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Article

Understanding Antimicrobial Resistance through Culture and Community: A One Health Study in Lakewood

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Abstract

Antimicrobial resistance (AMR) is not only a biomedical challenge but also a sociocultural issue influenced by community beliefs, practices, and health-seeking behaviors. This study explored the sociocultural dimensions of AMR in Lakewood, Zamboanga del Sur, by comparing communities near and far from the lake using the One Health framework. Employing a descriptive–quantitative design, structured questionnaires and guided interviews were administered to 100 randomly selected residents of Barangays Poblacion and Bag-ong Kahayag. Results revealed that while respondents demonstrated a generally high level of knowledge on antimicrobials, misconceptions persisted, particularly regarding antibiotic use for viral infections and the completion of prescribed treatments. Cultural beliefs, such as reliance on herbal remedies, faith healing, and gender-influenced decision-making, were found to significantly shape antibiotic use, with stronger cultural beliefs recorded among residents living farther from the lake ($p = 0.0003$). Health-seeking behaviors reflected a mix of traditional and modern practices, as respondents reported both consulting physicians and resorting to herbal medicine or faith healers. The findings underscore that knowledge alone is insufficient to ensure rational antibiotic use; cultural norms and practices remain powerful determinants of AMR-related behaviors. This study highlights the need for culturally sensitive health education, stricter policy enforcement on antibiotic access, and community engagement through a One Health approach that integrates human, animal, and environmental health. By situating AMR within a sociocultural lens, this research contributes to the broader discourse on how cultural practices and community dynamics shape health outcomes in the Philippine context.

Keywords: *antimicrobial resistance, sociocultural beliefs, health-seeking behavior, One Health, Lakewood, Zamboanga del Sur*

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Introduction

Antimicrobial resistance (AMR) is a serious global health problem that needs immediate attention and action. The World Health Organization estimates that AMR causes around 700,000 deaths each year, and this number could reach 10 million by 2050 if nothing is done (WHO. (2019) Overusing and misusing antibiotics and other antimicrobial drugs have led to the rise and spread of AMR, making infections that were once easily treated now challenging or even impossible to cure.

AMR involves many drivers, stakeholders, and values. As Minssen and others (2020) state, social, cultural, behavioral, and economic factors impact antibiotic misuse, overuse, and abuse. By looking at the socio-cultural aspects of AMR in communities near and far from a lake, researchers can find attitudes, perceived norms, and values that lead to inappropriate antibiotic use and resistance. This information can help design effective stewardship programs, public health policies, and interventions considering local contexts and socio-cultural factors.

Areas near lakes have special cultures and work that affect antibiotic usage and resistance. For instance, fish farming with antibiotics in lake towns could drive up AMR (Chowdhury et al., 2022). Some communities live off the lake, so their livelihood and traditions are tied to using antibiotics in fishing, which increases AMR risk.

People- living close to lakes sometimes do things differently from others. They may fish for food or have special ways of thinking about germs and medicines. These differences can impact how they use antibiotics. For example, fish farmers dose fish with antibiotics, allowing resistant germs to develop (Chowdhury et al., 2022). Also, living by water might change views on health and treatment, affecting antibiotic prescribing. Experts must learn about cultural factors driving antibiotic resistance in lakeside versus inland areas. Understanding local beliefs and practices aids in creating targeted strategies suited to each community's needs. Researchers fill knowledge gaps and devise more effective interventions by carefully analyzing social contexts influencing antibiotic use. Additionally, AMR is spreading worldwide. It poses a significant risk to public health, especially in poorer countries where people and economies are expected to experience proportionately greater suffering than high-income countries (Vedadhir et al, 2020).

This study primarily aims to determine the socio-cultural dimensions affecting AMR in the community within the vicinity of selected hospitals near and far from Lake Brgy. Poblacion and Brgy. Bag-ong Kahayag of Lakewood, Zamboanga del Sur. Specifically, it will assess the knowledge, cultural beliefs, and health-seeking behavior relating to antimicrobial use among the people in the community within the hospitals' vicinity and eventually formulate policy recommendations on antibiotic use and

misuse, as well as the conduct of awareness campaigns about AMR in the selected regions across the country. Studying the socio-cultural dimensions of antimicrobial resistance (AMR) in communities near and far from a lake is crucial for understanding how cultural beliefs, healthcare practices, and community norms influence antibiotic use and resistance. This research sheds light on how attitudes, perceived norms, and values impact antibiotic consumption, contributing to the misuse and overuse of antibiotics, which accelerates the development of AMR. By exploring these dimensions, researchers can identify factors such as ease of access, social expectations, and cultural practices that influence antibiotic overconsumption, providing insights into the societal habits contributing to AMR. Understanding the shared responsibility for antibiotic resistance within societies, including the roles of government actors, health professionals, and food producers, is essential for developing effective strategies to combat AMR.

Moreover, studying these socio-cultural aspects in communities near and far from a lake can help tailor interventions to address specific cultural practices and norms that impact antibiotic use, ultimately contributing to more targeted and effective public health initiatives to mitigate the threat of AMR.

By researching the socio-cultural dimensions of AMR in communities near and far from a lake, researchers can contribute to the global efforts to combat AMR and promote sustainable development. Therefore, researching the socio-cultural dimensions of AMR in communities near and far from a lake is essential for developing targeted interventions and public health policies that consider local contexts and socio-cultural determinants. It helps create targeted solutions and public he-alth rules considering local situations and cultural/social factors. Research like this can aid the worldwide fight against AMR and promote sustainable development, especially in low and middle-income nations.

Global Burden of AMR

Antimicrobial resistance (AMR) has been recognized as one of the most urgent global health challenges of the 21st century. The World Health Organization (WHO, 2019) estimates that nearly 700,000 people die each year from drug-resistant infections, and this number could escalate to 10 million annually by 2050 if no immediate interventions are implemented. Beyond health, the economic consequences are staggering. Projections suggest that AMR could reduce global gross domestic product (GDP) by up to $3.4 trillion annually, pushing an estimated 24 million more people into extreme poverty (World Bank, 2017). These figures highlight the scale of AMR as

a global crisis that threatens both lives and livelihoods, disproportionately affecting low- and middle-income countries with weaker healthcare systems.

The global spread of AMR is exacerbated by international travel, migration, and trade, which facilitate the rapid dissemination of resistant pathogens across borders (Prestinaci et al., 2015). For example, resistant strains from one country's misuse of antibiotics in healthcare or agriculture can easily cross into another region due to globalization and interconnected economies. This phenomenon makes AMR a local or national concern and a transboundary issue requiring multilateral cooperation and global surveillance systems. Such interconnectedness underscores the need for collective responsibility and coordinated responses at regional and global levels.

Efforts to curb AMR have included creating global action plans and national strategies emphasizing antibiotic stewardship, surveillance, and innovation. However, success remains limited because many interventions often neglect socio-cultural and behavioral dimensions, equally important in driving antimicrobial misuse. While global frameworks stress biomedical interventions, communities' cultural and contextual realities, such as local healing traditions, health beliefs, and household-level practices, still play a vital role in shaping antibiotic use. Without integrating these socio-cultural perspectives, global efforts to address AMR risk overlook the lived experiences and practices of communities most vulnerable to its impacts (Vedadhir et al., 2020).

Environmental and Aquatic Contexts

Environmental factors, particularly those associated with aquatic ecosystems, play a crucial role in the proliferation of AMR. Antibiotics used in agriculture and aquaculture often find their way into water systems, creating reservoirs of resistance genes that can spread to human populations. Studies in Bangladesh, Vietnam, and other Southeast Asian countries have shown that unregulated antibiotic use in fish farms contributes to the emergence of resistant bacterial strains (Rahman et al., 2022; Hoa et al., 2011). These strains can spread to humans through food consumption, direct water contact, or environmental contamination, creating a cycle of resistance that transcends ecological boundaries.

Lakes, rivers, and groundwater are particularly vulnerable to contamination from human and animal waste, agricultural runoff, and aquaculture practices. For example, in lake-dependent communities, fish farmers often administer antibiotics to prevent disease outbreaks, inadvertently fostering the survival of resistant bacteria in aquatic environments (Chowdhury et al., 2022). Once resistance develops in these ecosystems, it becomes difficult to contain, as water serves as a medium for

widespread distribution of pathogens. Such findings demonstrate that environmental dimensions of AMR are not separate from human health but intricately connected through shared ecological systems.

Moreover, the environmental pathways of AMR highlight the importance of considering local livelihoods and practices when designing interventions. Communities that rely on fishing or agriculture often use antibiotics as therapeutic tools and preventive measures to protect their income sources. It creates a tension between sustaining livelihoods and preventing AMR. Interventions not accounting for these socio-economic realities risk alienating local stakeholders, undermining compliance, and effectiveness. Addressing AMR in environmental contexts thus requires balancing ecological sustainability with the cultural and economic practices of affected communities.

Socio-cultural and Behavioral Drivers of AMR

Beyond biomedical and environmental factors, socio-cultural and behavioral practices significantly influence the misuse and overuse of antibiotics. Misconceptions, such as the belief that antibiotics can cure viral infections like the common cold or influenza, remain widespread across many communities (Papadimou et al., 2022). Cultural reliance on self-medication, herbal remedies, and even faith-based healing practices further complicates antibiotic stewardship, as individuals may combine or substitute antibiotics with traditional methods. Such practices often stem from deeply ingrained cultural beliefs and norms, making them resistant to change through conventional public health campaigns alone.

Access-related issues also interact with cultural norms to exacerbate AMR. In many low- and middle-income countries, antibiotics can be purchased without prescriptions, reinforcing self-medication habits and informal advice-sharing among peers and family members (Haenssgen & Xayavong, 2020). This dynamic is not merely an issue of regulation but also of trust in healthcare systems. Communities that perceive healthcare as expensive, inaccessible, or culturally misaligned often turn to local remedies and informal advice networks. As a result, even when biomedical knowledge about antibiotics exists, it may not necessarily translate into rational antibiotic use.

Addressing these socio-cultural drivers requires culturally sensitive interventions that recognize the role of local traditions and community dynamics in shaping health behaviors. Community engagement, health literacy campaigns, and participatory approaches that involve local leaders and traditional healers can help bridge the gap between biomedical knowledge and cultural practice. Moreover,

incorporating gender perspectives, such as recognizing the influence of household decision-making dynamics, can enhance the effectiveness of AMR interventions. Understanding AMR through a socio-cultural lens reveals that it is not simply a matter of medical compliance but a complex interplay of culture, belief, and behavior that must be accounted for in public health strategies.

One Health Perspective

The One Health framework has gained prominence as a holistic approach to addressing antimicrobial resistance (AMR). It recognizes the interconnectedness of human, animal, and environmental health, emphasizing that AMR cannot be solved through isolated interventions (WHO, 2017). This perspective integrates insights from medicine, veterinary science, environmental management, and the social sciences to foster coordinated solutions. For example, the American Veterinary Medical Association (2008) highlights that effective AMR interventions require collaborative strategies across multiple disciplines and sectors, including community participation. Acknowledging these interdependencies, the One Health approach moves away from fragmented, biomedical-centric solutions and fosters shared responsibility.

In community-level practices, One Health underscores how antibiotic use in livestock, aquaculture, and households directly influences human health outcomes. Studies show that overuse of antibiotics in animal farming affects animal health and leads to resistant strains that circulate in the environment and eventually infect humans (Velazquez-Meza et al., 2022). Likewise, waste products, agricultural runoffs, and contaminated waterways are conduits for resistance genes. The interconnected cycle of resistance highlights the inadequacy of interventions focusing solely on human healthcare without addressing agriculture and environmental practices.

Furthermore, the One Health framework provides a valuable lens for incorporating socio-cultural dimensions into AMR research and interventions. Since antibiotic use is deeply embedded in cultural practices, health-seeking behaviors, and community norms, a purely scientific response risks overlooking these human factors; for instance, community mistrust of formal healthcare systems or reliance on traditional healers can undermine antibiotic stewardship programs unless addressed in culturally appropriate ways. By linking biological, environmental, and cultural factors, the One Health perspective offers a comprehensive platform to design interventions that resonate with communities while addressing AMR's broader ecological and epidemiological dimensions.

Policy & Community Interventions

Policy responses to AMR have centered mainly on global and national action plans, including the WHO Global Action Plan (2015), which stresses surveillance, rational drug use, and investment in new antibiotics. However, these policies often face challenges at the community level, where socio-cultural practices heavily influence antibiotic use. Weak regulatory enforcement, over-the-counter availability of antibiotics, and informal distribution networks hinder the success of prescription-only policies in many low- and middle-income countries (Laxminarayan et al., 2020). Without robust local enforcement and culturally adapted strategies, policies remain ineffective in altering community-level behaviors that drive AMR.

On the other hand, community-based interventions have shown promising results in bridging the gap between policy and practice. Health education campaigns incorporating local languages, values, and traditions are more likely to change antibiotic use behaviors than standardized biomedical messages (Ancillotti, 2021). For example, interventions that engage faith healers, barangay health workers, or traditional leaders help foster trust and encourage communities to adopt stewardship practices. Participatory education campaigns that involve women, who often serve as primary decision-makers for household health, have been particularly effective in changing behaviors related to antimicrobial use.

Finally, sustainable interventions require integrating community participation with structural support. Strengthening local healthcare systems by increasing access to affordable diagnostic services, ensuring the availability of licensed healthcare providers, and improving public trust in government institutions are critical to reducing reliance on self-medication and informal advice networks (Haenssgen & Xayavong, 2020). Additionally, multi-stakeholder collaboration between government agencies, non-governmental organizations, schools, and community groups ensures that interventions are not only top-down but also grassroots-driven. Policies that align with cultural practices, supported by local health education and structural reforms, are essential in reducing AMR at the community level.

Designs and Methods

This study employed a descriptive–quantitative research design appropriate for examining the socio-cultural dimensions of antimicrobial resistance (AMR) in selected communities. By adopting this design, the study systematically collected, analyzed, and presented measurable data on the knowledge, cultural beliefs, and health-seeking behaviors of residents in Brgy. Poblacion and Brgy. Bag-ong Kahayag of Lakewood, Zamboanga del Sur. Quantitative data gathering was complemented with guided

interviews to contextualize the numerical findings, allowing for both breadth and depth of understanding of AMR-related practices in the community.

The study population consisted of 100 randomly selected respondents, all residents living near or far from the lake. Random sampling was used to reduce bias and to ensure representativeness of different socio-demographic groups, including variations in age, sex, occupation, education, and income. Data collection was facilitated using a structured questionnaire, designed to cover three domains: (1) knowledge on antimicrobial use, (2) cultural beliefs about antibiotics and alternative remedies, and (3) health-seeking behaviors. The questionnaire was pre-tested for clarity and reliability before administration, while guided interviews were conducted in the local dialect to ensure accessibility and accuracy of responses.

The study strictly complied with the Philippine Health Research Ethics Board (PHREB) standards regarding research ethics. Approval was sought from an accredited Research Ethics Committee, and all respondents provided informed consent before participating. Confidentiality and anonymity were maintained following the provisions of Republic Act 10173 (Data Privacy Act of 2012). Ethical safeguards ensured voluntary participation and the right to withdraw at any stage. Data were encoded and analyzed using descriptive statistics and inferential tools, including independent samples t-test and Multiple Correspondence Analysis (MCA), to identify significant differences and patterns of association between knowledge, beliefs, and behaviors concerning AMR across the study sites.

Results

Socio-demographic Profile of Respondents

Table 1 presents the socio-demographic characteristics of the 100 surveyed residents of Lakewood. The majority were adult respondents (36–65 years old, 59%), with an average age of 46.11 years, indicating a population within productive working age. Most were female (63%) and predominantly married (65%), with an average of two children per household. Although 29% had no children, many respondents reported having daughters, averaging one per household. The findings reflect a family-oriented community structure with women playing central roles in household health decisions.

Table 1. Socio-demographic Profile of the surveyed residents of Lakewood

Age (Yrs.)	Freq. (n=100)	**Civil Status**	Freq. (n=100)
< 21 (Teens)	3	Live-in	1
21-35 (Young Adult)	27	Married	65

36-65 (Adult)	59	Separated	3
65+ (Elderly/Senior)	11	Single	20
Average Age	46.11	Widowed	11
Sex	Freq. (n=100)	**Group Affiliation**	Freq. (n=100)
Female	63	Christian Group	69
Male	37	Subanen	27
Number of Children	Freq. (n=100)	Other Affiliation	4
No Child	29	**Birth Order**	Freq. (n=100)
1 Child	22	1st Child	26
2 Children	21	2nd Child	16
3 Children	13	3rd Child	12
> 3 Children	15	4th Child	12
Average # of children	1.7 (~2)	5th Child	12
Number of Daughters	Freq. (n=100)	6th Child	9
No Daughter	38	> 6th Child	13
1 Daughter	21	Average birth order	3.7 ($\sim 4th$)
2 Daughters	20	**Estimated Income**	Freq. (n=100)
3 Daughters	12	Below 10,000	81
> 3 Daughters	9	10,000 – 20,000	9
Average # of daughters	1.4 (~1)	> 20,000	10
Education (Highest)	Freq. (n=100)	**Number of Working HH**	Freq. (n=100)
Elem. level (grad = 14)	34	No Working Person	2
HS level (grad = 24)	32	1 Working Person	48
Vocational	10	2 Working Person	42
College Level (grad =16)	24	> 2 Working Person	8
Occupation	Freq. (n=100)	Ave. # of Working HH	1.66 (~2)
Farming	30	**Number of Dependent**	Freq. (n=100)
Government Employment	9	No Dependent Person	14
Private Employment	11	1 Dependent Person	22
Own Business	24	2 Dependent Person	23
Pension	2	3 Dependent Person	19
> 1 Occupations	13	> 3 Dependent Person	22
Other Occupation	11	Ave. # of dependent persons	2.38 (~2)

Education levels were relatively low, with the highest proportion reaching only elementary (34%) or high school (32%) levels. Only 24% had

a college education, with 16 holding a degree. This limited educational attainment may influence health literacy, particularly in understanding appropriate antimicrobial use. Farming (30%) and small business ownership (24%) emerged as the primary livelihoods, while only a minority worked in government (9%) or private employment (11%). Household income was modest, with 81% reporting less than ₱10,000 monthly, far below the regional average (PSA, 2015). This economic vulnerability likely impacts healthcare access and reliance on self-medication.

The household structure also revealed reliance on one working member (48%), with an average of two dependents per household. This imbalance highlights the

economic pressures that shape health-seeking behavior and reliance on low-cost remedies. The socio-demographic profile indicates a low-income, female-majority, farming-dependent population with limited education, factors that strongly interact with knowledge, beliefs, and practices about antimicrobial use.

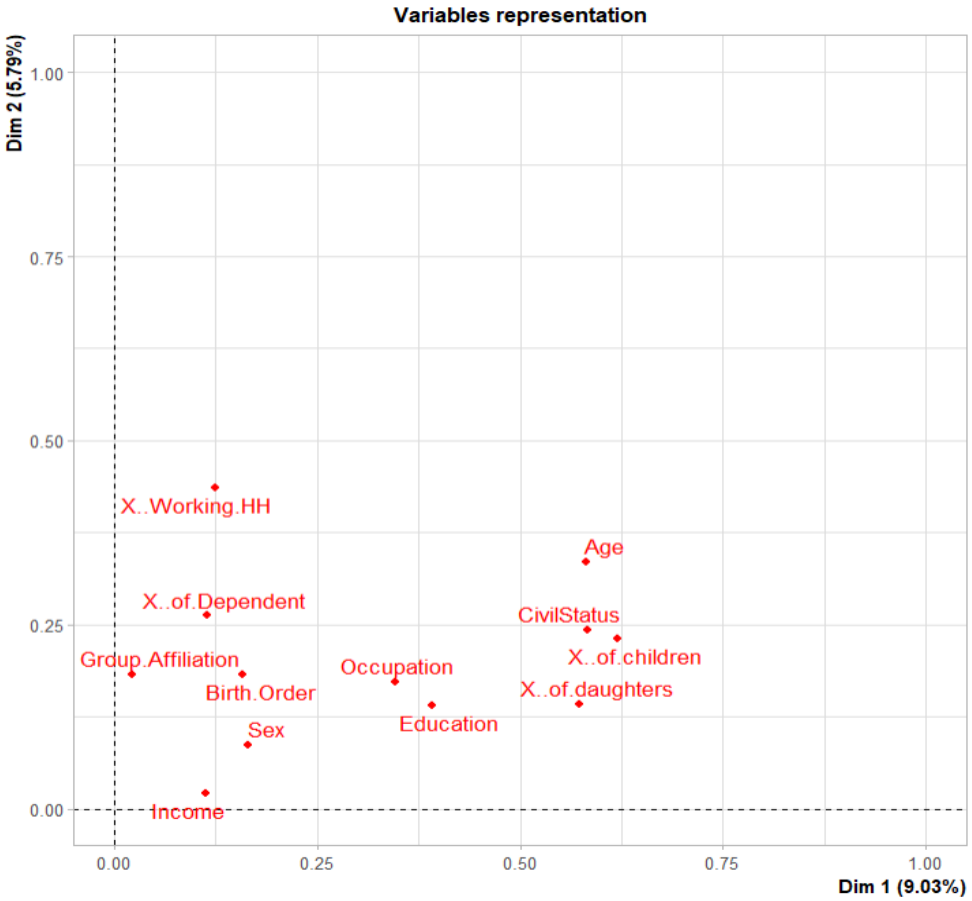

Figure 1. The Multiple Corresponding Analysis (MCA) Coordinate Plot of Different Socio-demographic Profiles of the Surveyed Residences in Lakewood

The Multiple Correspondence Analysis (MCA) in Figure 1 illustrates the associations among the socio-demographic variables of the surveyed residents of Lakewood. Dimensions 1 and 2 accounted for 14.82% of the variation in the dataset, which, although modest, still reveals meaningful patterns. The plot shows that the number of working household members and the number of dependents are closely related, suggesting that households with more dependents tend to have more working members to sustain their needs. Age, civil status, number of children, and number of daughters also formed a clear cluster, indicating that older and married respondents were more likely to have larger families, consistent with cultural expectations in the community. Another grouping emerged between education, occupation, and birth

order, highlighting how educational attainment is linked to occupation and shaped by familial roles, particularly the responsibility often borne by first-born children to pursue education and income-generating activities. Meanwhile, sex, group affiliation, and income were positioned nearer to the origin, reflecting weaker but notable associations, such as the tendency for income to be related to gender and livelihood opportunities. The MCA underscores that household composition, family structure, and socio-economic roles are strongly interconnected, shaping community dynamics and influencing health practices relevant to antimicrobial use.

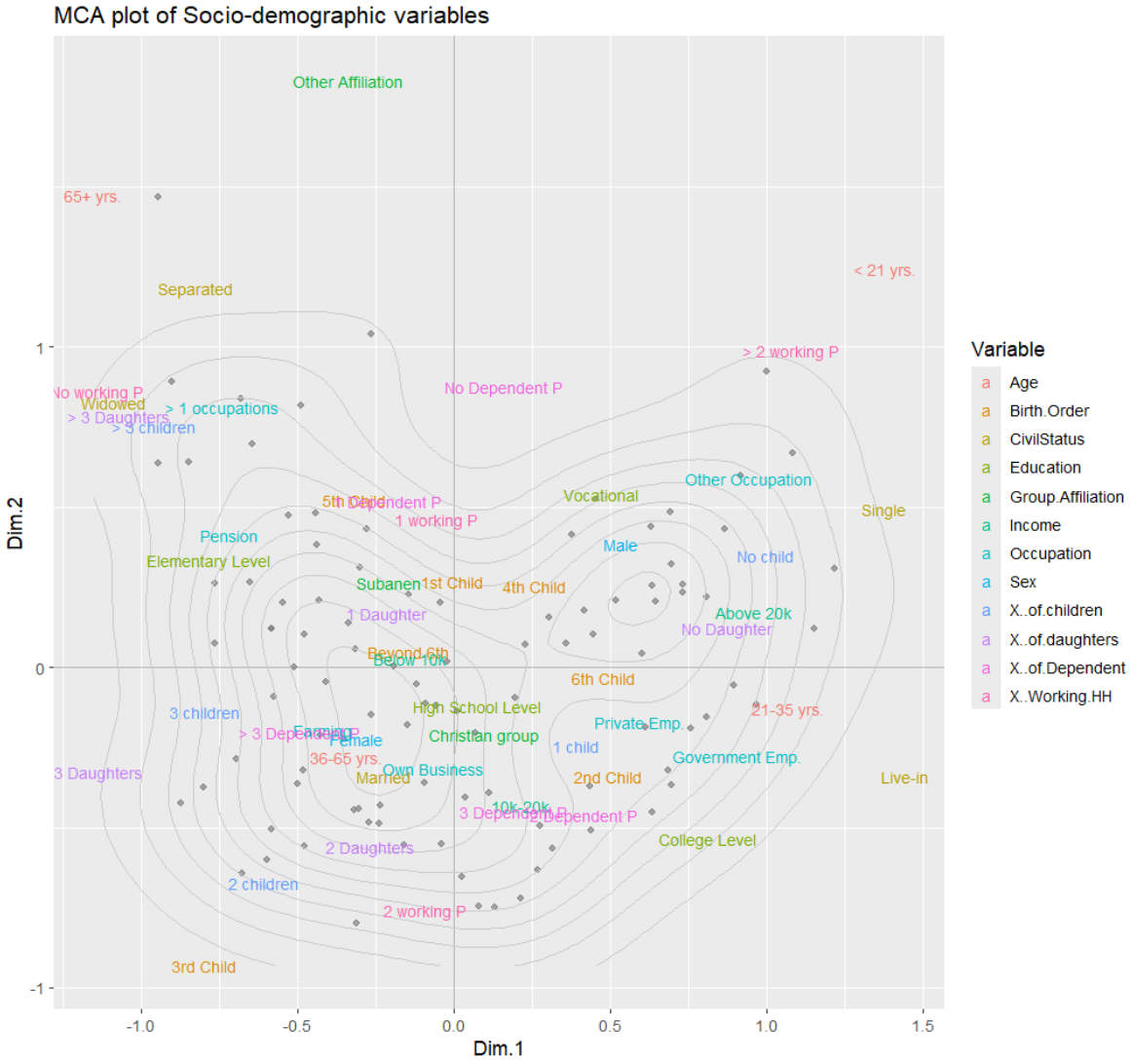

Figure 2. The MCA Coordinate Plot of the subgroup or features of the socio-demographic profile of the Surveyed Residence in Lakewood

The Multiple Correspondence Analysis (MCA) plot of socio-demographic variables in Figure 2 provides a deeper view of the relationships between

subcategories and individual observations. Distinct clusters can be observed, showing meaningful associations among household, family, and economic characteristics. On the left side of the plot, widowed respondents, those with more than three daughters or children, and households with no working members formed a cluster, suggesting that larger, dependent-heavy families with limited income sources are associated with greater socio-economic vulnerability. In contrast, those with higher income (above ₱20,000), male respondents, individuals without children or daughters, and those with multiple working members appeared on the right side of the plot, indicating a more economically stable subgroup. Educational attainment also aligned closely with occupation, as respondents with college-level education clustered with government and private employment, while those with only elementary education clustered with farming and pension-dependent households.

The plot further highlights family structure patterns. Married respondents in the 36–65 age range and individuals with two to three dependents clustered together, reflecting a typical middle-aged, family-sustaining group with moderate economic activities. Younger respondents (<21 years old) and singles were positioned farther away, reflecting their different life stages and household structures. Similarly, first-born and second-born children clustered near higher education and employment variables, which suggests the traditional expectation that earlier-born children pursue education or stable jobs to support the family. Conversely, respondents of higher birth order (fifth and sixth child) clustered near categories with limited dependents or lower occupational roles, indicating fewer expectations to assume breadwinner responsibilities.

Overall, the MCA plot reveals how socio-demographic subgroups in Lakewood are differentiated by household composition, age, education, and occupation, with clear divides between vulnerable households (widowed, many dependents, low education, farming-based livelihood) and more stable groups (male, higher income, college-educated, formally employed). These associations emphasize that cultural norms, family roles, and economic opportunities influence the community's health-seeking behaviors and antimicrobial practices.

Water–Fish–Human Nexus

Table 2 shows the interconnection of water sources, sanitation, and fish consumption among respondents. The faucet at home was the dominant source for drinking (30%), bathing (45%), washing clothes (45%), and washing dishes (47%), while water wells and natural springs also played significant roles in daily use. Notably, 18% relied on multiple water sources, which may reflect resilience and

vulnerability to contamination. This dependence on varied water sources underscores the potential role of water pathways in spreading antimicrobial resistance (AMR).

Table 2. Assessment of the Water-Fish-Human Nexus among the surveyed residents of Lakewood

B1. Family's main source of water for drinking	Freq. (n=100)
Faucet at home	30
Manual water pump (Poso)	6
Mineral water from the store	18
Water well	17
Natural spring in the locality	12
More than one water source	17

B2. Family's main source of water for bathing	Freq. (n=100)
Faucet at home	45
Manual water pump (Poso)	4
Water well	19
Natural spring in the locality	14
More than one water source	18

B3. Family's main source of water for washing clothes	Freq. (n=100)
Faucet at home	45
Manual water pump (Poso	5
Water well	22
Natural spring in the locality	17
More than one water source	11

B4. Family's main source of water for washing dishes	Freq. (n=100)
Faucet at home	47
Manual water pump (Poso	6
Water well	19
Natural spring in the locality	15
More than one water source	13

B5.1 Fish consumption at home/day	Freq. (n=100)
No fish/day	33
1 fish/day	41
2 fish/day	16
3 fish/day	10

B5.2 Fish consumption at home/week	Freq. (n=100)
1 fish/week	7
2 fish/week	15
3 fish/week	26
4 fish/week	16
5 fish/week	9
6 fish/week	2
7 fish/week	25

B6. Source of fish for meals	Freq. (n=100)
Bought from the local market	66
Barter from fisherfolk	8
Personal Catch from the river	2
More than one fish source	24

Fish consumption patterns were also revealing. The majority consumed one fish per day (41%) or three fish per week (26%), while 25% reported consuming seven fish per week. Most fish were sourced from local markets (66%), with a few reporting direct catch or barter from fisherfolk. This dependence on local fish highlights the community's vulnerability to AMR exposure from aquaculture practices where antibiotics may be misused.

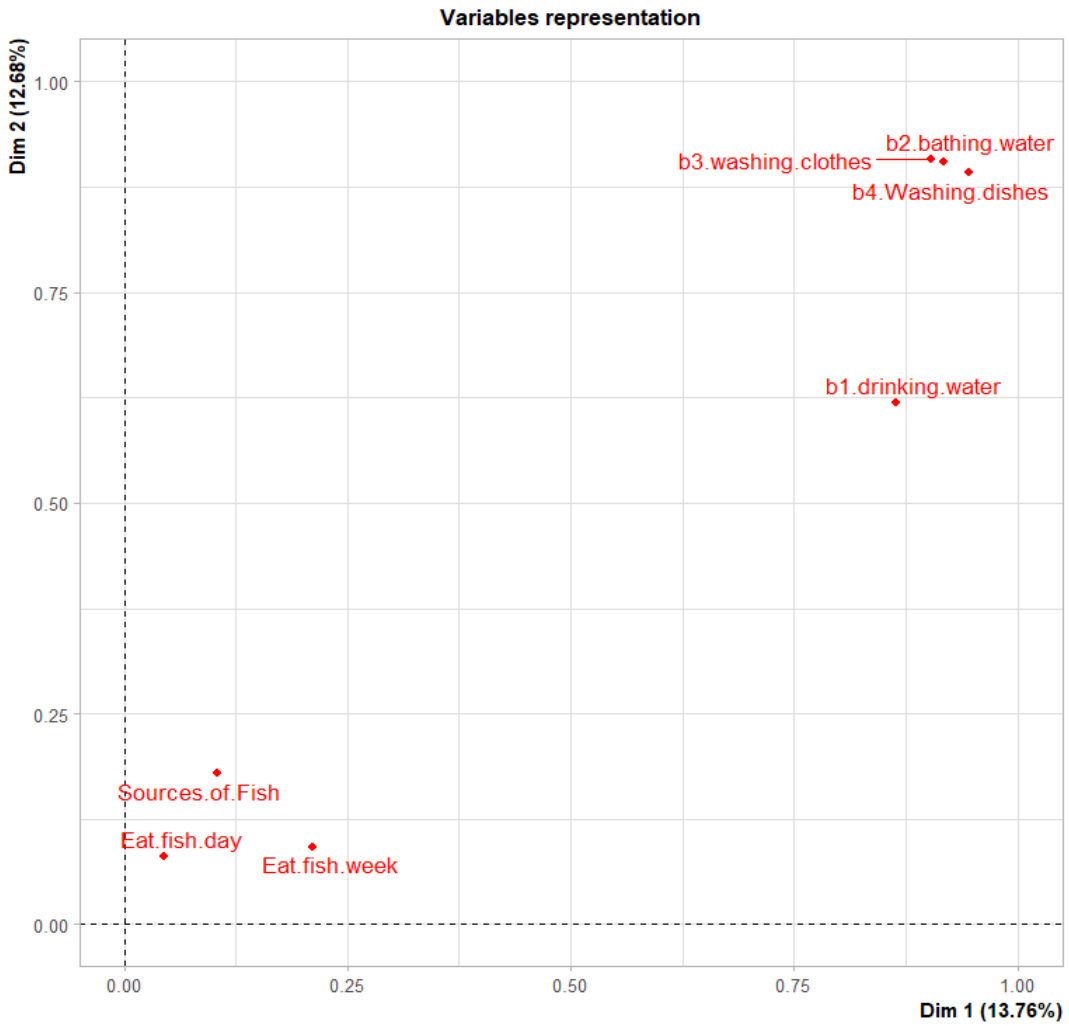

Figure 3. The Multiple Corresponding Analysis (MCA) Coordinate Plot of Different Water-Fish-Human Nexus Variables of the Surveyed Residence in Lakewood

The Multiple Correspondence Analysis (MCA) plot in Figure 3 illustrates the relationships among variables related to water use and fish consumption among the residents of Lakewood. Dimension 1 explains 13.76% of the variation, while Dimension 2 accounts for 12.66%, combining to capture 26.42% of the overall associations in the dataset. The variables naturally form two clusters. The first cluster, located in the upper right quadrant, groups bathing water (b2), washing clothes (b3), and washing dishes (b4), with drinking water (b1) positioned nearby but slightly apart. It indicates that the sources of water for household chores are strongly associated, while drinking water, though related, is more distinct, suggesting that families may prioritize safer or different sources for drinking compared to everyday domestic use.

The second cluster, located near the origin, comprises fish sources, fish consumption per day, and fish consumption per week. The close association of these variables reflects that the frequency of fish consumption is directly tied to where the

fish is obtained, whether from markets, barter, or personal catch. It suggests that access to fish sources strongly influences the volume and frequency of fish in household diets. The concentration of these variables around the origin also indicates relatively uniform practices across respondents, suggesting fish consumption is a common dietary habit in the community.

Overall, the MCA results reveal a clear separation between water-use and fish-consumption variables, highlighting two distinct but interrelated domains in the water–fish–human nexus. The distinction between drinking water and other water uses underscores the community's tendency to treat potable water differently from domestic-use water. At the same time, the strong clustering of fish-related variables reflects the cultural and economic importance of fish as a staple food. These associations are crucial for understanding pathways through which antimicrobial resistance (AMR) may spread, as both water sources and fish supply chains serve as potential transmission routes.

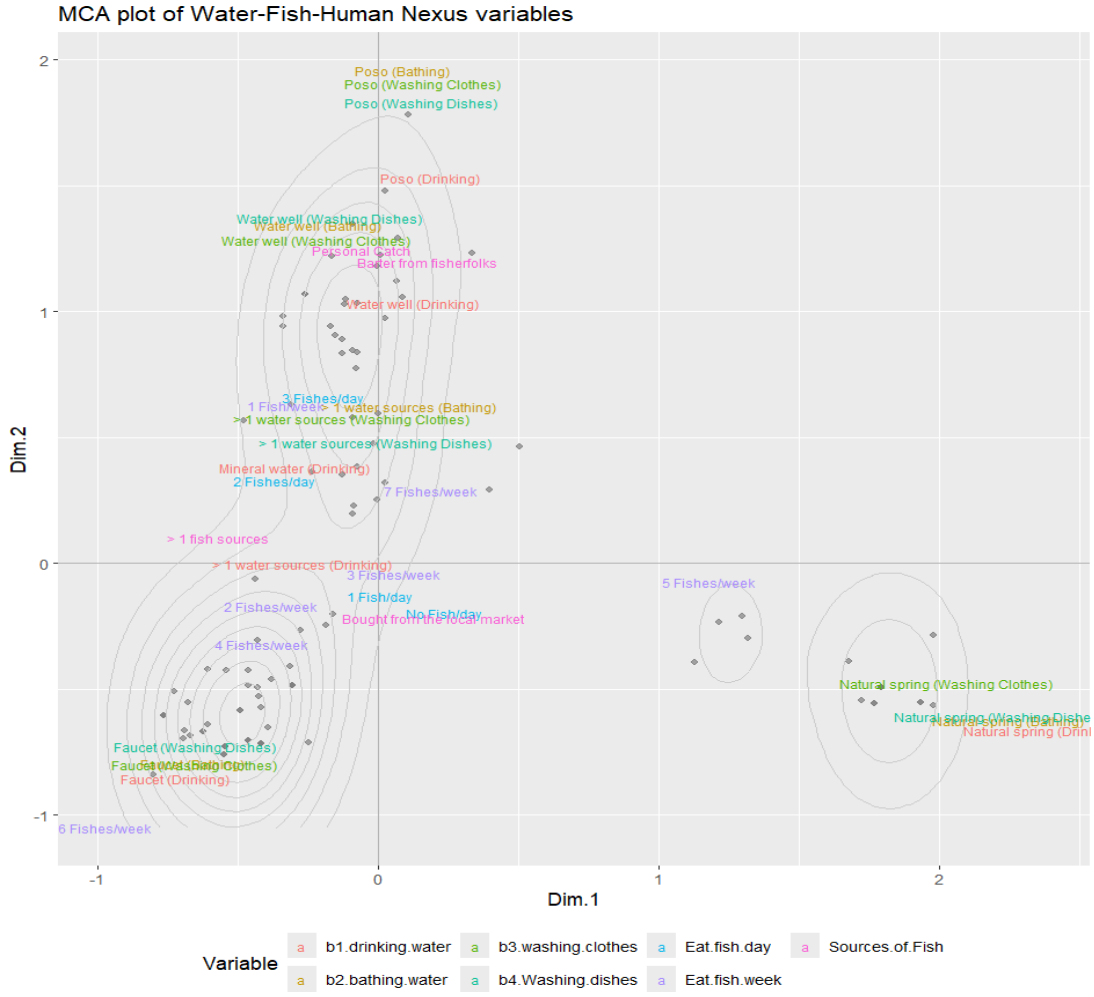

Figure 4. The MCA Coordinate Plot of the features of Water-Fish-Human Nexus Variables of the Surveyed Residence in Lakewood

The MCA plot in Figure 4 shows three main clusters linking water sources with fish consumption patterns. Households using faucet water for drinking and domestic purposes are associated with moderate fish intake (three to four fish per week), reflecting more modernized practices. Those relying on poso and water wells cluster with local fish sources such as personal catch or barter, indicating subsistence-based practices. Meanwhile, households using natural spring water are linked to higher fish consumption (five to seven fishes per week) and multiple fish sources, suggesting stronger integration into the local water–fish–human cycle. These associations emphasize how access to water resources shapes dietary practices and potential AMR exposure pathways in the community.

Knowledge of Antimicrobial Use

Table 3 highlights respondents' knowledge about antimicrobials. Overall knowledge was high (mean = 0.66), particularly regarding bacterial infections (e.g., pneumonia = 0.83; UTI = 0.87). Respondents were also aware that prescriptions are required for antibiotics (0.68) and doctors may change prescriptions for effectiveness (0.79). However, significant gaps were observed. Misconceptions persisted regarding antibiotics for viral infections such as COVID-19 (0.51) and the premature discontinuation of antibiotics once symptoms subside (0.42). Alarmingly, 49% agreed it was acceptable to stop antibiotics after three days, and 7% believed expired antibiotics could still be taken, practices that accelerate resistance. These findings confirm that while general awareness of antibiotic function exists, practical misconceptions undermine rational use. Knowledge alone is insufficient to ensure stewardship, as cultural norms and beliefs strongly influence behavior (Papadimou et al., 2022).

Table 3. Assessment of the Knowledge on Antimicrobial Use among the surveyed residents of Lakewood

No.	Knowledge on Antimicrobials' Use.	**Freq. (n=100)**		**Mean**	**VI**
		Yes	**No**		
1	Antibiotics are needed for bacterial infections, such as pneumonia.	83	17	0.83	High
2	The doctor will likely prescribe an antibiotic to a patient with a urinary tract infection (UTI).	87	13	0.87	High
3	We can buy antibiotics from a pharmacy even without a prescription.	38	62	0.62	High
4	Antibiotics must be taken entirely for 5 to 7 days as the doctor prescribes.	63	37	0.63	High

5	We can use a relative's prescription to buy antibiotics in a pharmacy for a similar illness.	17	83	0.83	High
6	When the prescribed 7 days of taking antibiotics are done and the symptoms are still present, it is okay to continue taking them for the next 7 days.	16	84	0.84	High
7	The pharmacy does not sell antibiotics to people who come without a prescription.	68	32	0.68	High
8	When the symptoms disappear after two days of taking antibiotics, there is no need to finish the remaining days.	58	42	0.42	Low
9	Antibiotics are needed for viral infections such as COVID-19 that may manifest as fever and loss of appetite.	49	51	0.51	High
10	Sometimes, a doctor may change the previously prescribed antibiotic to another one for effectiveness.	79	21	0.79	High
11	There are certified antibiotics for severe, life-threatening bacterial infections, such as sepsis, that doctors prescribe to hospitalized patients.	74	26	0.74	High
12	The doctor's prescription of antibiotics for UTI can be kept and reused to buy antibiotics whenever there is another episode of UTI-like symptoms.	35	65	0.65	High
13	Even when the symptoms disappear after three days of antibiotics, one must continue and complete the whole 7 days.	51	49	0.49	Low
14	Antibiotics are also prescribed by dermatologists to treat acne and other skin infections.	8	92	0.08	Low
15	Taking expired antibiotics for less than a month is alright if there is no discoloration.	7	93	0.93	High
Total		-	-	0.66	High

Cultural Beliefs on Antimicrobial Use

As shown in Table 4, cultural beliefs were overall low (mean = 0.32), yet some problematic views persisted. A high proportion (77%) preferred herbal medicines over antibiotics, while 44% believed antibiotics were primarily a profit-driven product. Gendered beliefs were also present, with 38% agreeing that wives require husbands' consent to take antibiotics. At the same time, positive cultural beliefs were also noted. Most recognized the importance of following doctors' prescriptions (93%) and consulting physicians when unwell (83%). These beliefs indicate that while some traditional perspectives persist, biomedical trust is evident among many respondents. The coexistence of traditional and biomedical beliefs highlights a dual health system, where faith healers, herbal remedies, and doctors coexist as sources of care. This duality can delay or complicate timely antimicrobial use and stewardship, particularly in rural and resource-limited settings.

Table 4. Assessment of Cultural Beliefs on Antimicrobial Use among the surveyed residents of Lakewood

No.	Cultural Beliefs on Antimicrobial Use	Freq. (n=100)		Mean	VI
		Yes	No		
1	I think that businesspeople make antibiotics to profit rather than to cure.	44	56	0.44	Low
2	I do not believe in taking antibiotics for 7 days when I can get better already after two days.	53	47	0.53	High
3	I can use a friend's prescription for a similar condition.	12	88	0.12	Low
4	I would rather drink herbal medicines than take antibiotics.	77	23	0.77	High
5	Faith healer is better than any antibiotics out there.	27	73	0.27	Low
6	Following the doctor's prescription of antibiotics will facilitate the treatment.	93	7	0.07	Low
7	Seeing a doctor immediately when something is wrong within the body is the best way to get well fast.	83	17	0.17	Low
8	Only the mother and not the father may give antibiotics medication to their child.	20	80	0.20	Low
9	A wife cannot take antibiotics if the husband does not agree to it.	38	62	0.38	Low
10	A mother buys antibiotics for her child if her husband will not give permission.	21	79	0.21	Low
Total		-	-	0.32	Low

Health-seeking Behavior

Table 5 shows respondents displayed mixed health-seeking behaviors (mean = 0.53). Positive practices included resting at home when sick (88%), consulting doctors immediately when symptoms arise (80%), and eventually visiting hospitals if conditions persisted (79%). These proactive behaviors are promising for AMR stewardship. Conversely, delaying treatment was also common. Seventy percent admitted continuing daily activities despite illness, while 71% reported using over-the-counter (OTC) medicines without consultation. Many relied on herbal remedies for cough and abdominal pain, with some consulting traditional healers before seeking biomedical care. The coexistence of modern and traditional health-seeking practices reflects cultural resilience and potential risk for AMR proliferation. While reliance on OTC medicines and herbal remedies reduces immediate healthcare costs, it may encourage misuse and delay appropriate treatment.

Table 5. Assessment of Health-seeking Behavior among the surveyed residents of Lakewood

No.	Health-seeking Behavior	Freq. (n=100)		Mean	VI
		Yes	No		
1	I am taking 1 2 3 4 5 maintenance medicines prescribed by my doctor. (1 maintenance - 23; 2 maintenance - 5; 3 maintenance - 1)	29	71	0.29	Low

2	I am health-conscious, so I take about 1 2 3 4 5 health supplements daily. (1 supplement - 26; 2 supplements - 3; 3 supplements - 1)	30	70	0.30	Low
3	Even if I feel sick, I continue the day's activities if I can still walk.	70	30	0.30	Low
4	If resting at home for one day does not halt my illness, on the third day I will go and consult a doctor.	76	24	0.24	Low
5	Whenever I feel sick, I immediately call in or file for sick leave and rest at home.	88	12	0.88	High
6	When I feel something unusual in my body, I will look for answers online.	24	76	0.76	High
7	I will only go to the hospital if I already feel like I could die any time.	38	62	0.62	High
8	When I do not feel well, I will visit and consult a doctor just to be sure.	80	20	0.80	High
9	Depending on the symptoms, I will get the over-the-counter (OTC) medicines we have ready at home and take those until I get better.	71	29	0.29	Low
10	With the COVID-19 scare, I buy stocks of over-the-counter (OTC) medicines at home, just in case.	33	67	0.67	High
11	When I have a stomachache, I first summon a manghihilot to perform an abdominal massage on me.	28	72	0.72	High
12	When I feel something unusual in my body, I will look for answers online.	81	19	0.19	Low
13	When I have cough, I would boil ____leaves and drink this for days. Gabon = 30, Lagundi = 22, Kalabo = 8, bayabas =2, dibulag =1	62	38	0.38	Low
14	If drinking boiled _____leaves for days does not cure my coughing, I will drink over-the-counter cough medicines. Solmux = 17, Lagundi tablet =16, Tuseran=9, Ambroxol =3, Carbosistine =3	55	45	0.45	Low
15	If, after taking OTC drugs or over-the-counter cough medicines, my cough does not improve, I decide to go and consult a doctor.	79	21	0.79	High
Total		-	-	0.53	High

Comparison of Communities Near and Far from the Lake

Table 6 compares the knowledge, cultural beliefs, and health-seeking behaviors of residents from Barangay Poblacion (near the lake) and Barangay Bag-ong Kahayag (farther from the lake). Results revealed no significant difference in knowledge ($p = 0.8729$) and health-seeking behavior ($p = 0.2892$) across the two groups, suggesting that location does not directly affect awareness or practices regarding antimicrobials. However, a significant difference in cultural beliefs ($p = 0.0003$) was found. Residents living farther from the lake exhibited stronger cultural beliefs influencing antimicrobial use, including reliance on traditional remedies and gender-influenced decision-making. In contrast, residents closer to the lake demonstrated relatively lower adherence to such beliefs. These findings suggest that cultural distance, rather than physical distance from natural resources, shapes AMR-related behaviors. Interventions must account for cultural variation, tailoring education and engagement strategies to community contexts.

Table 6. Comparison of the level of Knowledge, Cultural beliefs about antimicrobial use, and the health-seeking behavior between Lakewood residents who live near and those far from the lake.

Variables	Location/Area	N	Mean	SD	t	P-value
Knowledge of antimicrobial use	Poblacion	50	0.66	0.11	0.16	0.8729
	Bag-ong Kahayag	50	0.66	0.11		
	Total	100	0.66	0.11		
Cultural beliefs about the use of antimicrobials	Poblacion	50	0.26	0.13	-3.77	0.0003*
	Bag-ong Kahayag	50	0.37	0.02		
	Total	100	0.32	0.15		
Health-seeking Behaviour	Poblacion	50	0.51	0.12	-1.07	0.2892
	Bag-ong Kahayag	50	0.53	0.14		
	Total	100	0.52	0.13		

MCA Analysis of Knowledge, Beliefs, and Behavior

Figures 5 and 6 (MCA plots) illustrate the interrelationships between knowledge, cultural beliefs, and health-seeking behaviors. Results showed that high knowledge and health-seeking behavior clustered with low cultural beliefs, implying that informed individuals were more proactive and less influenced by traditional misconceptions. Conversely, low knowledge and high cultural belief stood distinct, reflecting greater vulnerability to inappropriate antibiotic use.

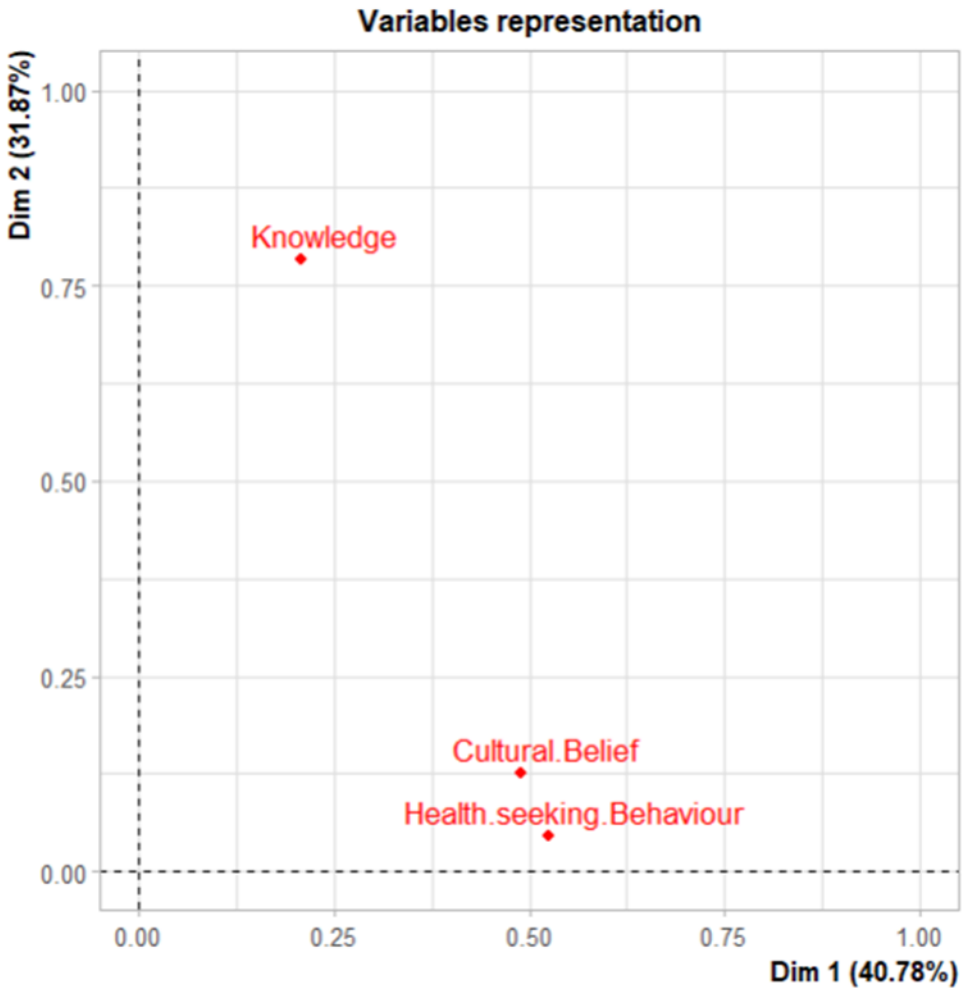

Figure 5. The MCA Coordinate Plot of Knowledge, Cultural Beliefs in Antimicrobials' Use and Health-seeking Behavior Variables of the Surveyed Residence in Lakewood.

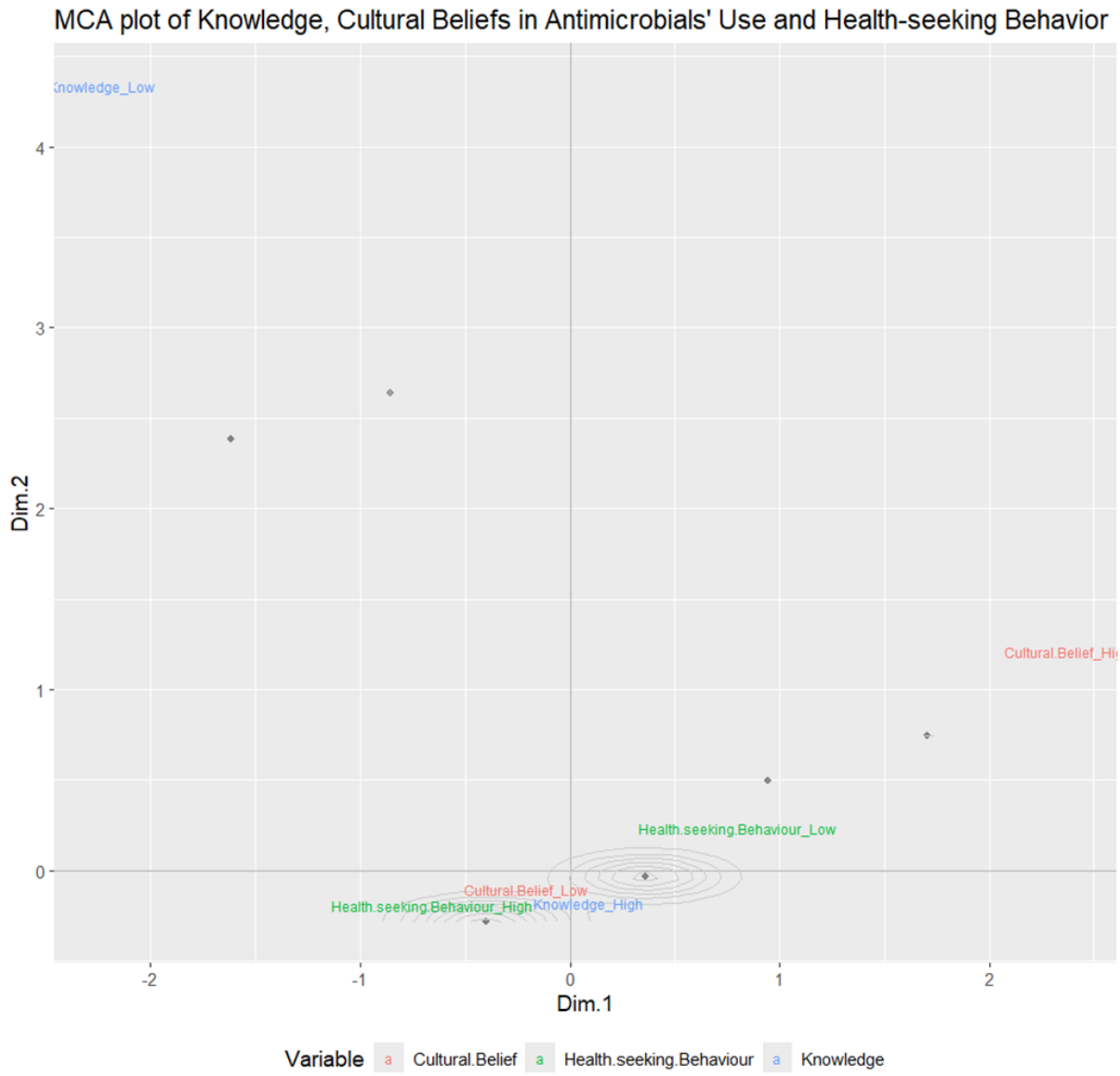

Figure 6. The MCA Coordinate Plot of the features of Knowledge level and Cultural Beliefs level in Antimicrobial's use and Health-seeking Behavior Level of the Surveyed Residence in Lakewood

The MCA explained 72.65% of the total variation, indicating strong explanatory power. These findings validate that knowledge alone does not predict behavior, but when combined with cultural beliefs, it significantly shapes AMR-related practices.

Discussions

This study highlights the interplay of socio-demographic characteristics, resource access, and cultural factors in shaping antimicrobial-related practices in Lakewood. The respondents were largely middle-aged, female, low-income, engaged in farming or small business, and had modest education levels. These characteristics

mirror rural Philippine communities where economic vulnerability and limited health literacy restrict access to formal healthcare. The Multiple Correspondence Analysis (MCA) further demonstrated that household composition, particularly the number of dependents and working members, strongly influenced family stability. Larger, low-income households with limited formal education were clustered with greater vulnerability, reinforcing findings that social structures and economic pressures play critical roles in health decision-making (PSA, 2015; Papadimou et al., 2022).

The water–fish–human nexus revealed important pathways through which antimicrobial resistance (AMR) may spread. Households relied on varied water sources, such as faucets, wells, springs, and pumps, often using multiple sources simultaneously. This pattern highlights adaptability and exposure risk, especially when water systems are vulnerable to contamination. Similarly, fish consumption was high, with most families consuming fish daily or weekly, sourced mainly from local markets. The MCA indicated clear distinctions between households with modernized access (faucet users), subsistence practices (poso and well users), and spring-reliant groups with high fish intake. These patterns suggest that dietary habits and reliance on potentially antibiotic-exposed aquaculture represent a significant but underexamined dimension of AMR exposure in rural settings (Chowdhury et al., 2022).

Beyond resources, knowledge, cultural beliefs, and health-seeking behaviors were revealed as interdependent factors shaping antimicrobial practices. While respondents demonstrated high awareness of antibiotics for bacterial infections, misconceptions persisted around viral infections, premature discontinuation, and expired medicines. Though overall low, cultural beliefs included firm reliance on herbal remedies and gendered decision-making, reflecting the coexistence of traditional and biomedical systems. Health-seeking behaviors similarly blended modern and traditional practices, with respondents consulting doctors and resorting to home remedies or faith healers. MCA analysis confirmed that higher knowledge and proactive health-seeking clustered with lower cultural beliefs, while low knowledge aligned with stronger traditional practices. These findings affirm that AMR stewardship cannot rely on knowledge dissemination alone but must engage with cultural norms, resource realities, and social structures. Tailored interventions, such as culturally sensitive education, stricter policy enforcement on antibiotic access, and cross-sector One Health strategies, are needed to address AMR effectively in rural Philippine contexts (Velázquez-Meza et al., 2022; WHO, 2019).

Conclusion

Through the One Health framework, this study examined the socio-cultural dimensions of antimicrobial resistance (AMR) in Lakewood, Zamboanga del Suk. Findings revealed that while respondents demonstrated generally high knowledge of antimicrobials, misconceptions around viral infections, premature discontinuation of treatment, and expired medicines persist. Cultural beliefs, though overall low, continue to shape health decisions, particularly reliance on herbal remedies, faith healing, and gender-influenced authority in seeking medical care. Health-seeking behavior reflected a blend of modern and traditional practices, with respondents consulting physicians and resorting to alternative remedies. These dynamics underscore that knowledge alone is insufficient for rational antibiotic use; cultural norms and socio-economic conditions remain powerful determinants.

The results highlight the importance of addressing AMR as a biomedical concern and a socio-cultural challenge requiring community-based and culturally sensitive approaches. Policies must go beyond awareness campaigns to integrate stricter antibiotic regulation, promote equitable access to healthcare, and engage local practices within the framework of One Health. By situating AMR within the lived realities of rural households, where family structure, economic pressures, and traditional health systems converge, this study contributes to designing more inclusive and effective interventions. Ultimately, tackling AMR in communities like Lakewood requires harmonizing scientific knowledge with cultural understanding, ensuring that stewardship strategies resonate with the values, needs, and practices of the people they aim to serve.

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