BMC Public Health

RESEARCH

Open Access

Using the *Q-method* to explore pregnant and breastfeeding women's perceptions of antibiotic use in Mahajanga, Northwest Madagascar

Sitraka Rakotosamimanana[1], Aina Harimanana[1], Timothée Razafindrabesa[1], Voahirana Ravololomihanta[2], Laurent Kapesa[3], Chiarella Mattern[1] and Daouda Kassié[1,4*]

Abstract

Background The Q-method is a research approach that combines quantitative and qualitative techniques to study people's subjectivity on a given theme. In Madagascar, antibiotic usage practices remain largely unstudied, particularly among pregnant and breastfeeding women. This study aims to use the Q-method to document the opinions of pregnant and breastfeeding women on antibiotic use practices in the Northwest region of Madagascar.

Methods The Q-method was applied to 115 pregnant and breastfeeding women from two districts, one urban and one rural, in Northwest Madagascar. The participants ranked 36 statements about antibiotic use on a 7-point scale ranging from −3 (strong disagreement) to +3 (strong agreement). Principal component analysis (PCA) was used to analyze the rankings and identify groups of women with differing or similar viewpoints. The Wilcoxon and Kruskal-Wallis rank sum tests were employed to assess significant differences among participants in each group and to evaluate the differences between these groups. Additionally, semistructured interviews were conducted to explore the participants' reasoning behind their rankings and to complement the quantitative findings.

Results Among the 115 women, 51% (59/115) resided in urban areas, while 49% (56/115) lived in rural regions. PCA identified two main groups of women with distinct viewpoints on antibiotic use. Group 1 comprised 55.6% (64/115) of the women and consisted of women who only complied with medical indications and instructions by being vigilant. Group 2 represented 35.6% (41/115) of the respondents and included women who believed in antibiotic usage based on receiving information first from multiple sources (medical staff or personal experience or other nonmedical relatives). 10 women (8.8%) could not be classified under either of the two groups. Differences in opinions were observed in Group 1 based on age ($p = 0.004$), marital status ($p = 0.013$), educational level ($p = 0.007$), gravidity ($p = 0.062$), and area of residence ($p = 0.125$), and in Group 2 based on educational level ($p = 0.065$) and gravidity ($p = 0.127$). Insights from the semistructured interviews enriched the interpretation of these groups' classification.

*Correspondence:
Daouda Kassié
daoudak@pasteur.mg

Full list of author information is available at the end of the article

Conclusions Pregnant and breastfeeding women surveyed in Northwest Madagascar believe that the best approach to antibiotic use is to follow the recommendations of health care professionals. However, some rely on advice from others, whether medical or nonmedical. To improve adherence to antibiotic treatments based solely on medical prescriptions and ensure their proper use in Madagascar, the communication between health care providers and patients must be strengthened.

Keywords Q-method, Pregnant and breastfeeding women, Antibiotics, Perceptions, Madagascar

Background

Antibiotic/Antimicrobial resistance (AMR) is a major global public health concern [1, 2] driven largely by the inappropriate and excessive use of antibiotics. In 2014, the World Health Organization (WHO) estimated that AMR caused nearly 700,000 deaths annually, a figure projected to increase to nearly 10 million deaths worldwide by 2025 if urgent measures are not taken [1]. Pregnant and breastfeeding women in low-income countries are particularly vulnerable to AMR, as antibiotics are among the most frequently prescribed drugs for these populations [3, 4].

In Madagascar, limited research has been conducted on antibiotic use in the general population, especially among pregnant and breastfeeding women. However, cohort monitoring in both urban and rural areas from 2012 to 2018 estimated that the incidence rate of severe neonatal bacterial infections was 196.3 per 1,000 live births, primarily occurring within the first three days of life [5]. Additional studies have reported an alarming increase in resistant enterobacteria-secreting extended-spectrum beta-lactamases (ESBLs), with the prevalence increasing from 10% in children under 15 years of age in 2009 to 18.5% in pregnant women from 2013 to 2014 and reaching 34% among pregnant women from 2018 to 2019 [5, 6].

Q-methodology combines qualitative and quantitative approaches to systematically study individuals' viewpoints [7]. Widely applied in biomedical and public health research, it helps researchers understand behaviors and opinions on specific themes [8, 9]. In addition to health, the Q-method has been used in diverse fields, such as psychology, the social sciences, and environmental studies [10, 11]. It provides a structured framework to capture subjective opinions, identify consensus or divergence between individuals, and generate insights critical for decision-making and intervention design [7, 12, 13]. Although Q-methodology typically involves smaller sample sizes than traditional quantitative methods have, it allows for robust and statistically meaningful analyses [14]. This method is particularly relevant for understanding perceptions and behaviors surrounding antibiotic use during pregnancy and breastfeeding, which are influenced not only by biomedical guidelines, but also by individual experiences, cultural norms, and trust in healthcare providers. By identifying shared perspectives among women, the Q-method offers a detailed and structured understanding of the diversity of viewpoints within the study participants. Such insights are essential for designing culturally appropriate public health messages and promoting the rational use of antibiotics in these vulnerable populations of Madagascar.

The objectives of this study aimed to (i) document the thoughts and perceptions of pregnant and breastfeeding women regarding antibiotic use using Q-methodology; (ii) identify distinct groups of women who share similar viewpoints on this topic; and (iii) characterize the unique attributes of these opinion-sharing groups to inform public health strategies.

Methods

Study sites

The northwestern region of Madagascar has distinct sociodemographic characteristics. According to the latest national census report (2018), the former province of Mahajanga experienced a high rate of increase in the female population between 1975 and 2018 (3.44%) compared with the national average of 3.04%. Additionally, the Boeny region, which is also located in this area, has an urbanization rate of 35.8%, which is significantly higher than the national average of 19.3% [15].

This study was conducted in the Northwest region, specifically, in two districts: Mahajanga I (urban), the capital city of the Boeny region, and Mahajanga II (rural), the suburban district surrounding the capital. The study was conducted in both rural and urban areas based on the hypothesis that women's perceptions of antibiotic use differ by place of residence. However, this factor was not assumed to be the sole determinant of these differences. Data collection took place in Mahajanga between June and September 2022 and was divided into two phases. The first phase occurred in June and July 2022 in the urban district of Mahajanga I, where interviews were conducted. The second phase involved a follow-up visit to the rural communities of Mahajanga II in August and September 2022. For each district, a Fokontany (the smallest administrative unit in Madagascar) was randomly selected as the study site [Figure 1].

Population studied

The study employed convenience sampling, selecting participants based on their availability and accessibility

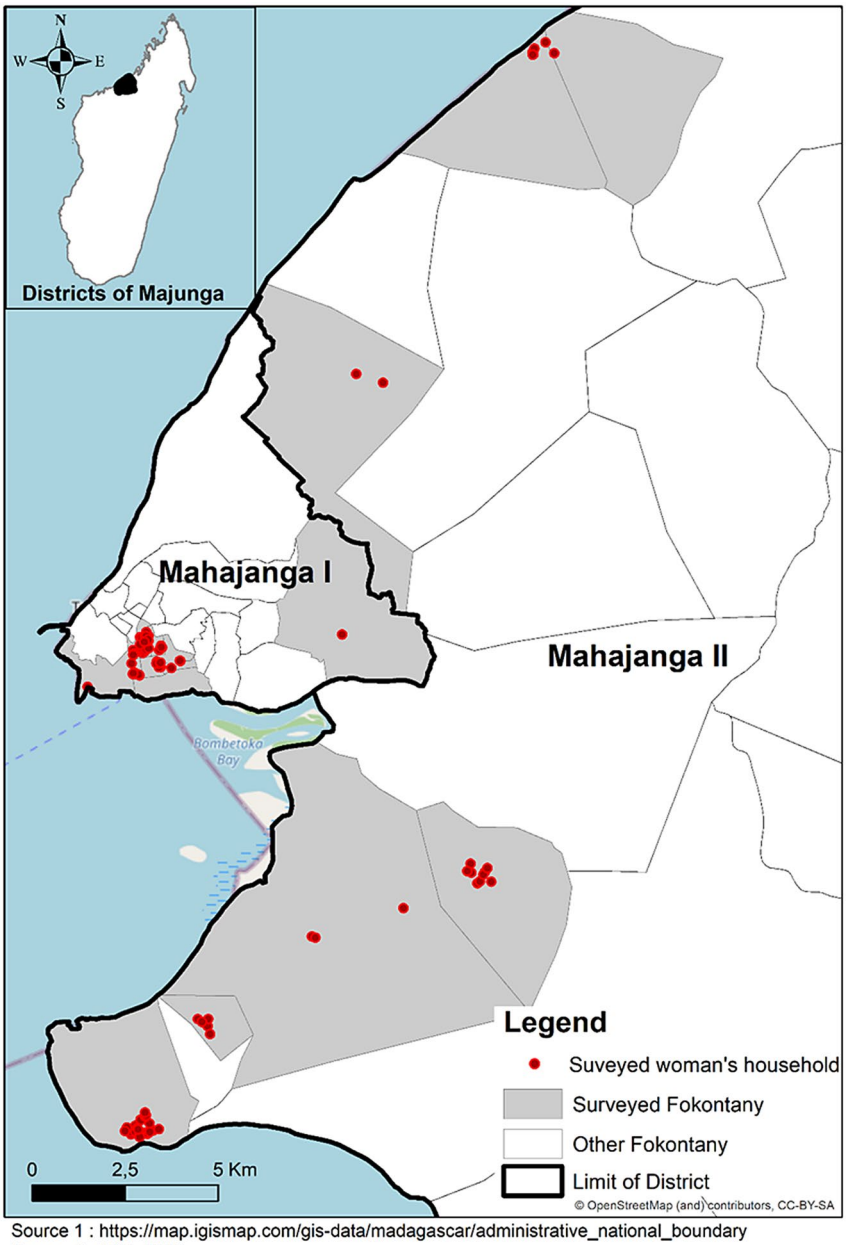

Fig. 1 Study area and the women investigated households location

within the study area, without aiming for strict population representativeness. While the standard reproductive age range is typically defined as 15–49 years, our inclusion criteria were adjusted to reflect the local context of Mahajanga, allowing participants from age 14. To minimize memory bias during the interviews, an additional criterion was applied: participants must have used at least one antibiotic within the three months prior to the interview.

Study design

This prospective study employed a mixed-method approach using Q-methodology to explore the opinions of pregnant and breastfeeding women in the urban and rural areas of Northwest Madagascar regarding antibiotic use. In our study, before starting the surveys, a sorting exercise was conducted with 8 women (3 pregnant and 5 breastfeeding) to ensure that the statements were clearly understood as formulated. These women were not included in the final study.

Data collection and processing using *Q-Methodology*

The Q-method applied in this study followed the five main steps outlined by Exel and Graaf [16].

1. Developing the statement list (*Concourse*). This step involved creating a collection of concepts and knowledge about antibiotics based on the study investigators' literature review. Two researchers from the research team independently selected statements for the list and ensured the inclusion of diverse aspects related to antibiotic accessibility, use, perception, and associated uncertainties. They then compared their selections and discussed any discrepancies until a consensus was achieved. This step aimed to capture a comprehensive set of ideas in circulation regarding antibiotic use to ensure relevance to the study's goals.

2. Statement selection (*Q-sample*). A set of 36 statements, representing a wide spectrum of opinions, beliefs, and perspectives about antibiotic use, was carefully constructed from the *Concourse*. These statements were derived from the theoretical and conceptual framework outlined in the literature. Duplicate or overlapping ideas were excluded to create a concise, meaningful sample. The selected statements focused on seven major topics related to the study objectives. These topics are "perception of medication consumption", "communication between the medication prescriber and the patient", "perception of medication prescriptions", "perception of community consumption", "community communication", "perception of alternatives", and "perception of antibiotics" (Supplementary Table S1). To ensure accessibility, the statements were translated by three native-speaking surveyors, who were also fluent in French, to ensure accuracy. Each statement was presented as a card randomly numbered from 1 to 36. Preparatory steps, such as finalizing the statement selection and constructing the *Concourse*, were completed before data collection.

3. Participant selection (*P-Set* or *Population Set or Q-participants*). Q-methodology studies typically have samples of approximately 40–60 participants [11, 17]. In this way, more analyses can be performed. The study included 115 pregnant and breastfeeding women who met the selection criteria. Eligibility required the participants to have consumed at least one antibiotic within three months prior to the survey and to have provided informed consent. A preliminary survey of women and pharmacies conducted in May 2022 at the study site identified a list of 20 commonly used antibiotics, complete with names and photos of these antibiotics. Opportunistic sampling was used because community workers assisted the research team in identifying and recruiting participants for the study.

4. Statement classification (*Q-Sorting or Ranking*). The participants ranked the 36 statements using a classification grid designed with a quasi-normal distribution. The quasi-normal grid provides a standardized approach to sorting and confirms that each participant follows the same procedure and that their responses can be compared consistently across the sample. The grid consisted of 36 boxes, each representing one statement, arranged across seven scales ranging from + 3 ("strongly agree") to -3 ("strongly disagree"), with 0 representing "neutral" or "no opinion". The participants rated each statement based on their level of agreement or disagreement (Supplementary Figure F1). After completing the sorting process, every woman participated in a semistructured interview. During this post-classification interview, each woman was asked to explain her reasons for ranking certain statements as + 3 or -3, which allowed the researchers to gather deeper insights into their perspectives. The interviews were recorded for further analysis.

5. Data analysis and interpretation. The final step of the Q-method involved analyzing the sorted data and interviews to identify patterns and interpret the results. Supplementary Table S1 indicates the intended polarity whether each statement reflects a practice aligned with clinical recommended antibiotic use (positive) or a practice considered inappropriate or risky (negative) [18–23]. This information enables the research team to interpret the responses of the women included in the study on each statement more clearly, by distinguishing whether perceptions aligned with clinical and public health recommendations for antibiotic management or not. However, regardless of the number of positive or negative statements, the analysis captures the diversity of perceptions and practices, and this imbalance does not affect the identification of profiles or patterns [13].

Data collection during the interviews was conducted using tablets, with the database recorded and centralized in real time via the *KoboToolbox*® platform. Participant information was anonymized to ensure confidentiality and protect their privacy.

Analysis of the statement rankings

For data analysis, principal component analyses (PCAs) were conducted on the participants' rankings using Ken-Q® Analysis Desktop Edition (KADE), software specifically designed for the Q-method. The methodology employed by Ken-Q KADE follows the approach described by Banasick [24]. The Q-sort data were organized into a matrix, with *statements* as columns and participants as rows. A correlation matrix was generated to identify the correlations between individual rankings and

assess the similarities or differences in their perspectives. Factor extraction was performed with an inverse PCA that treated *statements* as variables represented by columns in the matrix.

Groups of factors were identified through PCA, and a varimax rotation was applied to facilitate the interpretation of the results. Factor loadings and Z-scores were then calculated, with individuals assigned to composite factors (groups) through an auto-flagging process in the software on the basis of their similarity in the way that they sorted the statements and by evaluating which factor loading was the highest for each individual. Additionally, Ken-Q KADE® was used to identify distinguished and consensual *statements* within and between each group, further clarifying shared and divergent viewpoints.

Sociodemographic data analysis

To evaluate the associations between sociodemographic characteristics (breastfeeding status, age, marital status, education level, the person who recommended antibiotics, employment, antibiotic consumption period of use, gravidity, and area of residence) of surveyed women and the groups identified through PCA, the Wilcoxon rank-sum test (Mann-Whitney U) and Kruskal-Wallis rank-sum test, were applied, using R Studio® software. The Wilcoxon test was used for variables with only two modalities (categories) and the Kruskal-Wallis test for those with more than two modalities (the different categories or values of each variable). These non-parametric methods were applied between the Z-scores (continuous data) and the sociodemographic characteristics (categorical data) of women. These tests were selected due to the potential lack of normal distribution of Z-scores. If the result is statistically significant, the group is heterogeneous regarding the studied characteristic, suggesting a potential existence of subgroups that are influenced differently by this variable.

The significance threshold was set at $p < 0.2$, reflecting the exploratory nature of the study and the need to identify the potential trends or patterns for further investigation of antibiotic perceptions and usage among women [25, 26]. The relative frequencies of the variable modalities were also examined to identify which modalities were more represented in one group than in the other. The sociodemographic characteristics were simplified into two or three categories to facilitate meaningful comparisons and enhance the interpretability of the results given the sample size. This simplification allows for the identification of major contrasts without excessively fragmenting the data. Furthermore, this simplication avoids overinterpreting variations in perceptions. This approach finally ensures that the findings remain both interpretable and actionable for public health interventions.

Qualitative analysis and semistructured interviews

The participants' reasoning and the concepts that guided their classification decisions at the two extremes (+3 and −3) of the classification grid were recorded in real time with tablets on the centralized *KoboToolbox*® platform. These arguments were subsequently transcribed, translated, and subjected to thematic analysis to uncover patterns and themes. Discourse and content analyses were employed to identify and name the groups extracted from PCA based on the opinions expressed by the participants in each group. Arguments that supported the classification of statements at +3 (strongly agree) and −3 (strongly disagree) were carefully analyzed. The semistructured interview transcripts were coded by two researchers to ensure reliability in the thematic analysis [Figure 2]. The analyses, which were conducted manually, focused on verbatim statements from the semistructured interviews, which specifically highlighted the consistent and divergent opinions among the groups identified through PCA.

Results

Sociodemographic characteristics of the study participants

Among the 115 pregnant and breastfeeding women included in the study, 12% (14/115) were pregnant, while 88% (101/115) were currently breastfeeding. Nearly half of the participants (51%, 59/115) lived in an urban area, whereas the remaining 49% (56/115) resided in a rural area. The average household size was five people, the mean age of the respondents was 27 years, and 51% of the respondents were under 27 years old. However, women aged 14 to 35 years made up 85% (98/115) of the total participants. With respect to marital status, the majority (85%, 98/115) were married, while 15% (17/115) were single or unmarried. For educational attainment, 82% (94/115) of the women reached at least the secondary school level. In terms of employment, 32% (37/115) of the women were not engaged in any sector of work, 31% (36/115) were vendors/traders, and 37% (42/115) had other main activities (i.e., agriculture and livestock farming) (Table 1).

Antibiotic use among the study participants

In the three months preceding the study, 64% (74/115) of the participants reported using more than one antibiotic, whereas 36% (41/115) had taken only one antibiotic. Regarding the sources of antibiotics, 41% (47/115) obtained them from the public sector (basic health centers and public hospitals), 48% (55/115) obtained them from the private sector (pharmaceutical depots, private pharmacies, private clinics and hospitals), and 11% (13/115) obtained them from informal markets, including small shops and street vendors on bicycles.

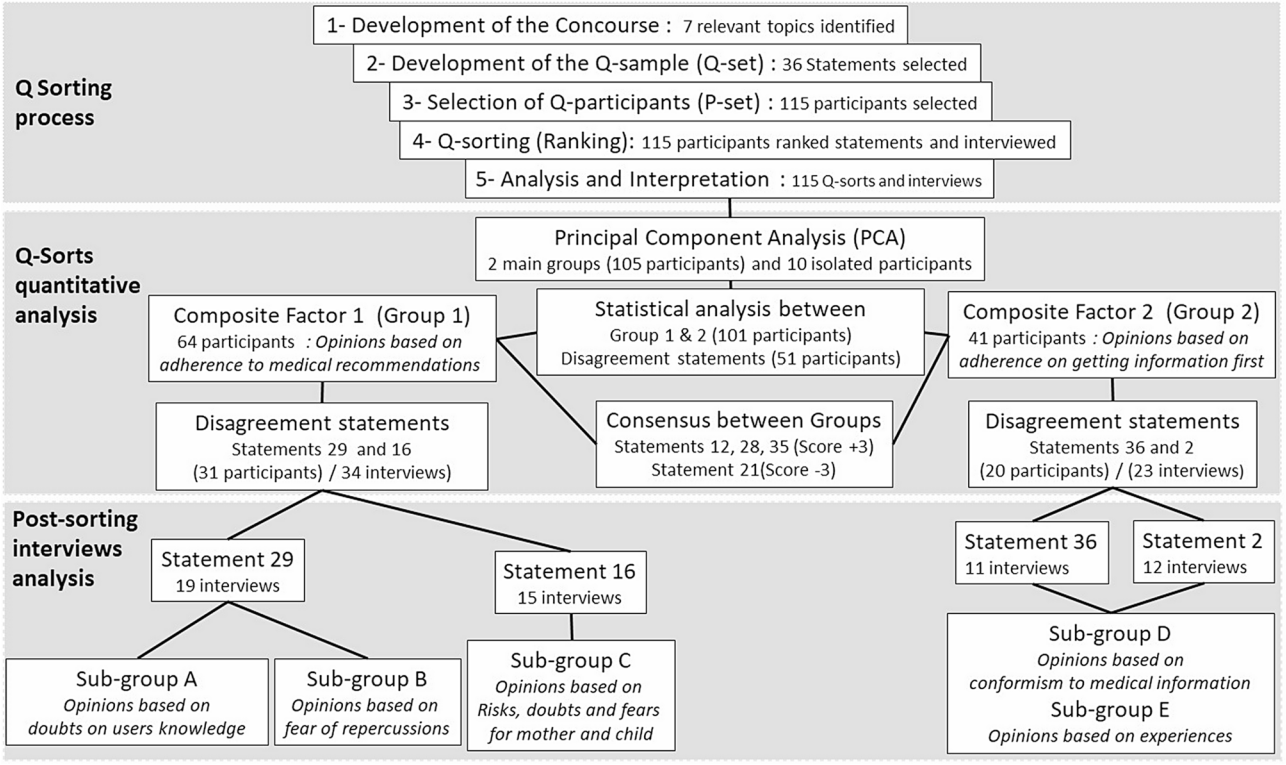

Fig. 2 Study flowchart from study design to post-sorting interviews results

Table 1 Sociodemographic features of study's participants according their location

Variables / Areas	Urban		Rural		Total	
	n	%	*n*	%	*n*	%
Woman status						
Breastfeeding	54	46.96	47	40.87	101	87.83
Pregnant	5	4.35	9	7.83	14	12.17
Age category						
≥ 27 years	38	33.04	21	18.26	59	51.30
< 27 years	21	18.26	35	30.43	56	48.70
Marital status						
Married	54	46.96	44	38.26	98	85.22
Unmarried	5	4.35	12	10.43	17	14.78
Educational level						
At least secondary level	53	46.09	41	35.65	94	81.74
Under secondary level	6	5.22	15	13.04	21	18.26
Person who recommended antibiotics						
Health agent	45	39.13	46	40.00	91	79.13
Other persons	14	12.17	10	8.70	24	20.87
Employment						
Other activities	11	9.57	31	26.96	42	36.52
Trader	26	22.61	10	8.70	36	31.30
No professional activity	22	19.13	15	13.04	37	32.17
Antibiotic consumption period of use						
≤ 1 month	29	25.22	17	14.78	46	40.0
2–3 months	30	26.09	39	33.91	69	60.0
Gravidity						
≤ 2	34	29.57	30	26.09	64	55.65
≥ 3	25	21.74	26	22.61	51	44.35

Overview of the classification of statements (*Q- sorting)*

The participants' rankings of the statements revealed trends in strong agreement (+3) and strong disagreement (-3) within the classification grid. The following statements were most frequently ranked at +3, reflecting strong agreement:

- Statement 35: "*The dosage must be written in the mother's health record*" (46.1%, 53/115).
- Statement 12: "*If in doubt, I seek the advice of a health worker before taking an antibiotic*" (33.9%, 39/115).
- Statement 28: "*Always follow the advice of your health professional when using antibiotics*" (31.3%, 36/115).

The following statements were most frequently ranked at -3, indicating strong disagreement:

- Statement 21: "*When the prescription is not readable, I take the medicine in my own way*" (48.7%, 56/115).
- Statement 36: "*I buy antibiotics directly without the advice of a health worker or without a prescription*" (26.1%, 30/115).
- Statement 29: "*I can share my antibiotics with other people*" (25.2%, 29/115).
- Statement 16: "*If a doctor prescribes medication, I can take them all without following the prescription*" (20.8%, 24/115).
- Statement 2: " *Excessive consumption of an antibiotic can make it even more effective* " (15.6%, 18/115).

Determination of the composite factors or groups of women with homogeneous opinions

Following PCA, eight components accounted for 50% of the variance, all with eigenvalues less than 1. After applying a varimax rotation, two of these composite factors were selected for further analysis, which was guided by our study hypothesis that women's perceptions of antibiotic use differ whether they reside in urban or rural areas. The interpretation of these qualitative factors is supported by the correlation of the Q-sorts and statements with each composite factor.

Among the 115 participants (Q-sorts), 55.6% (64/115) were strongly correlated with Composite Factor 1, whereas 36.5% (41/115) were correlated with Composite Factor 2. The remaining 10 women did not align with either factor, indicating unique perspectives that did not fit into the two primary groups. The two composite factors (groups) represent distinct groups of women with different opinions about antibiotic use.

For the first group (Group 1), the women shared similar opinions on the statements with which the participants strongly agreed (Score + 3), which were Statements 12 ("*If in doubt, I seek the advice of a health worker before taking an antibiotic*"), 28 ("*Always follow the advice of your caregiver when using antibiotics*"), and 35 ("*The dosage must be written in the mother's health record*"*).*

The statements with which these participants strongly disagreed (Score – 3) were Statements 29 ("*I can share my antibiotics with other people*"*),* 16 ("*If a doctor prescribes medication, I can take them all without following the prescription*"*)* and 21 ("*When the prescription is not readable, I take the medicine in my own way*").

For the second group (Group 2), these women shared similar opinions on the following statements.

The statements with which these participants strongly agreed (Score + 3) were statements 35, 12 and 28, the same as those in Group 1.

The statements with which these participants strongly disagreed (Score – 3) were Statements 36 ("*I buy antibiotics directly without the advice of a health worker or without a prescription*"), 2 ("*Excessive consumption of an antibiotic can make it even more effective*"*)* and 21 ("*When the prescription is not readable, I take the medicine my way*"*).*

Consensual and divergent opinions of the two groups of respondents

The analysis of the average rankings of the women in each of the two groups (composite factors) revealed both consensual and divergent statements within and between the groups.

Statements 12, 28, and 35 were opinions of strong agreement (+3) and formed a consensus among the participants in both groups. However, the statements that formed strong disagreement (-3) differed between the two groups, highlighting distinct perspectives.

Both groups strongly agreed on the statements that emphasized adherence to professional medical advice and the importance of following proper dosage instructions. However, they differed slightly in their disagreements. Group 1 strongly rejected the idea of sharing antibiotics (Statement 29) or ignoring prescriptions (Statement 16), and was labeled "*Antibiotic usage based on adherence to professional recommendations*" or "*cautious users*" regarding antibiotic use. They had a cautious approach, characterized by strict adherence to professional recommendations and a strong reluctance to engage in risky behaviors such as sharing antibiotics or self-medicating. In Group 2, in contrast, these women might reject purchasing antibiotics without a prescription (Statement 36), and have a misconception that excessive consumption enhances antibiotic efficacy (Statement 2); they can be called "*Antibiotic usage based on receiving information first*" or "*informed users*". This name highlights their approach according to a broader understanding of antibiotics, including the rejection of misconceptions such as

purchasing antibiotics without a prescription or believing in the effectiveness of excessive consumption while still following professional advice.

The main difference lies in their specific concerns: Group 1 women are focused on avoiding risks and misuse, while Group 2 women are more concerned with responsible purchasing and correcting misconceptions about antibiotics. Members of Group 2 take accountability for their actions and prioritize making decisions that are ethically and legally sound.

Sociodemographic characteristics of the two main groups

After performing the Wilcoxon and Kruskal-Wallis rank sum tests to analyze women's adherence to each group and the potential existence of subgroups based on sociodemographic characteristics, age ($p = 0.004$) was found to significantly influence women's adherence to medical recommendations in Group 1. It is likely that subgroups among the surveyed women have different perceptions depending on their age.

Marital status ($p = 0.013$) also significantly influences adherence to medical recommendations in Group 1, suggesting that married and single women may have different perceptions on this issue.

Regarding the educational level, a significant effect was observed on adherence to medical recommendations in Group 1 ($p = 0.007$). In Group 2, the effect is close to the threshold of significance ($p = 0.065$), suggesting a potential impact on the tendency to seek information before adhering to recommendations.

In the study population, the number of pregnancies appears to influence both groups ($p = 0.062$ for Group 1 and $p = 0.127$ for Group 2), which may affect adherence to medical recommendations and the inclination to seek information first.

The effect of place of residence is more pronounced in Group 1 ($p = 0.125$), suggesting a possible influence on adherence to medical recommendations.

In summary, Group 1 (opinions based on adherence to medical recommendations) is significantly influenced by age, marital status, and education level, while Group 2 (opinions based on adherence to getting information first) is less affected by these characteristics, although the education level and the duration of antibiotic use show a potential influence (Table 2).

Disagreement between the groups regarding the sociodemographic characteristics

To analyze the sociodemographic and contextual characteristics associated with the profiles derived from factor analysis, we conducted a descriptive comparison of the two identified groups. These groups are distinguished by a strong disagreement with specific statements from the Q-set (statements 16 and 29 for Group 1, statements 2 and 36 for Group 2), highlighting contrasting perceptions of antibiotic use (Table 3). The objective is not to directly compare these groups but rather to describe participants based on their group membership to explore potential associations between their profiles and perceptions. An examination of the relative frequencies of the various variables in both groups revealed distinct characteristics for each group.

For Group 1, the statements eliciting the strongest disagreement (-3) included perceptions of medication and antibiotic use/intake and broader issues of community communication regarding medication. Specifically, sharing antibiotics with others (Statement 29) and taking medicines without a medical prescription (Statement 16) were the subjects of consensus among individuals in the first group. They ranked these statements in strong disagreement (-3). Twelve women in this group strongly disagreed with Statement 16, 16 women disagreed with Statement 29, and three women disagreed with both statements, resulting in a total of 31 women.

In this group, the proportion of pregnant women was 16.1%, while 83.9% were breastfeeding. The majority of participants in this group were 27 years old or older (58.1%). A significant portion of women in Group 1 were married (90.3%) and had attained at least a secondary level of education (93.5%). Additionally, 77.4% of women in this group had been advised by a healthcare agent. Regarding antibiotic consumption, a higher proportion of women in Group 1 reported taking antibiotics in the month prior to the survey, and 51.6% of participants had a maximum of two pregnancies. Geographically, 74.2% of women in Group 1 lived in rural areas.

The most discussed theme in Group 2 was communication regarding women's perceptions of antibiotic consumption. The participants in this group strongly disagreed (score of -3) with two key statements related to the purchase of antibiotics without medical advice or without a prescription (Statement 36), and the effectiveness of the overconsumption of antibiotics (Statement 2) generated a consensus among these participants. Eight women in this group strongly disagreed with Statement 36, 9 women disagreed with Statement 2, and 3 women disagreed with both statements, resulting in a total of 20 women.

In this group, 10% of the women were pregnant, and 90% were breastfeeding. In terms of age, 65% of the women were under 27 years old. The group had 85% of married women, and 75% had at least a secondary level of education. Regarding antibiotic use, 25% of women in Group 2 had taken antibiotics in the month prior to our survey, and 75% of women in this group had had at least three pregnancies. Additionally, 50% of women in Group 2 lived in rural areas (Table 3).

Table 2 Relation between groups of women opinions and their sociodemographic features

Variables/Groups	Total		Group 1: Opinions based on adherence to medical recommendations			Group 2: Opinions based on adherence to getting information first		
	n	%	*n*	%	*p*-value	*n*	%	*p*-value
Woman status								
Breastfeeding	92	87.60	57	89.10	0.530	35	85.40	0.389
Pregnant	13	12.40	7	10.90		6	14.60	
Age category								
≥ 27 years	54	51.40	38	59.40	**0.004**	16	39.00	0.288
< 27 years	51	48.60	26	40.60		25	61.00	
Marital status								
Married	90	85.70	58	90.60	**0.013**	32	78.00	0.232
Unmarried	15	14.30	6	9.40		9	22.00	
Educational level								
At least secondary level	89	84.80	59	92.2	**0.007**	30	73.20	**0.065**
Under secondary level	16	15.20	5	7.80		11	26.80	
Person who recommended antibiotics								
Health agent	85	81.0	52	81.30	0.765	33	80.50	0.990
Other persons	20	19.0	12	18.80		8	19.50	
Employment								
Other activities	38	36.20	23	35.90	0.854 *	15	36.60	0.607 *
Trader	36	34.30	22	34.40		14	34.10	
No professional activity	31	29.50	19	29.70		12	29.30	
Antibiotic consumption period of use								
≤ 1 month	42	40.00	30	46.90	0.536	12	29.30	0.225
2–3 months	63	60.00	34	53.10		29	70.70	
Gravidity								
≤ 2	58	55.20	31	48.40	**0.062**	27	65.90	**0.127**
≥ 3	47	44.80	33	51.60		14	34.10	
Areas								
Urban	56	53.30	37	57.80	**0.125**	19	46.30	0.809
Rural	49	46.70	27	42.02		22	53.70	

* Kruskal-Wallis rank sum test

The sociodemographic profiles of the two groups reveal distinct characteristics. Group 1 is characterized by a higher proportion of older, married women with higher levels of education, more frequent healthcare advice, and greater representation in rural areas. In contrast, Group 2 is distinguished by a younger demographic, with a larger proportion of unmarried women and those with less formal education, as well as a notable percentage of women with no professional activity and more pregnancies.

Opinions and arguments of the two groups of respondents on disagreements

To distinguish the groups, discourse analyses were conducted by using participants' arguments as the basis for interpretation.

Group 1 disagreements: justifications and opinions

Each woman was interviewed about the reasons for her disagreement with each statement. In total, 34 responses were collected and analyzed.

The participants in Group 1 strongly disagreed with Statement 29 and cited concerns about the potential harm and social repercussions of sharing antibiotics; this was possibly influenced by a conformist attitude toward medical instructions and societal norms. According to the justifications for the participants disagreeing with Statement 29, two distinct subgroups emerged: (i) participants who expressed uncertainty about antibiotics because of a lack of knowledge, leading to hesitancy about sharing medications ("*Doubt on users knowledge*", subgroup A); and (ii) participants who emphasized fears of harmful consequences for others in the community, which might arise from shared medications ("*Opinions based on fear of repercussions*", subgroup B). The women's justifications reflected a cautious approach to antibiotics and a focus on preventing harm to others. Examples of the verbatim responses include the following: "*I really don't accept this because there might be some harmful effects*"; "*…This may cause an illness instead of a cure*"; "*…Because I'm afraid it might cause a problem for other*

Table 3 Sociodemographic characteristics of participants by group and key statements of strong disagreement

Variables/Statements groups	Group 1: Disagreement statements (16 and 29)		Group 2: Disagreement statements (2 and 36)		Total	
	n	%	*n*	%	*n*	%
Woman status						
Breastfeeding	26	83.90	18	90.00	44	86.30
Pregnant	5	16.10	2	10.00	7	13.70
Age category						
≥ 27 years	18	58.10	7	35.00	25	49.00
< 27 years	13	41.90	13	65.00	26	51.00
Marital status						
Married	28	90.30	17	85.00	45	88.20
Unmarried	3	9.70	3	15.00	6	11.80
Educational level						
At least secondary level	29	93.50	15	75.00	44	86.30
Under secondary level	2	6.50	5	25.00	7	13.70
Person who recommended antibiotics						
Health agent	24	77.40	16	80.00	40	78.40
Other persons	7	22.60	4	20.00	11	21.60
Employment						
Other activities	12	38.70	7	35.00	19	37.30
Trader	9	29.00	6	30.00	15	29.40
No professional activity	10	32.30	7	35.00	17	33.30
Antibiotic consumption period of use						
≤ 1 month	15	48.40	5	25.00	20	39.20
2–3 months	16	51.60	15	75.00	31	60.80
Gravidity						
≤ 2	16	51.60	5	25.00	21	41.20
≥ 3	15	48.40	15	75.00	30	58.80
Areas						
Urban	8	25.80	10	50.00	18	35.30
Rural	23	74.20	10	50.00	33	64.70

people"; and "*These medications could make someone sick, and I could be blamed afterwards for making their illness worse.*"

For Statement 16, "*If a doctor prescribes medication, I can take them all without following the prescription*", the participants in Group 1 strongly disagreed with this and expressed concerns about the risks associated with disregarding the prescribed instructions. For this statement, the Group 1 women's opinions had no subgroup and were mainly based on doubts and fears of the risks incurred by the mother and child in the event of the careless consumption of medications ("Opinions based on risks, doubts and fear for mother and child", subgroup C). The women often referenced the potential dangers to both the mother and the child from improper antibiotic use. Justifications included the following: "*… perhaps what will make me hesitate, for example…is the risk, for me and the baby (…) it may be that, as I said earlier, it may be that this also causes risks*" and "*… I prefer not to take any risks and go to the pharmacy to buy syrup, ask the pharmacist for advice! But I don't buy amox (amoxyciline) directly at the grocery store to give it to him when I don't even know if it's a quarter or how?*"

The responses of the Group 1 participants reflected a conformist viewpoint, characterized by caution and adherence to proper antibiotic use. Their reluctance to share antibiotics or consume them without following prescriptions originated from a desire to prevent harm and mitigate risks, both to themselves and their communities. These perspectives highlight the importance of knowledge and awareness in fostering responsible antibiotic practices. Some women had different options and therefore belonged to different subgroups.

Group 2 disagreements: justifications and opinions

Each participant was interviewed about the reasons for their disagreement with each statement. As a result, 23 responses were collected and analyzed.

For Statement 36, the participants in Group 2 expressed strong disagreement and cited reasons rooted in either medical guidance or personal experience. After an analysis of the discourse was performed, two subgroups of women were obtained. Their arguments revealed a

cautious approach to self-medication and a reliance on trusted information sources.

The participants in subgroup 1 ("*Opinions based on conformism to medical information*", subgroup D) grounded their arguments in information obtained from medical personnel, and they emphasized the importance of professional advice. Example justifications included the following:

> *…Yes! But if you buy anything, you will never be cured… it is always better to consult a doctor quickly when you are sick. But don't self-medicate.*
> *…The reason I don't accept this…medicines have a dose; you can't take them randomly if they don't come from the doctor!*

The participants in subgroup 2 ("*Opinions based on experiences*", subgroup E) shared personal or observed experiences from others that reinforced their caution about buying antibiotics without medical guidance. Example justifications included the following:

> *… My friend who almost died (…) Yes, she consumed a medicine even though the doctor told her to consume half of it, she consumed a whole one.*
> *…I can't, because I'm breastfeeding, sometimes it doesn't suit my child's health so I don't do it.*

For Statement 2, which suggests that overconsumption of antibiotics enhances their effectiveness, the participants again expressed strong disagreement, with the arguments aligning closely with those provided for Statement 36, and the same subgroups were identified (*Opinions based on conformism to medical information* - subgroup D and *Opinions based on experiences* - subgroup E). For these subgroups, some women had different options and belonged to both groups.

Through qualitative analyses, we can determine that the different subgroups provide further insight into specific concerns, including knowledge gaps, fears of repercussions, and personal experiences with antibiotic use in the study area.

Discussion

This study documented the opinions of pregnant and breastfeeding women in the northwestern region of Madagascar on the practices of antibiotic use in the community using Q-methodology.

This study revealed differences in the opinions expressed by pregnant and breastfeeding women in two districts of the Northwest region in relation to their opinions on the use and consumption of antibiotics not only in general but also in their community.

To our knowledge, no study on antibiotic consumption among pregnant and breastfeeding women in the northwestern region of Madagascar has been carried out until the present study.

The use of the Q-method in the context of this study highlights current ideas concerning the use of antibiotics in the community, particularly among pregnant and breastfeeding women in the study area. Compared with classic Q-methodology used in public health studies, which focuses on a thematic analysis of the arguments of the participants in the study [9–13, 16], additional qualitative analyses were performed in the present study. This allowed us to name the different groups of women identified by the factor analyses, to describe their characteristics and to identify subgroups of women's opinions. This particular approach demonstrates the complementarity of quantitative analyses with more qualitative approaches. We also had a sufficient number of women suitable for the research method. Indeed, a systematic review of Q-methodology studies indicates that the total p-set across the corpus ranges from 7 to 386, with an average of 41.6 participants [27].

The rankings of pregnant and breastfeeding women emphasized generally shared ideas on the use of antibiotics and reflected differing opinions on the use of antibiotics. According to our results, two main groups emerged among the study participants. One group had conformist opinions on antibiotic use based on vigilance and/or caution in antibiotic use, and the other group had opinions based on getting information (provided by medical staff or from personal or lived experiences) before using antibiotics. Within each of these two groups, age, marital status, and education level significantly influence adherence to medical recommendations. In contrast, the tendency to seek information before using antibiotics appears to be less affected by these factors. Similarly, women with fewer pregnancies were more likely to follow medical recommendations, whereas those with three or more pregnancies tended to rely more on personal experiences and information-seeking before using antibiotics. This difference may be attributed to more structured prenatal care among women with fewer pregnancies, reinforcing their adherence to medical guidance. The use of antibiotics in line with international recommendations and self-medication practices in the population may be the result of previous experience, according to studies performed in Uganda and Tanzania [28, 29]. Another study in Thailand found that access to accurate information about antibiotics significantly affects usage patterns and underscored the importance of reliable information sources in shaping public attitudes toward antibiotics [15].

In general, in terms of the sociodemographic characteristics, a significant difference between the groups was highlighted. The first group was characterized by older,

married women and those with a higher level of education, with a greater focus on health care advice and antibiotic use in the previous month. There was also a greater proportion of rural dwellers and women with fewer pregnancies. This finding is similar to studies performed in Malawi and Tanzania, where being single is associated with poor practices in the use of antibiotics and particularly, self-medication [30, 31]. The analysis of the interviews revealed that three types of opinions explain the women's membership in this group: opinions based on doubts about users' knowledge, opinions based on fear of repercussions and opinions based on doubts and fears concerning risks for mothers and children.

The second group included a larger proportion of younger, unmarried women and those with less education. Additionally, this group contained more women with no professional activity and those who have had more than three pregnancies. They also tended to have a higher proportion of breastfeeding women. The analysis of the interviews revealed that two types of opinions explained women's membership in this group: opinions based on conformity to medical information and opinions based on personal experiences. Our results show that women residing in urban areas were more vigilant in the use of antibiotics than were those residing in rural areas. In Nigeria, urban residents are more likely to have good knowledge of antibiotics than rural residents have [32]. This could be explained by the fact that women residing in urban areas may have more exposure to information regarding antibiotic use. This result was not observed in other studies, such as those in Sudan and Egypt, where residence in an urban environment increased the risk of misusing antibiotics [33, 34]. This difference in results may be due to differences in the study populations. We focused our study on pregnant and breastfeeding women, whereas the two studies mentioned were general population-based studies [33, 34]. Compared with other categories of the population, pregnant and breastfeeding women may be more vigilant and less inclined toward poor antibiotic use practices.

Our results are different from those of studies on the factors associated with self-medication with antibiotics in Africa, in which a low level of education most often arises as a factor associated with the use of antibiotics not in line with international recommendations [29, 33]. During our study, the degree of education was not considered a determinant of the opinions on antibiotic use practices among pregnant and breastfeeding women.

However, it is important to highlight that some findings from our study warrant further investigation. The relatively low levels of strong disagreement with risky antibiotic practices - such as buying antibiotics without a prescription, sharing them with others, or adjusting doses based on personal interpretation - suggest a concerning normalization of unsafe behaviors. Many respondents did not firmly reject these practices, and nearly half reported adjusting their own antibiotic use when prescriptions were unclear. This reflects both limited awareness of antibiotic misuse risks and reliance on social networks for health advice, contributing to bacterial resistance. These findings, consistent with studies in other low-resource settings [35], underscore the need to strengthen antibiotic distribution regulations and improve communication between healthcare providers and patients. A participatory approach that addresses sociocultural determinants is essential to adapt health messages and design targeted interventions beyond traditional awareness campaigns.

Limitations of the study

Our study provides valuable insights into perceptions of antibiotic use among pregnant and breastfeeding women. But several limitations should be considered when interpreting the findings.

First, the small and imbalanced sample, particularly the low number of pregnant women (14 out of 115), reflects the constraints of convenience sampling, which prioritized participant availability over representativeness. This limits the generalizability of our findings and may reduce the depth of insight into the specific perspectives of pregnant women.

Second, the eligibility criteria further restricted participation, potentially introducing selection bias and limiting the diversity of the sample.

Third, the geographical coverage of the study excluded landlocked rural areas, primarily due to logistical (poor infrastructure and transportation) challenges. Including women from these remote communities could have offered a broader understanding of attitudes toward antibiotic use.

Finally, although we made efforts to ensure the clarity of the statements used in the Q-sort, future research should further assess their reliability and validity, including through test-retest procedures.

Conclusion

Our findings provide fresh insights into how decisions are made in the fields of communications, education, and information. Regarding antibiotic consumption, the results do, in fact, reveal differences in opinions, behavior, and practices based on the sociodemographic, geographic, and other characteristics of the populations. A more detailed consideration of demographic characteristics may help us better understand the advantages of the prudent use of antibiotics and other pharmaceuticals in these populations.

In low-income countries, mixed and participatory research could be widely used to examine delicate or

poorly documented public health phenomena. In fact, these types of research expand the potential for creating specific and successful public health interventions and enable various demographic groups to freely express their opinions on complex public health phenomena. In relation to the use of antibiotics and the risks of antibiotic resistance, it is necessary to evaluate the practices and behaviors of populations to support decision-makers in adopting appropriate measures.

Abbreviations

AMR	Antimicrobial Resistance
WHO	World Health organization
PCA	Principal components Analysis

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-23140-1.

Supplementary Material 1

Supplementary Material 2

Acknowledgements

We thank USAID for funding this project. We would also like to thank the local health authorities and community workers on the ground.

Author contributions

SR, DK, AH, CM and LK conceptualized the study. SR, DK, TR and VR conducted the investigations. SR and DK performed the data curation, data analysis and formatting of the manuscript. SR wrote the first draft of the manuscript. All authors contributed to the interpretation of the findings and to the review and revision of the manuscript. All authors approved the final manuscript prior to submission.

Funding

The fieldwork was funded by the U.S. Agency for International Development (USAID) under the Research, Innovation, Surveillance and Evaluation (RISE) program (Cooperative Agreement #72068719CA0001). The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of USAID.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request. Some data and materials are also provided within the manuscript and in the supplementary information file (Supplementary Table S1).

Declarations

Ethics approval and consent to participate

The study was reviewed and approved by the Biomedical Ethics Committee of the Ministry of Public Health of the Republic of Madagascar (Approval No. 40 MSANP/SG/AMM/CERBM, dated March 31, 2022). The research is in accordance with the Declaration of Helsinki. All participants were informed about the study objectives, procedures, their right to decline participation, and the confidentiality of their personal and professional information. Written consent was obtained from all participants. For participants under the age of 18, verbal assent was secured alongside written consent from a parent or legal guardian.

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Institut Pasteur de Madagascar, Antananarivo 101, Madagascar
[2]Direction de la santé Familiale, Ministère de la santé Publique de la République de Madagascar, Antananarivo 101, Madagascar
[3]United States Agency for International Development, Antananarivo 101, Madagascar
[4]Centre de coopération Internationale en Recherche Agronomique pour le Développement, Montpellier, France

Received: 18 January 2025 / Accepted: 12 May 2025
Published online: 24 May 2025

References

1. World Health Organization (WHO). Antimicrobial resistance: global report on surveillance 2014. World Health Organ; 2014. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance
2. World Health Organization (WHO). Tackling drug-resistant infections globally: Final report and recommendations. 2020. https://www.who.int/en/news-room/fact-sheets/detail/antibiotic-resistance
3. Huynh BTK-DE, Cheang R, Randrianirina F, Seck A, Hariniaina Ratsima E, et al. Severe bacterial neonatal infections in Madagascar, Senegal, and Cambodia: A multicentric community-based cohort study. PLoS Med. 2021;18:e1003681.
4. Chen LY, Flood-Grady E, Hentschel A, Wright L, Mkuu R, Young A, Lemas DJ. A qualitative study of pregnant women's perspectives on antibiotic use for mom and child: implications for developing tailored health education interventions. Antibiotics. 2020;9:704.
5. Randriatsarafara FM, Ralamboson J, Rakotoarivelo R, Raherinandrasana A, Andrianasolo R. Antibiotic consumption at the university hospital of Antananarivo: prevalence and strategic challenges. Public Health. 2015;27:249–55. https://doi.org/10.1016/j.puhe.2015.01.012.
6. Stephenson W. The study of behavior: Q-technique and its methodology. University of Chicago Press; 1953.
7. Lurey CA, Morris M, Pollock J, Richards P, Hughes R, Hewlett S. A Q-methodology study of flare help-seeking behaviors and different experiences of daily life in rheumatoid arthritis. BMC Musculoskelet Disord. 2014;15:364. https://doi.org/10.1186/s12891-014-0364-x.
8. Patty NJ, van Dijk HM, Wallenburg I, Bal R, Helmerhorst TJ, van Exel J, et al. To vaccinate or not to vaccinate? Perspectives on HPV vaccination among girls, boys, and parents in the Netherlands: a Q-methodological study. BMC Public Health. 2017;17:872. https://doi.org/10.1186/s12889-017-4811-7.
9. McKeown B, Thomas DB. Q methodology. Wise; 2013. https://doi.org/10.4135/9781483384412
10. Barbour R, Kitzinger J. Developing focus group research: politics, theory, and practice. Wise; 1999.
11. Watts S, Stenner P. Doing Q methodology: theory, method, and interpretation. Qualitative Res. 2012. https://doi.org/10.1191/1478088705qp022oa.
12. Hwang KK, Lin MJ. Q-methodology for the study of subjectivity. PsycCRITICS. 1999;44. https://doi.org/10.1037/002036.
13. Brown SR. A primer on Q methodology. Operant Subjectivity. 1993;16:91–138. https://doi.org/10.22488/okstate.93.100504.
14. INSTAT. General population census. INSTAT. 2018: https://www.instat.mg/p/resultats-definitifs-du-rgph-3-2018-troisieme-recensement-general-de-la-population-et-de-lhabitation
15. Tangcharoensathien V, Chanvatik S, Kosiyaporn H, Kirivan S, Kaewkhankhaeng W, Thunyahan A, et al. Population knowledge and awareness of antibiotic use and antimicrobial resistance: results from National household survey 2019 and changes from 2017. BMC Public Health. 2021;21:2188. https://doi.org/10.1186/s12889-021-12237-y.
16. van Exel J, Graaf G. Q methodology: A sneak preview. 2005. Soc Sci. (2005) 2:1–30. Available online at: https://www.researchgate.net/profile/Gjalt_Graaf/publication/228574836_Q_Methodology_A_Sneak_Preview/links/02bfe50f946fc9978b000000.pdf
17. Stainton R. Q methodology. In: Smith J, Harré R, Langenhove L, editors. Rethinking methods in psychology. London, UK: SAGE; 1995. pp. 178–92. https://doi.org/10.4135/9781446221792.
18. Centers for Disease Control and Prevention (CDC). Antibiotic Use in the United States, 2021: Progress and Opportunities. 2021. https://stacks.cdc.gov/view/cdc/153896

19. O'Neill J. Tackling Drug-Resistant Infections Globally: Final Report and Recommendations. 2016. https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf
20. American College of Obstetricians and Gynecologists (ACOG). Antibiotic Prophylaxis for Gynecologic Procedures: ACOG Practice Bulletin, Number 195. 2020. https://aogcr.com/wp-content/uploads/2020/08/Prevention-of-Infection-after-Gynecologic-Procedures-ACOG-Practice-Bulletin-195-2013.pdf
21. Global Antibiotic Resistance Partnership (GARP). Situation Analysis and Recommendations: Antibiotic Use and Resistance in Developing Countries. 2011. https://onehealthtrust.org/wp-content/uploads/2017/06/kenya_executivesumm_web_15.pdf
22. National Institute for Health and Care Excellence (NICE). Antimicrobial stewardship: systems and processes for effective antimicrobial medicine use (NICE Guideline NG15). 2015. https://www.nice.org.uk/guidance/ng15
23. World Health Organization (WHO). Worldwide country situation analysis: Response to antimicrobial resistance. 2015. https://apps.who.int/iris/handle/10665/163468
24. Banasick R. Ken-Q Analysis (Version 2.0.1) [Computer software]. 2023. https://doi.org/10.5281/zenodo.8310377
25. Lee EC, Whitehead AL, Jacques RM, Julious SA. The statistical interpretation of pilot trials: should significance thresholds be reconsidered? BMC Med Res Methodol. 2014;14:41. https://doi.org/10.1186/1471-2288-14-41.
26. Wang BZZ, Wang H, et al. The p-value and model specification in statistics. Gen Psychiatry. 2019;32. https://doi.org/10.1136/gpsych-2019-100081.
27. Sneegas G, Beckner S, Brannstrom C, Jepson W, Lee K, Seghezzo L. Using Q-methodology in environmental sustainability research: A bibliometric analysis and systematic review. Ecol Econ. 2021;180:106864. https://doi.org/10.1016/j.ecolecon.2020.106864.
28. Kajeguka DCME. Self-medication practices and predictors for self-medication with antibiotics and antimalarials among community in Mbeya City, Tanzania. Tanzan J Health Res. 2017;19. https://doi.org/10.4314/thrb.v19i1.1.
29. Horumpende PGSS, Mazuguni FS, et al. Prevalence, determinants and knowledge of antibacterial self-medication: a cross sectional study in North-eastern Tanzania. PLoS ONE. 2018;13. https://doi.org/10.1371/journal.pone.0206666.
30. Sambakunsi CSSL, Varga CA, Solomon V, Mponda JS. Knowledge, attitudes and practices related to self-medication with antimicrobials in Lilongwe, Malawi. Malawi Med J. 2019;31. PMCID: PMC7036431 PMID: 32128032.
31. Awad AIEl. Self-medication practices with antibiotics and antimalarials among Sudanese undergraduate university students. Ann Pharmacother. 2007;41. https://doi.org/10.1345/aph.1K068.
32. Isah A, Aina AB, Ben-Umeh KC. Assessment of public knowledge and attitude toward antibiotics use and resistance: a community pharmacy-based survey. J Pharm Policy Pract. 2023;16. https://doi.org/10.1186/s40545-023-00619-z.
33. Blakeley B, McShane DGA, Gelman C, Robert, Jennifer L, Tackett. Abandonment of statistical significance. Am Stat. 2019;73:235–45. https://doi.org/10.1080/00031305.2018.1527253.
34. Elden NMKNH, Alli A, et al. Risk factors of antibiotics self-medication practices among university students in Cairo, Egypt. Open Access Macedo J Med Sci. 2020;8. https://doi.org/10.3889/oamjms.2020.3323.
35. Nair MM, Mahajan R, Burza S, Zeegers MP. Behavioural interventions to address rational use of antibiotics in outpatient settings of low-income and lower-middle-income countries: A systematic review. Tropical Med Int Health. 2021;26:504–17. https://doi.org/10.1111/tmi.13550.ssss.

Publisher's note