivided section of the perception.

Table 7. Level of Knowledge of the Respondents Based on Age

Age	Poor	Moderate	Good	Total

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22 years old and below	44	48	8	100
23 years old and above	13	15	4	32
Total	57	63	12	132

Table 7 presents the summary of the knowledge scores of the respondents based on age. The scores attained by 100 respondents aged 22 years old and below varied, with 44 respondents having a poor score, 48 respondents having a moderate score, and only 8 respondents having a good score. Similarly, the scores attained by 32 respondents aged 23 years old and above also varied, with 13 respondents having a poor score, 15 respondents having a moderate score, and only 4 respondents having a good score. In total, of the 132 respondents, 57 had a poor score, 63 had a moderate score, and only 12 had a good score.

In a study by Oh et al. (2010), younger age groups expressed poorer knowledge scores on antimicrobial resistance. Contrastingly, the study of Voidăzan, et al. (2019) showed that older respondents showed lower knowledge scores whilst younger respondents (18-34) showed to learn antimicrobial resistance from pharmacists.

Table 8. Level of Knowledge of the Respondents Based on Income

Income	Poor	Moderate	Good	Total
< Php 11,000	9	0	0	9
Php 11,000 - Php 21,999	13	6	0	19
Php 22,000 - Php 43,999	17	8	0	25
Php 44,000 - Php 76,999	5	12	3	20
Php 77,000 - Php 131,999	6	14	4	24
Php 132,000 - Php 219,999	4	12	2	18
> Php 220,000	3	11	3	17
Total	57	63	12	132

Table 8 presents the summary of the knowledge scores interpretation of the respondents with regards to their income. For those with a household income of less than 11,000 pesos, all of the 9 respondents had a poor level of knowledge. For those with a household income of 11,000 pesos to 21,999 pesos, most of the respondents had a poor level of knowledge, which represents 13 out of 19 respondents. For those with a household income of 22,000 pesos to 43,999 pesos, most of the respondents had a poor level of knowledge, which represents 17 out of 25 respondents.

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For those with a household income of 44,000 pesos to 76,999 pesos, most of the respondents had a moderate level of knowledge, which represents 12 out of 20 respondents. For those with a household income of 77,000 pesos to 131,999 pesos, most of the respondents had a moderate level of knowledge, which represents 14 out of 24 respondents. For those with a household income of 132,000 pesos to 219,000 pesos, most of the respondents had a moderate level of knowledge, which represents 12 out of 18 respondents. Lastly, for those with a household income of greater than 220,000 pesos, most of the respondents had a moderate level of knowledge, which represents 11 out of 17 respondents. Overall, most of the respondents had a moderate level of knowledge, which represents 63 out of 132 respondents.

In a study conducted by Mate et.al., (2019), it was stated that knowledge about antibiotics improved with increased monthly income, it was also mentioned that a poor level of knowledge was higher in those with a lower monthly income, which coincides with the results of our study. In another study by Shehadeh et.al., (2012), the percentage of participants with scores more than 70% was 14% in the low income group compared to the 24.8% in the higher income group, signifying that higher income groups are more knowledgeable when it comes to these topics.

Additionally, a study by Alqarni & Abdulbari (2019) stated that monthly income is significantly associated with the knowledge of antibiotics and its uses. Furthermore, it was also mentioned in their study that respondents who earned a higher monthly income showed higher knowledge towards antibiotic use.

Table 9. Level of Knowledge of the Respondents based on Educational Attainment

Educational Attainment	Poor	Moderate	Good	Total
College graduate	7	12	2	21
College undergraduate	34	39	7	80
High School	8	11	2	21
Others	8	1	1	10
Total	57	63	12	132

Table 9 presents the knowledge scores achieved by the respondents in accordance with educational attainment. For college graduates, most attained a moderate level of knowledge while 7 had a poor score, and only 2 with a good level of knowledge. For college undergraduates, most of the respondents either had a moderate or poor level of knowledge, with the 7 college undergraduates who had a good score representing the minority. For high school graduates, most achieved a moderate score, followed by 8 poor knowledge responses, and only 2 high school graduates with a good level of knowledge. Finally, respondents with other educational background not mentioned mostly had a poor level of knowledge with 1 respondent attaining a moderate score, and another attaining a good score.

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According to the study of Lim, et al. (2021) regarding the public's knowledge, attitudes, and practices on antibiotic use and resistance in Cambodia, it stated that the antibiotic knowledge of the respondents was individually associated with their education levels in utilizing univariable analysis. Furthermore, in the study of Lim, et al. (2021), it indicated that respondents with a university education had higher knowledge scores than those with secondary education. It showed that the level of knowledge of the respondents was affected by their educational attainment.

Table 10. Level of Attitude of the Respondents

Statements	Mean	Verbal Interpretation
1.If I catch a cold, I ask for an antibiotic prescription to prevent my symptoms from getting worse	3.4924	Agree
2. I believe that antibiotics cure my cold faster	3.2727	Neutral
3. I take left-over antibiotics when I have similar flu symptoms	3.8106	Agree
4. I would stop taking the prescribed antibiotics if I got better	3.4545	Agree
5. I prefer a shot to an oral medicine if antibiotics are needed	3.1288	Neutral
6. I do not check to see if antibiotics are included within the prescribed cold medicines	3.4924	Agree
7. It's good to be able to buy antibiotics online, without having to see a doctor	3.8788	Agree
8. If I have a cough more than a week, I often need antibiotics	2.9167	Neutral
Average	3.4309	Agree

Table 10 presents the summary of the mean responses of the respondents for each of the statements from the survey questionnaire. The degree of agreement for the first statement, "If I catch a cold, I ask for an antibiotic prescription to prevent my symptoms from getting worse", which resulted in a mean of 3.4924, corresponded with the verbal interpretation "Agree".

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Kim S., Moon, and Kim E. (2011) study on the attitudes on antibiotic use in South Korea also finds that the majority (70%) displayed the correct attitude by disagreeing with the statement. The study shows better public attitudes than what was measured from the residents of Metro Manila.

The degree of agreement for the second statement, "I believe that antibiotics cure my cold faster", which resulted in a mean of 3.2727, corresponded with the verbal interpretation "Neutral".

Crucis et al. (2019) study on the knowledge and attitudes of the residents from San Jose del Monte, Bulacan and Kim et al. (2011) also finds that the majority of the respondents (81.05% and 51.8%, respectively) responded appropriately by disagreeing with the statement. Both studies denote a better public attitude than the level of attitude measured.

The degree of agreement for the third statement, "I take left-over antibiotics when I have similar flu symptoms", which resulted in a mean of 3.8106, corresponded with the verbal interpretation "Agree".

The study by Crucis et al. (2019) and Kim et al. (2011) also measures better public attitude on the statement with the majority (72.55% and 53.1%, respectively) disagreeing with the statement.

The degree of agreement for the fourth statement, "I would stop taking the prescribed antibiotics if I got better", which resulted in a mean of 3.4545, corresponded with the verbal interpretation "Agree".

This poor attitude is similar with the majority of the residents of South Korea agreeing with the statement (77.6%). Contrastingly, however, the study by Crucis et al. (2019) finds that the significant majority (98.69%) displayed an appropriate attitude when the residents agreed to "A course of antibiotic should always be completed".

The degree of agreement for the fifth statement, "I prefer a shot to an oral medicine if antibiotics are needed", which resulted in a mean of 3.1288, corresponded with the verbal interpretation "Neutral".

The study by Kim et al. (2019) shows that 43.8% of the respondents agreed with the statement, showing inappropriateness. The average mean of this study suggests that perceived attitude on shots and oral medication on antibiotics is similar.

The degree of agreement for the sixth statement, "I do not check to see if antibiotics are included within the prescribed cold medicines", which resulted in a mean of 3.4924, corresponded with the verbal interpretation "Agree".

With a high mean of agreement, the residents of Metro Manila displayed a similar level of attitude by agreeing with the statement, in comparison with only 22.4% of the South Korean residents agreeing with the statement.

The degree of agreement for the seventh statement, "It's good to be able to buy antibiotics online, without having to see a doctor", which resulted in a mean of 3.8788, corresponded with the verbal interpretation "Agree".

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The study by André et al. (2010) recorded that only 10.9% of the residents in Sweden agreed to the statement, showing a better mean attitude towards this statement. Meanwhile, 75.82% of the residents had a correct response by disagreeing with the statement "I prefer to buy antibiotics from the pharmacy without a prescription" (Crucis et al., 2019)

The degree of agreement for the eighth statement, "If I have a cough more than a week, I often need antibiotics", which resulted in a mean of 2.9167, corresponded with the verbal interpretation "Neutral".

Overall, the resulting mean was 3.4309, which falls under the verbal interpretation "Agree". Since the statements are of inappropriate attitude, the respondents therefore manifested a poor level of attitude.

In a similar study by Kim et al., (2011), the study stated that the respondents' poor attitude may be correlated to the prevalence of inappropriate antibiotic usage in Korea (Kim & Park, 1998). Contrastingly, another study conducted on the respondents of San Jose del Monte, Bulacan, Philippines finds that the public had a positive attitude on antimicrobial use (Crucis, et al., 2019). In another study by Barber (2016), antibiotics are commonly available from nonmedical sources in poor countries, including the Philippines. The study also stated that the availability of antibiotics such as beta-lactam antibiotics (i.e., penicillin, cephalexin, and amoxicillin) in sari-sari stands give understanding about the misuse of antibiotics in the country.

Table 11. Level of perceived benefit of the Respondents

Statements	Mean	Verbal Interpretation
1.Despite the bitter taste of antibiotics, I have to take them because I know I can recover.	4.2348	Strongly Agree
2. If my bacteria is susceptible to antibiotics, I can use cheaper drugs	2.6364	Neutral
3. If I complete the course of antibiotic, I can reduce the risk of antibiotic resistance	3.7803	Agree
4. If I take antibiotics until finished, I can recover	4.0303	Agree
5. For any illness, I need to take antibiotics so that I can quickly recover	2.3864	Disagree
6. Antibiotics have few side effect	3.1742	Neutral
7. I choose antibiotics because they are safe to use	3.1742	Neutral
8. Antibiotics are used to prevent my illness from getting worse	3.6894	Agree
Average	3.38825	Agree

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Table 11 presents the summary of the mean responses of the respondents for each of the statements from the survey questionnaire.

The degree of the first statement, "Despite the bitter taste of antibiotics, I have to take them because I know I can recover", which resulted in a mean of 4.2348, corresponded with the verbal interpretation of "Strongly Agree".

The degree of the second statement, "If my bacteria is susceptible to antibiotics, I can use cheaper drugs", which resulted in a mean of 2.6364, corresponded with the verbal interpretation of "Neutral".

The degree of the third statement, "If I complete the course of antibiotic, I can reduce the risk of antibiotic resistance", which resulted in a mean of 3.7803, corresponded with the verbal interpretation of "Agree".

The degree of the fourth statement, "If I take antibiotics until finished, I can recover", which resulted in a mean of 4.0303, corresponded with the verbal interpretation of "Agree".

The degree of the fifth statement, "For any illness, I need to take antibiotics so that I can quickly recover", which resulted in a mean of 2.3864, corresponded with the verbal interpretation of "Disagree".

The degree of the sixth statement, "Antibiotics have few side effect", which resulted in a mean of 3.1742, corresponded with the verbal interpretation of "Neutral".

The degree of the seventh statement, "I choose antibiotics because they are safe to use", which resulted in a mean of 3.1742, corresponded with the verbal interpretation of "Neutral".

The degree of the eighth statement, "Antibiotics are used to prevent my illness from getting worse", which resulted in a mean of 3.6894, corresponded with the verbal interpretation of "Agree".

Overall, the resulting mean was 3.38825, which falls under the verbal interpretation "Agree".

The mean perceived benefit of the respondents is 3.38825, with a verbal interpretation of "Agree", suggesting a high level of perceived benefit. These results, however, did not concur with the study of Bakhit et al., (2019), which reported the reluctance of participants to take antibiotics for minor, self-limiting illnesses, and preferred to reserve usage for more severe infections. This displays awareness and concern about overusing or misusing antibiotics, particularly a few participants with past experiences of antibiotic resistance who were especially cautious of taking antibiotics. Additionally, some participants also abstained to allow the body to fight the infection naturally, and advocated for staying healthy in the first place. Another concern of other participants, aside from the risk of resistance, included the risk of potential side effects, such as vomiting, nausea, thrush, and diarrhea. Another study by Szymczak et al., (2018), concluded similarly, including the preference for alternative treatment or natural remedies. In the same stroke, the participants were more concerned about antibiotic adverse events more than its benefits or the risk of developing antibiotic resistance.

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Table 12. Level of Perceived Barrier of the Respondents

Statements	Mean	Verbal Interpretation
1.If the prescription stated to take antibiotics every 8 h a day, it makes me feel difficult to arrange my drug schedule	2.5682	Disagree
2. I have difficulty taking antibiotics because of the bitter taste	2.3182	Disagree
3. The relatively large size of antibiotic tables makes me face difficult to take them	2.6061	Neutral
4. Taking 3x one day's antibiotic can be taken in the morning at 06:00, noon at 14:00 and in the afternoon at 18:00	3.0379	Neutral
5. I am not allowed to drink milk when I take antibiotics	2.6288	Neutral
6. I want to take antibiotics when they are in syrup	2.6894	Neutral
Average	2.6414	Neutral

Table 12 presents the summary of the mean responses of the respondents for each of the statements from the survey questionnaire.

The degree of agreement for the first statement, "If the prescription stated to take antibiotics every 8 h a day, it makes me feel difficult to arrange my drug schedule", which resulted in a mean of 2.5682, corresponded with the verbal interpretation "Disagree".

The degree of agreement for the second statement, "I have difficulty taking antibiotics because of the bitter taste", which resulted in a mean of 2.3182, corresponded with the verbal interpretation "Disagree".

The degree of agreement for the third statement, "The relatively large size of antibiotic tables makes me face difficult to take them", which resulted in a mean of 2.6061, corresponded with the verbal interpretation "Neutral".

The degree of agreement for the fourth statement, "Taking 3x one day's antibiotic can be taken in the morning at 06:00, noon at 14:00 and in the afternoon at 18:00", which resulted in a mean of 3.0379, corresponded with the verbal interpretation "Neutral".

The degree of agreement for the fifth statement, "I am not allowed to drink milk when I take antibiotics", which resulted in a mean of 2.6288, corresponded with the verbal interpretation "Neutral".

The degree of agreement for the sixth statement, "I want to take antibiotics when they are in syrup", which resulted in a mean of 2.6894, corresponded with the verbal interpretation "Neutral".

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Overall, the resulting mean was 2.6414, which falls under the verbal interpretation "Neutral".

A study by Anwar et al. (2021) mentioned barriers to quality use of antibiotics and prevention of antibiotic resistance. The leading cause is a patient-related barrier, as self-medication and antibiotic demand is inherent to patients. Patients would purchase from general drugstores and redistribute it among their families without proper dosage prescription. This poses a significant threat to the development of antibiotic resistance and should be on the priority list of things to be addressed by the policymakers. Another cause is the Institutional-related barrier, as there is a limited number of antibiotics available at a local pharmacy. This would be caused by financial constraints faced by the healthcare system. In another study conducted by Herawati et al. (2020) on the knowledge and perception of antibiotic use and microbial resistance, they found out that the barrier to treatment adherence is associated with difficulties with time management. Situations like these would threaten the effectiveness of the antibiotic.

Table 13. Level of Perceived Threat of the Respondents

Statements	Mean	Verbal Interpretation
1.Taking antibiotics not in accordance with the doctor's recommended dosage will worsen my illness	3.9242	Agree
2. Antibiotic treatment without a doctor's prescription leads to bacteria in my body resistance to antibiotics	3.9621	Agree
3. Using antibiotics not in accordance with the prescription leads to longer treatment duration	4.053	Agree
4. Taking antibiotics irregularly can cause fatal side effects such as death	3.447	Agree
5. Taking antibiotics without a doctor's prescription leads to difficulty in treating my illness	4.1061	Agree
6. The use of antibiotics not in accordance with the doctor's prescribed course will worsen my health condition	3.8333	Agree
7. Not taking all antibiotics prescribed by the doctors may aggravate the disease	3.9242	Agree
8. The use of antibiotics without a prescription leads kidney damage	3.7652	Agree
Average	3.8768	Agree

Table 13 presents the summary of the mean responses of the respondents for each of the statements from the survey questionnaire.

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The degree of agreement for the first statement, “Taking antibiotics not in accordance with the doctor’s recommended dosage will worsen my illness”, which resulted in a mean of 3.9242, corresponded with the verbal interpretation “Agree”.

The degree of agreement for the second statement, “Antibiotic treatment without a doctor’s prescription leads to bacteria in my body resistance to antibiotics”, which resulted in a mean of 3.9621, corresponded with the verbal interpretation “Agree”.

The degree of agreement for the third statement, “Using antibiotics not in accordance with the prescription leads to longer treatment duration”, which resulted in a mean of 4.053, corresponded with the verbal interpretation “Agree”.

The degree of agreement for the fourth statement, “Taking antibiotics irregularly can cause fatal side effects such as death”, which resulted in a mean of 3.447, corresponded with the verbal interpretation “Agree”.

The degree of agreement for the fifth statement, “Taking antibiotics without a doctor’s prescription leads to difficulty in treating my illness”, which resulted in a mean of 4.1061, corresponded with the verbal interpretation “Agree”.

The degree of agreement for the sixth statement, “The use of antibiotics not in accordance with the doctor’s prescribed course will worsen my health condition”, which resulted in a mean of 3.8333, corresponded with the verbal interpretation “Agree”.

The degree of agreement for the first statement, “Not taking all antibiotics prescribed by the doctors may aggravate the disease”, which resulted in a mean of 3.9242, corresponded with the verbal interpretation “Agree”.

The degree of agreement for the first statement, “The use of antibiotics without a prescription leads kidney damage”, which resulted in a mean of 3.7652, corresponded with the verbal interpretation “Agree”.

Overall, the resulting mean was 3.8768, which falls under the verbal interpretation “Agree”.

A public perception on threat can be found in a study by Broniatowski et al. (2018) on the perceptions of patients and clinicians on antibiotic prescription wherein the respondents displayed concern on the threat of side effects of antibiotic use despite endorsing its use. Some patients may refuse to take antibiotics due to their perceived adverse effects of antibiotics use (Irawati et al., 2018). Perceived threat is important to be discerned as it is significantly related to antibiotic use adherence (Wattiheluw, et al., 2020)

Table 14. Level of Perceived Self-efficacy of the Respondents

Statements	Mean	Verbal Interpretation
1. I always try to take antibiotics in accordance to the doctor’s prescription	4.2500	Strongly Agree
2. Even if I finish the antibiotics prescribed by the doctor, I	2.9318	Neutral

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am still not sure I will recover		
3. The taking of antibiotics makes me confident that I am recovering quickly	3.7197	Agree
4. Every time my doctor prescribes antibiotics, I need to find additional information about them	3.9015	Agree
5. With antibiotics being given to me, I clarify to the doctor/pharmacist about them	3.9242	Agree
6. I am not sure if I need to take every antibiotic that is prescribed by the doctor	2.5605	Disagree
7. It is easy to finish antibiotics	3.4924	Agree
8. Without a doctor's prescription, I always try not to buy antibiotics	3.9242	Agree
Average	3.5881	Agree

Table 14 presents the summary of the mean responses of the respondents for each of the statements from the survey questionnaire.

The degree of agreement for the first statement, "I always try to take antibiotics in accordance to the doctor's prescription", which resulted in a mean of 4.2500, corresponded with the verbal interpretation "Strongly Agree".

The degree of agreement for the first statement, "Even if I finish the antibiotics prescribed by the doctor, I am still not sure I will recover", which resulted in a mean of 2.9318, corresponded with the verbal interpretation "Neutral".

The degree of agreement for the first statement, "The taking of antibiotics makes me confident that I am recovering quickly", which resulted in a mean of 3.7197, corresponded with the verbal interpretation "Agree".

The degree of agreement for the first statement, "Every time my doctor prescribes antibiotics, I need to find additional information about them", which resulted in a mean of 3.9015, corresponded with the verbal interpretation "Agree".

The degree of agreement for the first statement, "With antibiotics being given to me, I clarify to the doctor/pharmacist about them", which resulted in a mean of 3.9242, corresponded with the verbal interpretation "Agree".

The degree of agreement for the first statement, "I am not sure if I need to take every antibiotic that is prescribed by the doctor", which resulted in a mean of 2.5605, corresponded with the verbal interpretation "Disagree".

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The degree of agreement for the first statement, "Without a doctor's prescription, I always try not to buy antibiotics", which resulted in a mean of 3.9242, corresponded with the verbal interpretation "Agree".

The degree of agreement for the first statement, "It is easy to finish antibiotics", which resulted in a mean of 3.4924, corresponded with the verbal interpretation "Agree".

Overall, the resulting mean was 3.5881, which falls under the verbal interpretation "Agree".

A similar study about attitudes and practice toward antibiotic use by Raupach-Rosin et al., (2019), stated that in regards to following recommended antibiotic regimen stated by the physician, majority of the respondents (95.7% [93.5%, 98.0%]) adhere to the protocol or take the recommended antibiotic prescribed by the physician or pharmacist. On the contrary, a study by Tong et al., (2018), data in this study shows that 86.97% of all patients showed non-compliance with antimicrobial drugs, stated reasons for these lack of self-compliance are fear of adverse effects caused by the long-term usage, study and work schedule, chances of stopping medication when health becomes better, too many drugs, lack of knowledge about the disease, as well as the smell and shape of the drugs.

Difference between the Level of Knowledge, Attitude, and Perception and the Demographic Profiles of the Respondents

This section shows the significant difference between the level of knowledge, attitude, and perception and the demographic profile of the respondents. The study utilized a one-way ANOVA test to compare the knowledge and attitude, as well as the subdivided sections of perception, to the demographic profile of the respondents.

Table 15. Difference between the Level of Knowledge and the Demographic profile of the Respondents

	Demographic Characteristic	F	p-value	Evaluation
Knowledge	Age	0.298	0.586	Not Significant
	Household income	7.944*	<0.001	Significant
	Educational Attainment	1.773	0.156	Not Significant

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"*" denotes that the correlation is significant at the 0.05 level

Table 15 presented the difference in the level of knowledge according to the demographic profile of the respondents using Analysis of One Variance (ANOVA). At 0.05 significance level, the knowledge between household income displays a significant difference (*p*-value = <0.001). Thus, the null hypothesis that there is no significant difference in the level of knowledge classified into household income is rejected. Levels of knowledge in between age and in between household income, however, does not denote a significance at 95% confidence level (*p*-value = 0.586, *p*-value = 0.156).

The significance in the difference of knowledge in between household income is supported by profile analysis testing (Pillai's trace = 0.442, p-value = 0.0011) wherein the four highest levels of household income greater than or equal to Php 220,000 (G), Php 132,000 - 219,999 (F), Php 77,000 - 131,999 (E), and Php 44,000 - 76,999 were all shown to significantly display better knowledge when contrasted against cohorts of Php 22,000 - 43,999 (C) , Php 11,000 - 21,999 (B), and less than Php 11,000 (A).

In a study conducted by Mate et.al., (2019), it was stated that knowledge about antibiotics improved with increased monthly income, it was also mentioned that a poor level of knowledge was higher in those with a lower monthly income, which coincides with the results of our study. In another study by Shehadeh et.al., (2012), the percentage of participants with scores more than 70% was 14% in the low income group compared to the 24.8% in the higher income group, signifying that higher income groups are more knowledgeable when it comes to these topics. A study by Crucis et al. (2019) showed that there was no significant relationship between the respondents' knowledge and demographic profile which supports the finding of a no significant difference in terms of educational attainment but contradicts the determined significant difference among age groups and household income. According to the study of Lim, et al. (2021), however, respondents with secondary education scored lower on both knowledge and attitudes compared to respondents with university education which contradicts the study.

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Table 16. Difference between the Attitude and Demographic Profile of the Respondents

	Demographic Characteristics	F	p-value	Evaluation
Attitude	Age	7.256*	0.008	Significant
	Household income	4.498*	<0.001	Significant
	Educational Attainment	0.902	0.442	Not Significant

"*" denotes that the correlation is significant at the 0.05 level

Table 16 presented the difference between the levels of attitude of the adults classified into age, household income, and educational attainment. At a *p*-value of 0.008, the difference in attitude in terms of age is significant. The difference in attitude in terms of family income is also significant (*p*-value = <0.001). Thus, the null hypothesis that there is no significant difference in the level of attitude classified into age and household income is rejected. However, the difference in attitudes according to educational attainment was measured to be insignificant (*p*-value = 0.442).

Testing with profile analysis supported the significance of the difference of the levels of attitude in terms of age (Pillai's trace = 0.092, p-value = 0.0298) and household income (Pillai's trace = 0.442, p-value = 0.0011). 23 years old and above showed a higher level of upper limit mean, suggesting better attitudes. While the four highest household income classes showed significantly better attitudes when compared to the three lowest income groups with one exception (Php 132,000 - 219,999 against Php 11,000 - 21,999).

In a study by Maidin et al. (2021), a difference was established between the attitudes of older age groups and younger age groups, showing a higher mean for older age respondents. A similar difference was noted by a study Alqarni and Abdulbari (2019). Contrastingly, age groups proved to be insignificantly related in the residents of a community in Bulacan (Crucis et al., 2019). Attitude and household income displayed a significant relationship. This study, however, did not correspond to the research conducted by Wattiheluw et al., (2020), which found that adherence to using antibiotics had no significance and did not differ among groups based on income. This was further substantiated with similar literature mentioned in the study about the same results.The study of Crucis et al. (2019) did not find a significant relationship in attitude among different educational levels.

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Table 17. Difference between the Perception and Demographic Profile of the Respondents

	Demographic Characteristic	F	p-value	Evaluation
Perceived Benefit	Age	0.664	0.416	Not Significant
	Household income	1.553	0.173	Not Significant
	Educational Attainment	0.705	0.551	Not significant
Perceived Barrier	Age	7.228*	0.008	Significant
	Household income	2.353*	0.035	Significant
	Educational Attainment	0.568	0.637	Not significant
Perceived Threat	Age	1..328	0.251	Not Significant
	Household income	1.498	0.184	Not Significant
	Educational Attainment	1.004	0.393	Not significant
Perceived Self-efficacy	Age	0.954	0.331	Not Significant
	Household income	0.557	0.764	Not Significant
	Educational Attainment	1.271	0.287	Not significant

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"*" denotes that the correlation is significant at the 0.05 level

Table 17 shows the difference in the levels of perception classified into age, household income, and educational attainment. At 0.05 confidence interval, differences in the perceived barrier in terms of age (*p*-value = 0.008) and in terms of household income (*p*-value = 0.2353) were found to be significant. Therefore, the null hypothesis that stated that there is no difference in the levels of perception of the adults classified into age and household income is rejected. However, the differences in the levels of perception in terms of educational attainment proved to be insignificant at perceived benefit (*p*-value = 0.551) at perceived barrier (*p*-value = 0.568) at perceived threat (*p*-value = 0.393) and at perceived self-efficacy (*p*-value = 0.287)

Testing with profile analysis supported the significance of the difference in perception in terms of age (Pillai's trace = 0.092, p-value = 0.0298) and household income (Pillai's trace = 0.442, p-value = 0.0011). To check which pairs of age and income class have significantly different behaviors of Perception, a multiple comparisons test was conducted using Bonferroni-adjusted 95% simultaneous confidence intervals (see Appendix I). Difference in perception in terms of educational attainment also proved to be insignificant through profile analysis (Pillai's trace = 0.096, p-value = 0.636).

The findings coincide with a study on Chinese migrants, Hu and Wang in 2015 that found a significant difference in the perception of antibiotics among age groups less than 30, 30 to 39, and 40 and above. The cited study indicates that the less than 30 age group had more occurrence of the practice of self-medication, indicating less barriers to acquire and use antibiotics. The findings of this study do not coincide with the findings of Ingerski et al. (2010) who found that there were no significant differences between the reported barriers of antibiotic use and the demographic characteristics (including age). In a different study by Gavidia et. al., (2012) it was mentioned that immediate administration of antibiotics whenever a fever develops can prevent progression to sepsis and shock, but according to the researchers, barriers such as poverty and illiteracy are associated with delays in assessment and treatment of fever. This study makes a point of household income having a significant relationship with perceived barriers which corresponds to the results of our study. The study of Crucis et al. (2019) did not find a significant relationship in the perception of the residents in Bulacan among different educational levels, this outcome also corresponds to the results obtained in our study.

Relationship of the Knowledge, Attitude, Perception, and Demographic Profile of the Respondents

This section shows the significant relationship of the different variables. The study utilized Spearman's rho to correlate the knowledge, attitude, subdivided sections of perception, and demographic profile of the respondents.

Table 18. Relationship between the Demographic Profile, Knowledge, Attitude, and Perception of the Respondents

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		Age	Household Income	Educational Attainment	Knowledge	Attitude	Perceived Benefit	Perceived Barrier	Perceived Threat	Perceived Self-Efficacy
Age	Correlation		0.014	-.444*	0.048	.212*	-0.055	-.205*	-0.118	-0.098
	p-value		0.873	<0.001	0.585	0.015	0.532	0.019	0.179	0.263
Household income	Correlation	0.014		-0.095	.458*	.175*	-0.122	-.227*	0.083	0.017
	p-value	0.873		0.279	<0.001	0.045	0.163	0.009	0.341	0.848
Educational Attainment	Correlation	-.444*	-0.095		-0.163	-0.117	0.032	0.123	-0.069	-0.008
	p-value	<0.001	0.279		0.062	0.182	0.715	0.159	0.432	0.927
Knowledge	Correlation	0.048	.458*	-0.163		.550*	-.268*	-.381*	.421*	-0.011
	p-value	0.585	<0.001	0.062		<0.001	0.002	<0.001	<0.001	0.899
Attitude	Correlation	.212*	.175*	-0.117	.550*		-.482*	-.643*	.241*	-.191*
	p-value	0.015	0.045	0.182	<0.001		<0.001	<0.001	0.005	0.029
Perceived Benefit	Correlation	-0.055	-0.122	0.032	-.268*	-.482*		.324*	0.125	.532*
	p-value	0.532	0.163	0.715	0.002	<0.001		<0.001	0.154	<0.001
Perceived Barrier	Correlation	-.205*	-.227*	0.123	-.381*	-.643*	.324*		-0.111	.173*
	p-value	0.019	0.009	0.159	<0.001	<0.001	<0.001		0.206	0.047
Perceived Threat	Correlation	-0.118	0.083	-0.069	.421*	.241*	0.125	-0.111		.487*
	p-value	0.179	0.3411	0.432	<0.001	0.005	0.154	0.206		<0.001

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Perceived Self-efficacy	Correlation	-0.098	0.017	-0.008	-0.011	-0.191*	-.532*	.173*	.487*
	p-value	0.263	0.848	0.927	0.899	0.029	<0.001	0.047	<0.001

"*" *denotes a significance at the 0.05 level*

The study shows that age has a significant but low negative correlation with education on antibiotic use (r_s = -0.444, *p*-value = <0.001). This suggests that as the respondents aged, the educational attainment decreases. However, the consensus from the Philippine Statistics Authority (PSA), shows that the educational attainment of college graduates increased from 4.3% in 2000 to 10.1% in 2010. Nonetheless, age is related with educational attainment since most college students graduate 21 to 24 years old, from a 4 to 5 year bachelor's degree.

Table 18 shows that there was a significant, but low positive correlation between the respondent's household income and knowledge on antibiotic use and antibiotic resistance (r_s = .458, *p*-value = <0.001). This suggests that as the respondent's household income increases, there is also an increase in their knowledge. In a study by Alqarni & Abdulbari (2019) it was stated that monthly income is significantly associated with the knowledge of antibiotics and its uses. Additionally, it was also mentioned in their study that respondents who earned a higher monthly income showed higher knowledge towards antibiotic use.

The study shows that knowledge has a significant and with a moderate positive correlation with attitude towards antibiotic use (r_s = 0.550, *p*-value = <0.001). This suggests that as the knowledge of the respondent increases, their attitude towards antibiotic use also increases. Similarly to the study of Kim et al. (2011). Respondents who have sufficient knowledge on antibiotics were more likely to have a favorable view towards attitude and the use of antibiotics. It also showed that higher-scoring respondents were more likely to verify a prescription is comprised of antibiotics, and understood which of the prescription medications contain antibiotics. According to Nepal, et al. (2019), education campaigns should be aimed at groups and individuals who fit the knowledge-attitude association.

Table 18 shows that the knowledge of respondents on antibiotic use and resistance had a significant relationship with the perceived benefit that they observed on antibiotic use, however it had a negligible correlation (r_s = -.268, *p*-value = 0.002). This suggests that the knowledge and perceived benefit of the respondents on antibiotic use showed too little correlation that it may be negligible. Similar to the result of our study, in the study of Visschers, Feck, and Herrmann (2021), it stated that the knowledge is negatively associated with the perceived benefits of antibiotics. It was observed that more knowledge on antibiotic functioning and resistance, decreased the perceived benefits of antibiotics.

A significant, weak, negative correlation has been shown to exist between the knowledge of the respondents on antibiotic use and antimicrobial resistance, and the perceived barriers they observe to antibiotic use (r_s = -0.381, *p*-value = <0.001). This correlation denotes that as the knowledge of a respondent increases, their perceived barrier to antibiotic use decreases. A study by Black, Cartwright, Bakharaiba, Al-Mekaty, and Alsahan (2014) has identified poor knowledge to be associated as a barrier to optimal antibiotic use. Furthermore, the cited study advocates for

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an improvement to the knowledge of the general population and of medical professionals about antibiotic use.

Table 18 shows that there was a significant, but low positive correlation between the respondent's knowledge and perceived threat (r_s = 0.421, *p*-value = <0.001). This suggests that the respondent's knowledge and perceived threat are directly proportional to each other. In a study by Alhomound et al., (2017) and Khalifeh et al., (2017) it was mentioned that the malpractice of using leftover antibiotics can be related to the respondent's lack of knowledge and awareness towards the side effects and contraindications, which could possibly lead them to using drugs inappropriately. This states that as the respondent's knowledge decreases, the perceived threat towards misuse of antibiotics also decreases. Additionally, a study by Herawati et al., (2021) of 135 nurses also indicated a significant relationship between knowledge and perceived threat.

Table 18 shows that the age of the respondents had a significant relationship with their attitude towards antibiotic use, however it had a negligible correlation (r_s = .212, *p*-value = 0.015). This suggests that as the age of the respondents and their attitude towards antibiotic use showed too little correlation that it may be negligible. According to the study of Maidin, et al. (2021) regarding the public knowledge and attitudes towards antibiotic usage in Perlis, Malaysia, age has a significant relationship with the mean attitude score. It presented that the mean attitude of the respondents is higher in older age groups.

Attitude and household income displayed a significant but negligible positive correlation (r_s = 0.175, *p*-value = 0.045). This corresponds with the study by Wattiheluw et al., (2020), which found that adherence to using antibiotics had no significance and did not differ among groups based on income. This was further substantiated with similar literature mentioned in the study about the same results.

Attitude and perceived benefit displayed a significant and low negative correlation (r_s = -0.482, *p*-value = <0.001). This suggests that when the attitude of the respondents towards antibiotics increases, their perceived benefit of it decreases and vice versa, albeit only weakly. This coincides with a study conducted by Chen et al., (2020), which stated that despite having a broadly positive perceived benefit of antibiotic use, a portion of their respondents aired out negative sentiments surrounding antibiotics. More specifically, a common attitude of the respondents included a general avoidance of taking antibiotics as long as it is possible.

The study shows that there was a significant, but negative moderate correlation between the attitude and perceived barrier of the participants (r_s = -.643, *p*-value = <0.001). The correlation implies that as poor attitudes of the respondents increase, perceived barriers decrease. In a study by Chen et al., (2020) the respondents presented barriers that affected their attitude towards using antibiotics. These barriers centered around whether it would affect themselves or the infant in their care. This study emphasizes that attitudes characterized the beliefs of the women.

The study shows that attitude has a significant and with very weak positive correlation with perceived threat towards antibiotic use (r_s = -0.241, *p*-value = 0.005). This suggests that as the attitude of the respondent increases, the perceived threat also increases. In the study of Kim et al. (2011). Understanding antibiotic use is critical since personal decisions highly depend on this information. Therefore, the lack of information regarding antibiotic use can impact the behavior towards the threats of antibiotic use.

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Table 18 shows that the attitude of the respondents towards antibiotic use had a significant relationship with their perceived self-efficacy on antibiotic use, however it had a negligible correlation (r_s = -.191, *p*-value = 0.029). This suggests that the attitude and perceived self-efficacy of the respondents on antibiotic use showed too little correlation that it may be negligible. According to the study of Raupach-Rosin, et al. (2019), only few respondents reported that they asked their general practitioner for a prescription, while the majority of the respondents reported to take antibiotics as recommended by the physician. It indicates that the attitude of the respondents affects their perceived self-efficacy.

The study shows that age has a significant but negligible correlation with perceived barriers on antibiotic use (r_s = -0.205, *p*-value = 0.019). This suggests that as the respondents aged, the perceived barrier decreases. The study by Herawati et al. (2020) has found that caregivers have perceived more barriers for younger aged people to take their antibiotics. Children with cystic fibrosis were also found to find the swallowing of antibiotic pills, and disdain for its taste as key barriers to optimal antibiotic use (Modi & Quittner, 2006).

Household income and perceived barrier showed a significant but negligible negative correlation (r_s = -.227, *p*-value = 0.009). This suggests that as the respondent's household income decreases, their perceived barrier increases. In a study by Gavidia et. al., (2012) it was mentioned that immediate administration of antibiotics whenever a fever develops can prevent progression to sepsis and shock, but according to the researchers barriers such as poverty and illiteracy are associated with delays in assessment and treatment of fever. This study makes a point of household income having a significant correlation with perceived barriers.

The perceived barriers and perceived benefits of the respondents have shown to have a significant, weak positive correlational relationship (r_s = 0.324, *p*-value = <0.001). This suggests that as a respondent's perceived benefits of antibiotics increases, so does their perceived barriers to antibiotic use. A similar result was observed in women who recognized the effectiveness of antibiotics in treating infections, but still expressed negative statements, and tangible and psychological barriers to antibiotic use (Chen et al., 2020).

Table 18 shows that there was a significant, but moderate negative correlation between the respondent's perceived benefit and perceived self-efficacy (r_s = -.532, *p*-value = <0.001). This means that as the respondent's perceived benefit increases, their perceived self-efficacy decreases and vice versa. However, in a study by Herawati et al., (2021) a contradicting result stated that there is a positive correlation between self-efficacy and perceived benefit among their respondents.

Perceived barrier and perceived self-efficacy displayed a significant but negligible positive correlation (r_s = 0.173, *p*-value = 0.047). These results, however, were in contrast with a study by Yin et al., (2021), which stated that respondents with high perceived barriers were more likely to report self-medication, but those with a higher perceived self-efficacy were less likely to report self-medication. This is a clear indication of a strong, inverse relationship between the two.

The study shows that perceived threat has a significant, but low positive correlation with perceived self-efficacy on antibiotic use (r_s = .487, *p*-value = <0.001). This correlation suggests that as a respondent's perceived threat on antibiotics increases, perceived self efficacy also increases. A study showed that information gathering was a major contributor to women's self-efficacy prior to using antibiotics for themselves or their infants. This study characterized that

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collecting adequate information on the risks of antibiotics made mothers more confident in decision making about taking antibiotics. (Chen et al., 2020).

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IV. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study aimed to determine the Knowledge, Attitude, and Perception of residents residing in Metro Manila regarding antibiotic use and antimicrobial resistance using quantitative and comparative design as a research method. This study was limited to respondents between 21 to 59 years of age who are not medical professionals. A google form questionnaire survey was distributed through social media platforms and by using snowball sampling. A total of 132 responses were collected and analyzed using descriptive and inferential statistical tools. The descriptive statistical tools used were the frequency and percentage distribution and weighted mean. This study utilized Profile Plot Analysis, One-Way Analysis of Variance, and multiple comparison tests using the Bonferroni test and Spearman's Rho for inferential statistical tools.

Overall, 63 respondents representing the majority displayed moderate levels of knowledge, followed by 57 respondents who showed poor level of knowledge, and finally only 12 respondents who exemplified good levels of knowledge on antimicrobial resistance and antibiotic use. Overall, the respondents had a mean agreement in observing inappropriate attitudes. An overall agreement to perceived benefit of antibiotics, neutral perception on perceived barrier from antibiotic use, overall agreement to perceived threat of antibiotic use, and overall agreement on the perception of self-efficacy were measured. The residents have expressed the poor attitude of taking left-over antibiotics when they have similar flu symptoms.

Testing with ANOVA for the differences in the levels of knowledge classified into demographic variables netted a significant difference in terms of household income (p-value = <0.001), but an insignificant difference in terms of age and educational attainment at 95% confidence interval. Differences in the levels of attitude were significant when classified by age (p-value = 0.008) and household income (p-value = <0.001) while not significant for educational attainment. There were no significant differences in perceived benefit according to age, household income, and educational attainment. Perceived barrier was significantly different in terms of age (p-value = 0.008) and household income (p-value = 0.035) but not with educational attainment. There were no significant differences in perceived threat according to age, household income, and educational attainment. There were also no significant differences in perceived self-efficacy among age, household income, and educational attainment. Profile plot analysis supported a finding of a significant difference in the levels of knowledge, attitude, and perception, in terms of age (p-value = 0.0298) and household income (p-value = 0.0011) at 95% confidence interval.

Among the variables tested, knowledge was found to have a low positive correlation with household income and a moderate positive relationship with attitudes. Attitude was found to be negatively related with perceived benefit and barrier. Perceptions were also significantly related with age, household income, knowledge, and attitude.

Conclusions

The growing threat antimicrobial resistance poses against the general population of the world is a danger exacerbated by disinformation and misinformation. In a third world country like

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the Philippines, especially, the lack of access to knowledge leaves them more vulnerable to the evolving defense mechanisms of pathogens. Through this quantitative research, it was found that more than half of the respondents had moderate levels of knowledge, but is closely followed by the number of respondents who displayed poor levels of knowledge. With that being said, only a small number of the respondents obtained a score indicating a high level of knowledge. Having an adequate understanding of antimicrobial resistance directly correlates to proper and meticulous usage of antibiotics. The various, interconnecting relationships signify that an increase in the knowledge of the community can lead to better attitudes and perception on antibiotic use. Therefore, it must be one of the primary pivot points to combat disinformation and reduce the occurrences of medicines becoming ineffective due to antimicrobial resistance.

Recommendations

The research was conducted amidst the COVID-19 pandemic, limiting the distribution of survey questionnaires only through online means. As observed, this limited the representation of different populations particularly in age and educational attainment. A survey questionnaire distribution via physical means is recommended to accommodate more respondents, leading to a more accurate representation and more reliable results. Further study can be conducted on a larger scale by including other regions outside of Metro Manila. Contrastingly, the researchers also recommend limiting a study to a more niche or specific community where interventions can be done if the community is found to possess poor levels of knowledge, attitude, and perception on antibiotic use and antimicrobial resistance. With the rise of antiviral drug use due to COVID-19 therapy, a study on the public use of antiviral drugs among other antimicrobial agents can also be conducted.

An action plan conducted by willing students, researchers, or medical professionals can also be an important instrument for the development of the community's knowledge, attitude, and perception on antibiotic use. Interventions can revolve around low-income or rural communities where low levels of knowledge, attitudes, and practices might be prevalent.

The government and its law makers and enforcers can contribute to antimicrobial stewardship by conjuring and enforcing laws that will further regulate distribution and use of antibiotics and other antimicrobial agents. Additionally, the government and the health sector can cooperate for advocacies that will increase the public knowledge, attitude, and perception on antibiotics.

Lastly, we recommend that future Filipino researchers have a local translation of the survey questionnaires to help the respondents understand the content, especially those unfamiliar with medical terminologies.

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