Knowledge and Practices about Antibiotic use among the residents of Pampanga: Basis for health promotion plan

Lacanilao, Luis Miguel G., Alviz, Jholiza R., Gonzales., Alexandra E., Sumagui, Kristen Nicole D., Manlutac, Joseph Michael*

lmglacanilao.student@ua.edu.ph, jralviz.student@ua.edu.ph, aegonzales.student@ua.edu.ph, kndsumagui.student@ua.edu.ph, joseph_michael.manlutac@ua.edu.ph*

University of the Assumption- Del Pilar Unisite Subdivision, San Fernando City, 2000, Pampanga
Angeles University Foundation, AngelesCity, 2009, Philippines
Central Luzon Center for Health, Development, City of San Fernando, Pampanga, 2000 Philippines

ABSTRACT

Antibiotics are intended for the treatment of bacterial infections. However, their misuse and abuse have led to the emergence and spread of antibiotic resistance which poses a significant threat to public health globally and locally. This growing threat requires immediate action to address and eliminate the increasingly prevalent challenge of antibiotic resistance. This quantitative correlational research aimed to examine the level of knowledge and practices of the respondents regarding antibiotic use by utilizing measures of central tendency. In addition, the association of these variables with that of their sociodemographic factors in the context of developing antibiotic resistance was measured by Chi-squared and Fisher's exact tests. Purposive sampling method was employed to recruit the 509 respondents aged 18 to 59 years old from each local government unit of the four (4) congressional districts of Pampanga. The results indicate a high level of knowledge yet the practices related to antibiotic use were rated as fair only, thus highlighting the importance of addressing the gap between their knowledge and practice. A health promotional plan was created based on the findings which aims to improve the public's awareness and participation in responsible use of antibiotics.

KEYWORDS: antibiotics, antibiotic resistance, bacterial infections, misuse, abuse, knowledge, practices, health promotional plan

I.INTRODUCTION

The discovery of antibiotics is arguably the most remarkable breakthrough in the medical field in the 20th century as they have been nothing but instrumental in improving and saving numerous lives by treating infections caused by bacteria. A systematic analysis done by the Global Research on Antimicrobial Resistance (GRAM) Project and the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) in 2019 revealed that 7.7 million global deaths were found to be linked to bacterial infections (e.g., pneumonia, sepsis, and meningitis), making them responsible for the 13.6% of global deaths and the second-leading mortality cause in that year. Of those deaths, it is estimated that 1.2 million people have died as a direct result of antibiotic-resistant bacterial infections (Murray et al., 2022).

Paul Ehrlich and Alexander Fleming discovered Salvarsan and penicillin, which are antibiotics used to treat bacterial infections.

There is, however, an ever-growing concern about the current antibiotic resistance crisis. Antibiotic resistance is said to occur when bacteria cease to respond to antibiotics meant to kill them and the widespread abuse and misuse of antibiotics serve as the main culprit as to why many bacteria have become unresponsive to antibiotics (Ventola, 2015). From 2000 to 2015, greater accessibility to antimicrobials has contributed to an approximately 65% increase in human antibiotic consumption globally (Klein et al., 2018). While this may sound like a good tiding, its clear consequence is a greater opportunity for antibiotic resistance.

Antibiotic resistance poses major threats to global health, food security, and development to anyone regardless of age, gender, race, and socioeconomic status (CDC, 2020; World Health Organization [WHO], 2021). Furthermore, it also increases medical costs, prolongs hospital stays, and increases the mortality rate (Murray et al., 2022). This phenomenon is further dreaded due to the growing list of infections (e.g., pneumonia, tuberculosis, sepsis, gonorrhea) that are becoming harder, if not totally impossible, to treat (WHO, 2020).

The WHO's Global Action Plan on Antimicrobial Resistance (AMR) outlines strategic objectives to reduce and limit the impact of antibiotic resistance. In the US, the National Action Plan for Combating Antibiotic-Resistant Bacteria (CARB) confers coordinated and strategic actions for the U.S. government to take until 2025 to improve the course of antibiotic resistance. The Philippines adopted the One Health Approach to combat AMR in 2014, mandated by Administrative Order No. 42 S. 2014. This plan was motivated by a 2012 situation analysis of AMR. The Philippine National Action Plan on Antimicrobial Resistance 2019-2023 is being guided by the DOH, and Republic Act 10918 prevents unauthorized procurement of antibiotics.

Self-medication is the practice of self-consuming medication without proper diagnosis or prescribed treatment from a physician. It is common in the Philippines with a prevalence rate of 31%-66%, particularly for low-income households. Low-income families may try to self-medicate their children or take them to conventional or unqualified practitioners instead of seeking assistance from skilled healthcare providers. This can lead to prolonged illness, frequent doctor visits, longer hospital stays, more expensive treatments, or death.

Health promotion through public health campaigns is essential to combat antibiotic resistance. Kumar and Preetha (2014) suggest a settings-based approach in specific settings and considering demographic patterns, learning environments, family patterns, and cultural, social, and economic factors. Results should be used to create a health promotion plan.

The need for a health promotion plan to address the threat of antibiotic resistance in low and middle-income countries is highlighted. This study will provide statistical data to evaluate the knowledge and practices of respondents in Pampanga, which can be used as a basis for future studies.

1.1 Methodology

The study utilized a quantitative correlational research design as it dealt with numerical and statistical data in understanding the threat of developing antibiotic resistance in relation to the level of knowledge and practices of the respondents toward antibiotic use and their sociodemographic factors (age, sex, local government unit, congressional district, highest educational attainment, religion, nature of occupation, monthly income, parental status, and civil status). The results produced were also the basis of content for the health promotion plan which sought to improve the knowledge and practices of the respondents.

1.2 Respondents and Setting

Based on the sample size taken from the population of 15 to 64 years old in the province of Pampanga and the estimated population coming from the DOH Central Luzon Center for Health Development (CLCHD) and Knoema in 2022 which was estimated to be 1,919,839, the Raosoft software with 95% confidence level and 5% margin of error computed with a minimum of 385 respondents distributed equitably based from local government unit population. On the other note, during the course of data collection, 509 respondents participatedin the study.

In terms of the locale, Pampanga was the most strategic locale as this study may benefit the community, where the institution is situated. Respondents were selected based on the criteria of being (a) a resident of Pampanga and (b) under the 18 to 64 years old age group. The number of respondents recruited from each of the twenty-two (22) local government units in Pampanga, namely Apalit, Arayat, Bacolor, Candaba, City of San Fernando, Floridblanca, Guagua, Lubao, Mabalacat, Macabebe, Magalang, Masantol,

Mexico, Minalin, Porac, San Luis, San Simon, Sasmuan, Santa Ana, Santa Rita, Santo Tomas, and Angeles City as shown below in Table 1.

Pampanga total population (DOH-CLCHD, 2022)	LGU (n=22)	Population/LGU	15-64 y/o pop/LGU	% in the sample	Respondents/LGU
2,990,403	Apalit	123,712	79,423	4.14%	17
	Arayat	152,961	98,201	5.12%	20
15-64 y/o in the PH (Knoema, 2022)	Bacolor	45,215	29,028	1.51%	6
64.2%	Candaba	127,861	82,087	4.28%	16
	City of San Fernando	351,388	225,591	11.75%	45
	Floridablanca	143,421	92,076	4.80%	18
15-64 y/o in Pampanga (2022)	Guagua	134,558	86,386	4.50%	17
1,919,839	Lubao	184,295	118,317	6.16%	24
	Mabalacat	287,381	184,499	9.61%	37
	Macabebe	86,914	55,799	2.91%	11
Sample size (95% confidence level, 5% margin of err	Magalang	129,650	83,235	4.34%	17
385	Masantol	65,387	41,978	2.19%	8
	Mexico	177,179	113,749	5.92%	23
	Minalin	54,672	35,099	1.83%	7
	Porac	142,525	91,501	4.77%	18
	San Luis	62,000	39,804	2.07%	8
	San Simon	60,958	39,135	2.04%	8
	Sasmuan	32,089	20,601	1.07%	4
	Sta. Ana	63,226	40,591	2.11%	8
	Sta. Rita	46,956	30,146	1.57%	6
	Sto. Tomas	46,380	29,776	1.55%	6
	Angeles	471,675	302,815	15.77%	61
		2,990,403	1,919,839	100.00%	385

Table 1. Computation of the sample size per LGU.

Sampling Method

The sampling design used was non-probability sampling, particularly the purposive sampling method. This sampling method was utilized in identifying the respondents from the population of Pampanga. Cohen and Crabtree (2013) stated that the term "purposive sampling" refers to the selection of a sample using some pre-established criteria to identify who is germane and has experience with the phenomenon being studied. In this study, the respondents were selected based on the criteria of being (a) a resident of Pampanga and (b) under 18 to 64 years old. The researchers would benefit from this sampling method as the respondent selection will be narrowed down to individuals who satisfy the need of the study.

1.3 Research Instrument

In collecting the data needed for the study, a self-made survey questionnaire was utilized. In identifying which statements to include, the researchers have initially searched for related literature to ensure that the problem statements will be answered. In total, the survey questionnaire is composed of twenty-five (25) statements—10 knowledge statements and 15 practice statements—in English and Filipino languages to assess the level of knowledge and practices of the respondents. The ten (10) statements in the knowledge variable are answerable by true or false. Whereas, the fifteen (15) statements in the practice variable were rated using a 5-point Likert scale, with 1 representing “strongly disagree” and 5 representing “strongly agree.” This Likert scale is a popular choice for measuring attitudes, opinions, and perceptions on a wide range of topics (Mcleod, 2023).

To ensure its validity, the instrument went through a Content Validation Index (CVI) process, wherein three experts—a pharmacist supervisor, a community health pharmacist, and a psychometrician—evaluated its content. Furthermore, the instrument was subjected to a pilot test involving 30 respondents from the province of Bulacan who are also 18 to 59 years old. Data from the pilot test were then analyzed by a statistician to assess the reliability of the instrument. Wherein, the internal consistency for the constructs of knowledge (α = 0.7249, acceptable internal consistency) and practices (α=0.8906, good internal consistency) were identified. The interpretation of the values, as adapted from the website StatiscsHowTo.com (2015), is presented in Table 2.

Cronbach's alpha	Internal consistency
α ≥ 0.9	Excellent
0.9 > α ≥ 0.8	Good
0.8 > α ≥ 0.7	Acceptable
0.7> α ≥ 0.6	Questionable
0.6 > α ≥ 0.5	Poor
0.5 > α	Unacceptable

Data Collection Procedure:

Letters of intent, endorsement, and request were sent to the university's Dean of the College of Nursing and Pharmacy, the Department of Health Central Luzon Center for Health Development, and the President and Hospital Administrative Officer of GreenCity Medical Center. Respondents answered a survey questionnaire either personally or through the Google Forms platform. Ethical Consideration: A bilingual informed consent form was reviewed and approved by the University of the Assumption Research Ethics Board (UAREB).

Data Analysis:

Data was translated into computerized numerical form by encoding them in Google Spreadsheet and IBM Statistical Package for the Social Sciences (SPSS). Chi-square test was used to determine the association between socio-demographic factors and the level of knowledge and practices of the respondents.

The Chi-square test and Fisher's Exact Test were used to examine the association between two categorical variables and whether the experimentally observed results were consistent with the hypothesis. Combining categories in certain socio-demographic variables (highest educational attainment, religion, and monthly income) was necessary due to some assumptions on the expected frequencies of the Chi-square test being violated. The researchers assessed the level of knowledge and practices of the respondents by comparing their scores to correct answers and adding them to a final score of 10 points. The practice scores were obtained by adding the respondents' ratings based on a 5-point Likert scale, resulting in a total score of 75 points. The results were used to create a health promotion plan to improve the level of knowledge and practices.

2. RESULTS

The data gathered was organized, tabulated, and analyzed in congruence with the purpose of the research study. The gathered data are presented in tabular and textual forms.

In total, there are 509 respondents in the study, with 222 (43.61%) males, and 287 (56.39%) females. **Table 3** shows the socio-demographic profile of the respondents. Most of the respondents were 18 to 24 years old (64.64%), followed by 25 to 34 years old (16.70%), 45 to 54 years old (8.24%), 35 to 44 years old (7.07%), and lastly, 55 to 59 years old (2.75%). The respondents came from different municipalities in Pampanga, with most of the respondents coming from Angeles City (18.47%), and the City of San Fernando (12.18%). The district with the highest number of respondents is the third (32.42%). In terms of highest educational attainment, the majority were high school graduates (72.50%). The most common religion is Roman Catholic (80.55%), mostly students (58.15%), with an income of Php 9,520 or less (74.26%), single (78.76%), and with no child (76.23%).

Table 3. Socio-demographic profile of respondents

Profile	Frequency	Percentage
AGE		
18 to 24 years old	329	64.64
25 to 34 years old	85	16.70
35 to 44 years old	36	7.07
45 to 54 years old	36	8.24

55 to 59 years old	14	2.75
SEX		
Male	222	43.61
Female	287	56.39
LOCAL GOVERNMENT UNIT		
Apalit	18	3.54
Arayat	31	6.09
Bacolor	9	1.77
Candaba	20	3.93
City of San Fernando	62	12.18
Floridablanca	18	3.54
Guagua	19	3.73
Lubao	24	4.72
Mabalacat	39	7.66
Macabebe	12	2.36
Magalang	19	3.73
Masantol	9	1.77
Mexico	44	8.64
Minalin	11	2.16
Porac	18	3.54
San Luis	11	2.16
San Simon	9	1.77
Sasmuan	4	0.79
Sta. Ana	20	3.93
Sta. Rita	6	1.18
Sto. Tomas	12	2.36
Angeles	94	18.47
CONGRESSIONAL DISTRICT		
1st District	154	30.26
2nd District	89	17.49
3rd District	165	32.42
4th District	101	19.84
HIGHEST EDUCATIONAL ATTAINMENT		
No schooling - Elementary level	15	2.95
Elementary graduate	34	6.68
High School graduate	369	72.50
College graduate	82	16.11
Post-graduate	9	1.77
RELIGION		
Roman Catholic	410	80.55
Iglesia ni Cristo (INC)	33	6.48
Islam	7	1.38
Born Again Christian	39	7.66
Others	20	3.93
NATURE OF OCCUPATION		
Health-related	40	7.86
Non-health-related	146	28.68
Student	296	58.15
Unemployed	27	5.30
MONTHLY INCOME		
No income to Php 9,520	378	74.26
Php 9,520 to Php 19,040	67	13.16
Php 19,041 to Php 38,080	42	8.25
Php 38,081 to Php 66,640	13	2.55

Php 66,641 and above	9	1.77
CIVIL STATUS		
Single	406	79.76
Married	95	18.66
Widowed	6	1.18
Widower	2	0.39
Divorced	0	0
PARENTAL STATUS		
With child	121	23.77
Without child	388	76.23

Table 4 shows the knowledge of respondents on antibiotic use. There were 97.05% who are aware that antibiotics kill bacteria, however, 30.45% also believe that it treats viral infections. In addition, 86.44% know that using antibiotics longer than the indicated duration can contribute to antibiotic resistance and 83.69% agreed that antibiotics can cause side effects (83.69%). Furthermore, the majority of them disagreed that self-medication is safe and acceptable (74.85%) and were aware that bacteria can become resistant to antibiotics (73.87%). Only a little more than half of the respondents know that prescriptions from nurses cannot be used to purchase antibiotics from the pharmacy (55.21%), that antibiotics cannot be stopped when they feel better (51.28%), and that you can take another kind of antibiotic if you are allergic to one (51.08%). On the other hand, only 21.02% only know that humans can become resistant to antibiotics. The number of correct answers of each respondent were summed up and the mean score is equal to 6.24.

Table 4. Knowledge of respondents on antibiotic use

	Knowledge items	True n (%)	False n (%)	n (%) with correct answers
1.	Antibiotics kill bacteria	494 (97.05)	15 (2.95)	494 (97.05)
2.	Antibiotics treat viral infections	354 (69.55)	155 (30.45)	155 (30.45)
3.	Using antibiotics for a duration longer than that indicated contributes to antibiotic resistance.	440 (86.44)	69 (13.56)	440 (86.44)
4.	Antibiotic treatment can be stopped when you started to feel better to prevent antibiotic resistance.	248 (48.72)	261 (51.28)	261 (51.28)
5.	Self-medication is safe and acceptable.	128 (25.15)	381 (74.85)	381 (74.85)
6.	Antibiotics can cause side effects such as rash, nausea, diarrhea, and yeast infections.	426 (83.69)	83 (16.31)	426 (83.69)
7.	Prescriptions from nurses can be used to purchase antibiotics from the pharmacy	228 (44.79)	281 (55.21)	281 (55.21)

8. If you are allergic to one antibiotic, you are not able to take any kind of antibiotic.	249 (48.92)	260 (51.08)	260 (51.08)
9. Humans can become resistant to antibiotics.	402 (78.98)	107 (21.02)	107 (21.02)
10. Bacteria can become resistant to antibiotics.	376 (73.87)	133 (26.13)	376 (73.87)
Mean score			**6.24**

The total score was used to classify the level of knowledge of the respondents based on Bloom's cut-off point. **Table 5** shows the distribution of respondents as to their knowledge level. Most of the respondents (39.10%) have high knowledge of antibiotic resistance (score of 8 to 10), while 29.08% have fair knowledge (score of 6 to 7). On the other hand, almost 1/3 (31.83%) still have poor knowledge of the subject (score of 0 to 6).

Table 5. Level of knowledge of respondents on antibiotic use

Level of knowledge	Scores	Frequency	Percentage
High	8-10 (80%-100%)	199	39.10
Fair	6-7 (60%- 79%)	148	29.08
Poor	<6 (<60%)	162	31.83

Presented in **Table 6** are the practices of the respondents on antibiotic use. 60.43% strongly agree that they seek help from a doctor when it comes to their antibiotic treatment, and 21.02% agreed to this. Additionally, most respondents stronglyagree that they complete the course of treatment of the antibiotics as prescribed by their doctors (64.64%), that they consult a doctor before starting antibiotics (60.43%), and when they feel side effects (60.31%). Likewise, the majority strongly agree that they discourage people from self-medicating when it comes to antibiotics (43.61%) and that they seek or ask advice from pharmacists on antibiotic treatment (38.90%).

Moreover, the majority agree that they seek advice from the members of their family for antibiotic treatment (32.22%) and that they rely on their experience when it comes to antibiotic treatment (25.93%).

On the other hand, most of them strongly disagree that they share antibiotics with families or friends that have similar symptoms (44.20%), that they buy the antibiotics from sari-sari stores, and on seeking advice from neighbors (44.20%). Whereas, 32.81% strongly agree that they discontinue taking antibiotics when their symptoms have improved. Lastly, 26.91% strongly disagree that they save their leftover antibiotics for future use and 26.52% strongly disagree with relying on social media for information. The majority (29.47%) also disagree that they seek advice from friends on this matter.

A median score of 5, which corresponds to "Strongly Agree" was observed in completing the course of treatment, consulting a doctor for antibiotic treatment and before its start, and when they feel side effects. A median of 4, corresponding to "Agree" was seen in discouraging people from self-medicating, and seeking advice from pharmacists. On the other hand, respondents were neutral on saving the leftover medicines, seeking advice from family members, and relying on social media and experience when it comes to antibiotic use.

The respondents, on average, disagree on sharing antibiotics, buying from small stores, discontinuing when symptoms improved, and seeking advice from friends and neighbors.

Table 6. Practices of respondents on antibiotic use

Practices items	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mdn
	n (%)					

1. I share my antibiotics with someone else in my family or friends with similar symptoms.	225 (44.20)	92 (18.07)	44 (8.64)	94 (18.47)	54 (10.61)	2
2. I complete the course of treatment for the period prescribed by the doctor.	16 (3.14)	21 (4.13)	19 (3.73)	124 (24.36)	329 (64.64)	5
3. I consult a doctor first before starting an antibiotic.	16 (3.15)	15 (2.95)	32 (6.30)	138 (27.17)	307 (60.43)	5
4. I save my leftover antibiotics at home for future use.	137 (26.92)	83 (16.31)	64 (12.57)	134 (26.33)	91 (17.88)	3
5. I buy antibiotics from a sari-sari store.	251 (49.31)	108 (21.22)	43 (8.45)	85 (16.70)	22 (4.32)	2
6. I discontinue taking antibiotics when symptoms have already improved.	167 (32.81)	107 (21.02)	52 (10.22)	120 (23.58)	63 (12.38)	2
7. I discourage other people from self-medicating with antibiotics.	38 (7.47)	50 (9.82)	80 (15.72)	119 (23.38)	222 (43.61)	4
8. I seek advice from my family members regarding antibiotic treatment.	87 (17.09)	77 (15.31)	91 (17.88)	164 (32.22)	90 (17.68)	3
9. I seek advice from my friends regarding antibiotic treatment.	145 (28.49)	150 (29.47)	81 (15.91)	101(19.84)	32 (6.29)	2
10. I seek advice from my neighbors regarding antibiotic treatment.	225 (44.20)	124 (24.36)	82 (16.11)	0 (0.00)	0 (0.00)	2
11. I seek help from a doctor when it comes to antibiotic treatment.	17 (3.34)	5 (0.98)	19 (3.73)	107 (21.02)	361 (70.92)	5
12. I seek advice from a pharmacist when it comes to antibiotic treatment.	39 (7.66)	30 (5.89)	47 (9.23)	195 (38.31)	198 (38.90)	4
13. I rely on social media platforms and the Internet to seek information about antibiotics.	135 (26.52)	111 (21.81)	107 (21.02)	117 (22.99)	39 (7.66)	3

14. I rely on my own experience when it comes to antibiotic treatment.	123 (24.17)	104 (20.43)	107 (21.02)	132 (25.93)	43 (8.45)	3
15. I consult my doctor when I feel side effects during my antibiotic treatment.	18 (3.54)	7 (1.38)	40 (7.86)	137 (26.92)	307 (60.31)	5

Legend: SD- Strongly Disagree, D-Disagree, N-Neutral, A-Agree, SA-Strongly Agree

Presented in **Table 7** is the level of practice based on Bloom's cut-off point, with the highest possible score of 75. Only 14.15% have a high level of practice (score of 60 to 75), while majority, 44.60% have a fair level (score of 45 to 59). Lastly, 41.26% a have poor level of practice on antibiotic resistance (score of less than 45).

Table 7. Level of practice of respondents on antibiotic use

Level of practice	Scores	Frequency	Percentage
High	60-75 (80%-100%)	72	14.15
Fair	45-59 (60%- 79%)	227	44.60
Poor	<45 (<60%)	210	41.26

The association of the socio-demographic variables on the level of knowledge and practice was shown in **Table 8**. Chi-square Test was used to determine this, however, when an assumption of the Chi-square Test was not satisfied, Fisher's Exact Test was used.

All socio-demographic profiles such as age, sex, educational attainment, religion, nature of the occupation, monthly income, civil status, parental status, and district have significant associations with the level of knowledge (p-values less than 0.05). Moreover, all variables except religion have a significant association with the level of practice (p-values less than 0.05).

Table 8. Association of level of knowledge and practice and socio-demographic variables

Socio-demographic variables	Level of knowledge (p-value)	Level of Practice (p-value)
Age	<0.001*	0.012*
Sex	<0.001*	<0.001*
Educational attainment	<0.001*	<0.001*
Religion	0.001*	0.050[f]
Nature of occupation	<0.001*	<0.001*
Monthly income	<0.001[f]*	0.027[f]*
Civil status	0.016[f]*	0.002[f]*
Parental status	<0.001*	<0.001*
District	0.003*	0.003*

*: significant association observed
f: Fisher's exact test was used

Table 9 features the contents of the health promotional plan with the program name **"AGaP (Alaga, Gabay, at Paggamit): Pampanga-na Laban sa Antibiotic Resistance,"** which took into consideration the established results of the study. It will cater to the community members of the four districts of Pampanga with

respect to the socio-demographic profile of the respondents (age, sex, local government unit, congressional district, highest educational attainment, religion, nature of occupation, monthly income, parental status, and civil status). The acronym "AGaP" takes inspiration from the Filipino word "agapan" which means "to prevent something" to communicate the idea that the community members should take the appropriate measures in order to prevent antibiotic resistance.

The desired behaviors for the stakeholders after implementing the plan are outlined, highlighting an overall augmentation in their awareness and practices. Having said this, to help them adapt better behaviors, the communication objectives, key messages, strategies and activities, and channels and communication materials to be used are laid out, taking into account the significant knowledge and practice gaps, as well as the resources and manpower to utilize. Possible issues and barriers that may hinder the goal of the activity were also anticipated in order to address and mitigate them at the earliest convenience. Ultimately, to assess whether the plan will be successful and effective, monitoring and evaluation indicators are also pinned down.

DISCUSSION

Antibiotic resistance is a global public health concern caused by misuse and abuse of antibiotics. This study assesses the knowledge and practices of the public in Pampanga and creates a health promotion plan to raise awareness of antibiotic use.

The Level of Knowledge of the Respondents Regarding Antibiotic Use

This study found that the level of knowledge of a person contributes to the risk of antibiotic resistance. Most respondents have a high knowledge level, but it is still important to be aware of responsible antibiotic use. This will help to minimize the risk of antibiotic resistance.

The Level of Practice of the Respondents Regarding Antibiotic Use

Furthermore, the results also support the association between the level of practice and the risk of antibiotic resistance. In determining the appropriateness of the practices of the respondents, only 72 respondents (14.15%) have a high level of practice while the majority of them have fair (227, 44.60%) and poor (210, 41.26%) levels. Correlating this observation with that of the knowledge level of the respondents, it can be inferred that while the majority of them have a high level of knowledge on antibiotic use, they do not practice what they know. Hence, it can be argued that incorrect practices in using antibiotics are largely motivated by a lack of appropriate knowledge and attitude (Karuniawati et al., 2021). Various factors such as the desire for immediate relief, past experiences, time and financial constraints, and the underestimation of the gravity of the disease also influence consumers to self-medicate (Russom et al., 2019; Watkins et al., 2019). Receiving an accurate assessment, diagnosis, and treatment plan from a doctor is the gold standard in reducing the likelihood of complications brought on by self-medication. Seeking proper assistance from professionals before using antibiotics is crucial in preventing antibiotic resistance because when used unnecessarily, antibiotics may cause serious and fatal side effects like Clostridioides difficile infection and severe anaphylactic reaction (WHO, 2021; CDC, 2020; Johns Hopkins Medicine, 2019; Mayo Clinic, 2022).

The Relationship of the Socio-demographic Factors of the Respondents and Their Levels of Knowledge and Practices toward Antibiotic Use.

A significant association ($p < 0.05$) between all socio-demographic variables of the respondents and their level of knowledge has been established in this study. Moreover, all variables except religion have significant associations with their level of practice ($p < 0.05$). In this light, these factors should then be taken into account when planning for interventions to mitigate the risk of antibiotic resistance in the province. **Age** is linked with their level of knowledge ($p < 0.001$) and practices ($p < 0.012$) toward antibiotic use in this study. Knowledge and practices about proper antibiotic use and age vary among studies as elderly individuals in Malaysia and Indonesia (60-80 years old) have poor knowledge than younger age groups (Kong et al., 2019; Yunita et al., 2022) but those 18 to 34 years old in India and Singapore demonstrated poorer knowledge about antibiotic use than the ≥ 50 years age group (Bhardwaj et al., 2021; Guo et al., 2021). On the other hand, appropriate practices (e.g., not saving and giving leftover antibiotics for future use and completing the full course of antibiotic treatment) are significantly associated with the older age group (≥ 50 years old) than those who are 21 to 49 years old (Guo et al. 2021). This age-related difference may be due to the extent of experience with antibiotics of the respondents as well as with their educational background as the **highest educational attainment** of the respondents is likewise associated with proper knowledge ($p < 0.001$) and practices ($p < 0.001$) about antibiotic use in this study. Several studies from different countries have established that those with high (tertiary education and above) and medium (secondary education) educational status have higher rates of correct knowledge and appropriate practices than those with low education (primary or no formal education) (Mallah et al., 2021; Dejene et al., 2022; Voidăzan et al., 2019; Kong et al., 2019; Gebeyehu et al., 2015; Effah et al., 2020; Yunita et al., 2022). Having appropriate knowledge,

that is understanding information about antibiotics and educational messages, could improve practices, thus influencing proper consumption.

Similarly, the statistical test result showed that **sex** is significantly associated with the respondents' knowledge ($p < 0.001$) and practices ($p < 0.001$). Generally, studies present that women have greater knowledge of antibiotics and better practices than men (Yunita et al., 2022; Bhardwaj et al., 2021; Nepal et al., 2019; Waasethet al., 2019) but some factors may be contributing as to why there is such occurrence. Possible causes may includean unequal distribution of male and female respondents and whether they have children which makes them to bein contact with healthcare providers more often as they are usually the primary caregivers of their families, thus improving their knowledge, and hence their practices, about antibiotics over time.

Where the respondents reside, as determined by the **congressional district** of their LGU, likewise has an association with their knowledge ($p = 0.003$) and practices ($p = 0.003$) regarding antibiotic use. It can then be misconstrued that the policies and strategies of the LGUs that tackle antibiotic resistance (e.g., awareness campaigns and regulation of antibiotics distribution) can influence these variables. For instance, Briones et al. (2022) inferred that the distance between the residence and the Rural Health Unit can harbor negative practices (e.g., storing antibiotics at home for future use, not consulting a physician, self-medication) as large medical and travel expenses may be incurred, especially in remote areas, which makes patients' compliance to medication regimen and follow-up visits more unlikely. This said, such issues could be resolved under the RA 7160 or the Local Government Code of 1991 which ensures the establishment of a more responsive local government framework through a decentralized system wherein more authority, resources, and powers are given to LGUs. Thereby, improving the efficiency and efficacy of the delivery of healthcare services to those underprivileged (Food and Agriculture Organization of the United Nations, 2022; Cuenca, 2018). With the Philippines having a decentralized healthcare system, the healthcare authorities in different LGUs will be able to closely monitor antibiotic consumption and take immediate actions when appropriate, such as updating prescribing guidelines or enacting restrictions on specific antibiotics in their communities.

Too, in a broader sense, studies have concluded that those living in urban communities possess greater knowledge about antibiotic use as they have better access to primary healthcare providers and pharmacies than those in rural areas (Yunita et al., 2022; Chow & Nor Liana, 2020; Gu et al., 2015). In line with this, **monthly income** and employment status may also be a factor in that urban areas generally offer more job opportunities, thus increasing one's ability to seek professional medical advice, healthcare services, and compliance with the prescribed antibiotic therapy (Collantes & Germo, 2018; Schmiege et al., 2020). Hence, as demonstrated by statistical results, the monthly income of an individual, especially when high, also influences his or her knowledge ($p < 0.001^f$) and practices ($p = 0.027^f$) regarding antibiotic use as he or she can afford to avail of healthcare services more readily and can purchase complete regimens to complete the prescribed treatment (Di et al., 2022).

Furthermore, the **nature of occupation** also plays a role in the respondents' knowledge ($p < 0.001$) and practices ($p < 0.001$) on antibiotic use. With students occupying the majority of the respondents in this study (58.15%), it can be inferred that education indeed has an influence on these variables. Moreover, although only 7.86% of the total respondents are working in health-related occupations, an Italian-based study affirmed that pharmacists, doctors, and other healthcare professionals are more likely than non-healthcare professionals to demonstrate greater awareness of antibiotic use and appropriate practices (e.g., the role of hand hygiene as an infection prevention and control measure) (Barchitta et al., 2021). This may be due to their constant exposure to healthcare-related information and trends which can influence their beliefs regarding antibiotic use. However, this also poses negative consequences as having relatives or friends who work in the healthcare sector is linked to inappropriate antibiotic use as they are likely to not have a formal and proper assessment from a physician and retain antibiotic medications in their houses due to their access in a healthcare setting (Scaioli et al., 2015; Byrne et al., 2019).

Religion also affects a person's beliefs and values, including that of healthcare. It may interfere with his or her understanding and acceptance of information about antibiotics. Findings revealed that religion is also associated with knowledge ($p = 0.001$) but not with practice ($p = 0.050^f$) level on antibiotic use. Studies suggest that respondents who have strong spiritual views are less likely to take their medications, including antibiotics, as prescribed which suggested a link between spiritual beliefs and medication adherence (Mohrs, 2015; Kretchy et al., 2013). Advent Health University (2020) affirmed this by stating that a varying range of religious and spiritual convictions can have an effect on how patients perceive their experiences and make choices regarding their medical care as guided bythe teachings and customs of their respective religions. Hence, it can be said that because spirituality ties with a supreme power that may boost a person's faith in the possibility of divine healing, religious people may underestimate the benefit of adhering to prescribed antibiotic therapy in curing their disease.

Statistical results likewise support the association of the respondents' knowledge ($p = 0.016$ [f]) and practices ($p = 0.002$[f]) on antibiotic use with their **civil status**. Comparably, a similar association was observed with their **parental status** (knowledge and practice = $p < 0.001$). Findings from related studies deduced that this may be because parents with children have more exposure to antibiotic information than those without or who are single (Alkhalifah et al. (2022). Yet, Tagum-Briones et al. (2022) contested that being a mother may yield negative consequences as they tend to self-medicate their children's disease owing to their past treatment experiences, hence also leading to the misuse of antibiotics. Likewise, Al-Ayed (2019) affirmed in a study conducted in Saudi Arabia that parents were found to acknowledge that their understanding of antibiotic use was insufficient. This attitude is probably due to the fact that the parents may not have thought their child's health was critical and have limited time to take their child to a doctor.

A Healt The DOH spearheads the Philippine National Action Plan on Antimicrobial Resistance 2019-2023 to improve awareness and understanding of antimicrobial resistance through effective communication and education. Mass media is the most commonly used means to disseminate information.h Promotion Plan Related to Awareness of Antibiotic Use.

To attend to this call, this study has utilized the findings to formulate the program "AGaP (Alaga, Gabay, at Paggamit): Pampanga-na Laban sa Antibiotic Resistance," focusing on significant key points to help the public achieve desired behaviors which primarily underline the lack of awareness and appropriate practices for responsible antibiotic use.

Conclusion

This study investigated the level of knowledge and practices about antibiotic use of residents in Pampanga. It found that 39.10% had a high level of knowledge, 29.08% had a fair knowledge level, and 31.83% had a poor knowledge level. Most respondents had fallen short of correctly identifying that antibiotics do not treat viral infections and humans do not develop resistance to antibiotics.

In terms of practices, 44.60% have a fair practice level, 41.26% have a poor practice level, but only 14.15% exhibited high practice levels regarding antibiotic consumption. Thus, it can be said that although most have demonstrated a high level of knowledge, they need to put what they know into action to prevent the development of antibiotic resistance in the province. Of the included statements, the respondents were found to be neutral on whether to save their leftover antibiotics for future use, seek advice from family members, rely on information from social media platforms and the Internet, and depend on their previous experience with antibiotic therapy. The study found that all socio-demographic variables were significantly associated with their knowledge level. However, all variables except religion had significant associations with their level of practice. To improve the public's knowledge and practice towards responsible antibiotic use, the AGaP (Alaga, Gabay, at Paggamit) Program is being implemented in the four congressional districts of the province. Support and resources from LGUs and community members are needed.

Implications to the Nursing Profession

- **Nursing Education.** The responsible use of antibiotics should be reinforced and integrated into the BSN curriculum across various applicable nursing subjects. This approach fosters early awareness among student nurses, enabling them to provide valuable information to others such as their families and friends. It is crucial for future healthcare professionals to receive a comprehensive undergraduate education in antimicrobial stewardship, equipping them with an adequate understanding of antibiotics, their uses, and the issue of antibiotic resistance. As future healthcare providers in clinical practice, these students bear a critical responsibility to promote responsible drug utilization among their patients.
- **Nursing Practice.** Nurses, particularly nurse educators, should emphasize the importance of responsible antibiotic use due to their role as healthcare professionals and as primary communicators of health-related messages to their clients. Based on the results, key messages can be developed to enhance clients' knowledge and improve their practices on antibiotic use.
- **Nursing Administration.** Nursing administrators can institute policies or guidelines related to responsible antibiotic use, benefiting clients and healthcare professionals alike. This approach aims to prevent the emergence and spread of antibiotic-resistant bacteria through their involvement in antibiotic stewardship and infection control programs. To effectively fulfill this role, nurses must possess accurate knowledge and

Recommendations

As established in this study, it cannot be denied that the public still has misconceptions about how to properly consume antibiotics. As a result of this, there is an escalating issue revolving around the ongoing crisis of antibiotic resistance. Thus, the researchers recommend the results of their study to the following:

- **General public.** The public should remain receptive to novel information related to proper antibiotic use and refine certain practices, such as not saving leftover antibiotics and assessing the veracity of information.
- **Health education and promotion officers.** Health promotion officers are encouraged to develop a customized health promotion plan with important key messages in consideration of the various socio-demographic variables of the citizens as these variables have a direct association with their knowledge and practices on antibiotic use.
- **Healthcare providers.** As they assume an active role in antimicrobial stewardship by improving the health-seeking behaviors of their clients, healthcare providers such as doctors and nurses are encouraged to include the significant knowledge and practice gaps highlighted in this study as part of their health education to their clients.
- **Policy makers and regulators.** The results of this study can suggest an evidence-informed policymaking decision by policymakers at the local and national levels to shape healthcare policies and regulations to tackle antibiotic resistance.
- **Future researchers.** Future researchers should broaden the scope of their investigations, improve the sample size and sampling method, and choose healthcare professionals as respondents to examine their perspective on antimicrobial stewardship. The health promotional plan should also be further consulted and validated.

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