

# Knowledge, Attitudes, and Practices (KAP) About Antibiotic Use in Hemodialysis Patients with Chronic Kidney Disease and Their Household Contacts, Medellín-Colombia

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**Purpose:** The lack of knowledge and the excessive and inappropriate use of antibiotics are some of the causes of bacterial resistance. Hemodialysis patients have a high consumption of antibiotics and are constantly cared by their household contacts. This population circulates between hospital and community and are a model to study knowledge regarding bacterial resistance and antibiotic use in these settings. This study describes the knowledge, attitudes and practices (KAP) about antibiotic use and bacterial resistance in hemodialysis patients and their household contacts in Medellín-Colombia.

**Patients and Methods:** A cross-sectional descriptive study was conducted on hemodialysis patients from a renal unit associated with a hospital in Medellín-Colombia, and their household contacts between May 2019 and March 2020. A KAP instrument was applied to participants during home visits. The KAP regarding antibiotic use were characterized, and a content analysis of open questions was made.

**Results:** A total of 35 hemodialysis patients and 95 of their household contacts were included. Of participants, 83.1% (108/130) did not correctly identify the situations in which antibiotics should be used. Likewise, a gap in knowledge about antibacterial resistance was evidenced thanks to the emerging categories in content analysis. Regarding attitudes, 36.9% (48/130) of the participants discontinued antibiotic treatment when they felt better. Additionally, 43.8% (57/130) agree to keep antibiotics in their home. Finally, it was found that it is usual for pharmacists and family members to recommend or sell antibiotics without prescription; likewise, pharmacies were the most popular place to acquire these medications.

**Conclusion:** This study identified gaps in KAP regarding the use of antibiotics and bacterial resistance in hemodialysis patients and their household contacts. This allows focusing education strategies in this regard, in order to increase awareness about the correct use of antibiotics and the consequences of bacterial resistance and to improve prevention actions in this vulnerable population.

**Keywords:** KAP, antibiotics, bacterial resistance

## Introduction

The lack of knowledge about the correct use of antibiotics and bacterial resistance is one of the reasons for its increase around the world, making it one of the most important public health problems recognized by the World Health Organization (WHO).<sup>1</sup> The excessive and inappropriate use of antibiotics in patients and communities have contributed to increased selection pressure and the spread of resistant microorganisms.<sup>2</sup> In order to address this problem, the WHO warns of the importance of carrying out interventions that improve the knowledge, allowing the change of conceptions, and promoting the implementation of good practices for the antibiotic use not only in general population but in medical students and veterinarian settings.

Hemodialysis patients present clinical characteristics that favor high consumption of antibiotics, such as frequent bacterial infections and high rates of hospitalization.<sup>3</sup> On the other hand, these patients constantly need accompaniment and assistance from their household contacts, both when traveling to health institutions and at home. Therefore, their household contacts also interact with the hospital environment and the health personnel, in addition to sharing spaces, objects and habits with the patients in homes, which can favor similar appreciations regarding the use of antibiotics and the bacterial resistance.

Likewise, different social, economic, and cultural factors of the country coincide in this population, which facilitates the high and incorrect use of antibiotics, such as easy access to these medications without a medical prescription, in addition to weak regulation and the absence of surveillance in this regard, as is the case of Colombia. That is why hemodialysis patients, and their household contacts are a model population to study knowledge, attitudes, and practices (KAP) regarding the antibiotic use and bacterial resistance, since they are in transit between the hospital and the community, having different sources that can influence their actions in this regard.

KAP studies are a method to identify gaps in knowledge, attitudes and practices, which would allow the design and implementation of educational strategies and public policies that promote targeted behavior changes, increasing knowledge about the use of antibiotics and bacterial resistance, and improving the actions to prevent it from different circumstances. Some studies of this type have been carried out in different populations of interest, including health workers, medical students, parents of pediatric patients, and general community.<sup>4-8</sup> Unfortunately, even when Colombia is considered an endemic country for bacterial resistance, there are few KAP-type studies in the general population and in medical students.<sup>9,10</sup> Therefore, the objective of this work was to describe the knowledge, attitudes, and practices regarding the antibiotic use and bacterial resistance in hemodialysis patients and their household contacts, in the metropolitan area of Valle de Aburrá (Colombia).

## Materials and Methods

### Type of Study

A cross-sectional descriptive study was conducted on hemodialysis patients and their household contacts between May 2019 and March 2020. The patients belonged to a dialysis center associated with a tertiary hospital in Medellín and had to share a home with at least one person (except patients who lived in nursing homes), who was defined as a household contact if lived in the same house as the patient for a period of no less than 6 months. All patients and household contacts older than 12 years old, who accepted the invitation and not have any mental illness (diagnosis provided by the family group), were included.

### Study Population

The patients and their household contacts were contacted from a cohort of a previous study carried out in research group,<sup>3</sup> and they were informed about the aim of the study and the processes to be carried out. Once they agreed to participate, a visit was arranged to each home, located in different neighborhoods of the metropolitan area, where the KAP-type survey regarding the antibiotic use and bacterial resistance was applied ([Supplement 1](#)).

### Instrument and Data Collection

Initially, a design of the KAP instrument containing 26 closed questions and 6 open questions was carried out based on the review of the literature of previous KAP-type studies about the antibiotic use, in addition to the knowledge of different expert researchers from MICROBA research group of University of Antioquia with experience in bacterial resistance, epidemiology, microbiology and education. Prior to the start of the study, a pilot was carried out in different communities in Medellín, in order to assess the coherence, good writing, language used and understanding of the instrument. Subsequently, those questions and answers that had problems were adjusted.

Single, multiple, and open-ended questions assessed sociodemographic characteristics, knowledge about antibiotic use and antimicrobial resistance, as well as attitudes and practices about antibiotic use. The questionnaire addressed four sections: i) sociodemographic characteristics of participants (7 items), ii) knowledge about the antibiotic use and bacterial resistance (13 items), iii) attitudes related to antibiotic use (7 items), and iv) practices regarding antibiotic use (6 items).

## Analysis of the Information

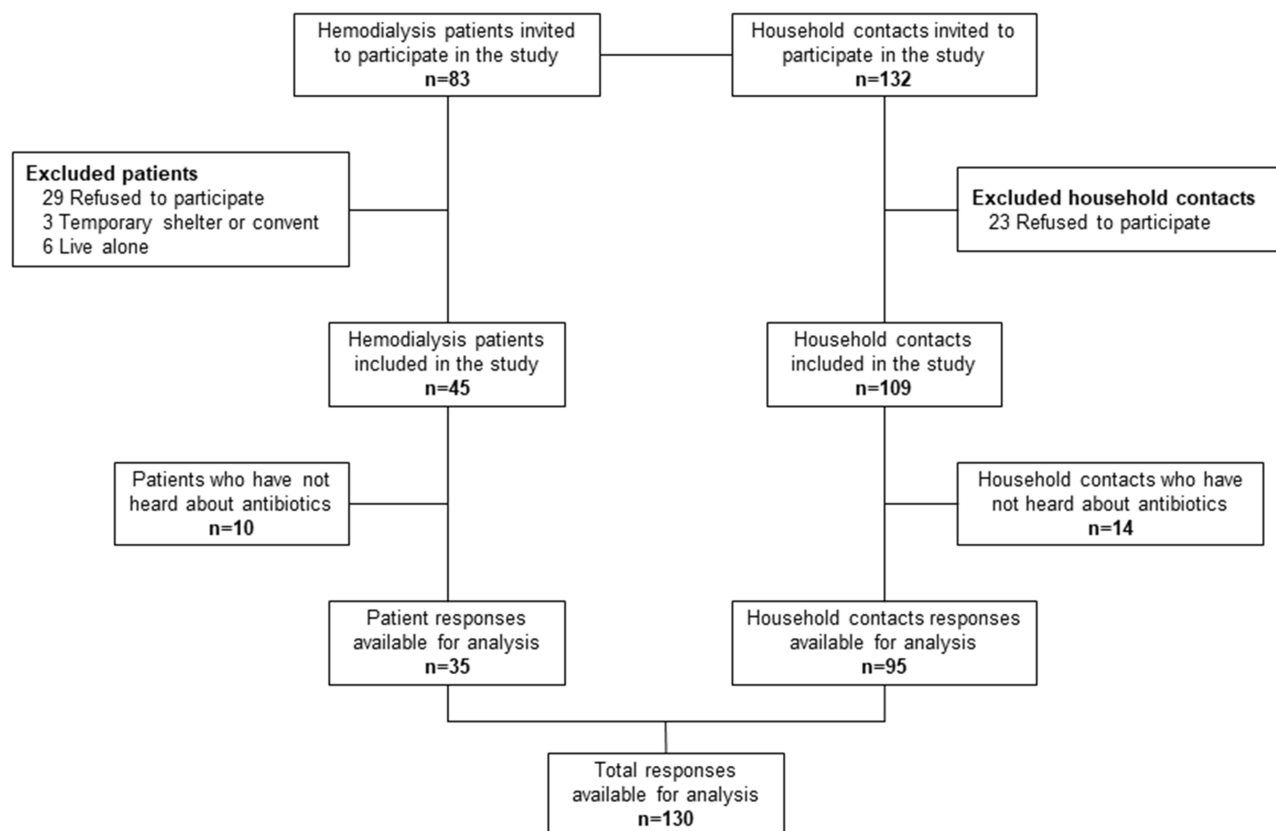
A descriptive analysis was carried out by estimating absolute and relative frequencies for each of the answers in the KAP questions. Additionally, for quantitative sociodemographic variables, the median and interquartile range were estimated. In the KAP instrument, open questions (questions 6, 7, 9, 13) were considered, which were studied through content analysis using the specialized software NVivo (Version 1.0). In this analysis, similar responses (words, examples, or situations) by the participants, were grouped into emerging categories, which refer to responses not expected by the researchers. The answers to questions 3 and 5 were categorized according to the consensus among the researchers, in “correct profiles”, when the options selected by the participants corresponded only to symptoms or to bacterial infections; ‘incorrect profiles’, when participants selected some symptoms related to bacterial infections, but at least one option not related to them; and “does not know”.

## Ethical Aspects

The project complies with the World Medical Association’s Declaration of Helsinki and was approved by the Bioethics Committee for Human Research of University of Antioquia (CBEIH-SIU) (approval no. 17-65-689), and written informed consent was obtained from each participant, in case they were minors, the informed consent was signed by their parents or legal guardians.

## Results

A total of 83 hemodialysis patients and 132 household contacts were invited to participate in the study, of which 35 patients and 95 household contacts agreed to participate, the process of inclusion of the participants is shown in (Figure 1). Of the participants, 93.1% (121/130) resided in Medellín, with districts 4 and 10 being the most frequent with 18.5% (24/130) and 15.4% (20/130), respectively. In addition, in the municipality of Sabaneta, 2.3% (3/130) of all the participants were surveyed; likewise, in the municipality of Bello, 4.6% (6/130) were surveyed. The median age of the participants was 48 years (IQR 32–



**Figure 1** Participant inclusion process.

**Table 1** Sociodemographic Characteristics of Hemodialysis Patients and Their Household Contacts

Characteristic	All Participants (n=130) n (%)	Patients (n=35) n (%)	Household Contacts (n=95) n (%)
Female	83 (63.8)	17 (48.6)	66 (69.5)
Age - Median (IQR)	48 (32–62)	58 (45.5–69.5)	41 (26–59)
Years of life in the area of residence - Median (IQR)	20 (6–36.7)	22 (4.5–42.5)	20 (6.5–33.5)
<b>Participant type</b>			
Adult	121 (93.1)	35 (100)	86 (90.5)
Pediatric	9 (6.9)	0 (0.0)	9 (9.5)
<b>Residence area (municipality)</b>			
Medellín			
Commune 1	5 (3.9)	1 (2.9)	4 (4.2)
Commune 2	3 (2.3)	1 (2.9)	2 (2.1)
Commune 3	13 (10.0)	3 (8.6)	10 (10.5)
Commune 4	24 (18.5)	7 (20.0)	17 (17.9)
Commune 5	15 (11.5)	3 (8.6)	12 (12.6)
Commune 6	9 (6.9)	3 (8.6)	6 (6.3)
Commune 7	8 (6.2)	2 (5.7)	6 (6.3)
Commune 8	3 (2.3)	1 (2.9)	2 (2.1)
Commune 9	6 (4.6)	1 (2.9)	5 (5.3)
Commune 10	20 (15.4)	6 (17.1)	14 (14.7)
Commune 11	2 (1.5)	0 (0.0)	2 (2.1)
Commune 12	3 (2.3)	1 (2.9)	2 (2.1)
Commune 13	5 (3.9)	1 (2.9)	4 (4.2)
Commune 15	3 (2.3)	1 (2.9)	2 (2.1)
Commune 16	2 (1.5)	1 (2.9)	1 (1.1)
Bello	6 (4.6)	2 (5.7)	4 (4.2)
Sabaneta	3 (2.3)	1 (2.9)	2 (2.1)
<b>Educational level</b>			
None	4 (3.1)	2 (5.7)	2 (2.1)
Complete Primary	19 (14.6)	10 (28.6)	9 (9.5)
Incomplete Primary	15 (11.5)	5 (14.3)	10 (10.5)
Completed secondary	23 (17.7)	4 (11.4)	19 (20.0)
Incomplete Secondary	22 (16.9)	5 (14.3)	17 (17.9)
Complete technical or technological studies	18 (13.9)	4 (11.4)	14 (14.7)
Incomplete technical or technological studies	2 (1.5)	0 (0.0)	2 (2.1)
Complete University	19 (14.6)	4 (11.4)	15 (15.8)
Incomplete University	8 (6.2)	1 (2.9)	7 (7.4)

62), with 93.1% (121/130) of the participants being adults and 63.8% (83/130) being women. Regarding the educational level of population, 46.1% (60/130) did not finish high school, and only 28.4% (37/130) had a higher educational level. The details of the characteristics separated by patients and household contacts are shown in [Table 1](#).

## Knowledge

Regarding people's knowledge about the different antibiotics, 54.6% (71/130) mentioned at least one antibiotic, 33.1% (43/130) did not know or did not remember the name of any antibiotic and 12.3% (16/130) confused antibiotics with other types of medication such as analgesics or anti-inflammatories. Among the antibiotics best known by the participants, amoxicillin was reported in 27.5% (47/171) of the cases, followed by penicillin and ampicillin with 15.8% (27/171) and 8.8% (15/171), respectively.

The main sources of information about antibiotics were the health personnel 58.5% (76/130) and the family 26.9% (35/130), both in patients and the household contacts. However, most people incorrectly identified situations where antibiotic use is appropriate 83.1% (108/130), 74.3% (26/35) of patients and 86.3% (82/95) of household contacts. Likewise, 82.8% (29/35) of patients and 80% (76/95) of household contacts erroneously identified the circumstances in which antibiotics have a therapeutic effect, and 65.4% (85/130) of population reported that whenever a fever occurs, children should receive antibiotics. On the other hand, 68.6% (24/35) and 73.7% (70/90) of patients and household contacts, respectively, believe that antibiotics may stop working. In addition, 42.3% (55/130) of population, 34.3% (12/35) of patients and 45.3% (43/95) of household contacts reported knowing what antibiotics are used for in agriculture, poultry or livestock; while 62.9% (22/35) of patients and 58.9% (56/95) of household contacts reported having heard about antibiotic resistance. Additionally, 77.1% (27/35) and 72.6% (69/95) of patients and household contacts, respectively, reported knowing about the adverse effects caused by antibiotics (Table 2).

Regarding the content analysis of the open questions, different emerging categories were found according to their stories, that is, some common answers were identified that indicated some knowledge or belief mistaken about the subject. Regarding the question about the use of antibiotics in agriculture, poultry or livestock, two relevant categories

**Table 2** Knowledge About the Antibiotic Use and Antimicrobial Resistance of Hemodialysis Patients and Their Household Contacts

Questions	All Participants (n=130) n (%)	Patients (n=35) n (%)	Household Contacts (n=95) n (%)
<b>1. Have you heard about antibiotics?</b>			
Yes	130 (100)	35 (100)	95 (100)
<b>2. Who has taught you about antibiotics? <sup>a</sup></b>			
College/school	12 (9.2)	0 (0.0)	12 (12.6)
Internet	6 (4.6)	0 (0.0)	6 (6.3)
Doctor	76 (58.5)	24 (68.6)	52 (54.7)
Pharmacist	15 (11.5)	6 (17.1)	9 (9.5)
Relatives	35 (26.9)	6 (17.1)	29 (30.5)
Friends	10 (7.7)	5 (14.3)	5 (5.3)
TV and radio	17 (13.1)	6 (17.1)	11 (11.6)
Other	33 (25.4)	13 (37.1)	20 (21.1)
<b>3. When should antibiotics be used? <sup>b</sup></b>			
Correct profile	18 (13.8)	7 (20.0)	11 (11.6)
Wrong profile	108 (83.1)	26 (74.3)	82 (86.3)
Does not know	4 (3.1)	2 (5.7)	2 (2.1)
<b>4. When do you decide to see the doctor? <sup>a</sup></b>			
When present something strange that had not happened before	39 (30.0)	13 (37.1)	26 (27.4)
When start to feel sick	29 (22.3)	9 (25.7)	20 (21.1)
When feel very sick	94 (72.3)	19 (54.3)	75 (78.9)
Other	18 (13.8)	7 (20.0)	11 (11.6)
<b>5. What can antibiotics cure? <sup>c</sup></b>			
Correct profile	20 (15.4)	3 (8.6)	17 (17.9)
Wrong profile	105 (80.8)	29 (82.8)	76 (80.0)
Does not know	5 (3.8)	3 (8.6)	2 (2.1)
<b>6. Do you know why antibiotics are used in agriculture, poultry or livestock?</b>			
Yes	55 (42.3)	12 (34.3)	43 (45.3)
<b>7. Have you heard about antibiotic resistance?</b>			
Yes	78 (60.0)	22 (62.9)	56 (58.9)

(Continued)

Table 2 (Continued).

Questions	All Participants (n=130) n (%)	Patients (n=35) n (%)	Household Contacts (n=95) n (%)
<b>8. If you take antibiotics every time you get sick, what can it cause? <sup>a</sup></b>			
Absolutely nothing	4 (3.1)	2 (5.7)	2 (2.1)
It relieves us of the disease quickly	33 (25.4)	6 (17.1)	27 (28.4)
The antibiotic will not help us against other infections	57 (43.8)	13 (37.1)	44 (46.3)
It will always keep us healthy	10 (7.7)	4 (11.4)	6 (6.3)
Does not know	18 (13.8)	5 (14.3)	13 (13.7)
Other	25 (19.2)	10 (28.6)	15 (15.8)
<b>9. Do antibiotics have harmful effects?</b>			
Yes	96 (73.8)	27 (77.1)	69 (72.6)
<b>10. Should children receive antibiotics whenever there is a fever?</b>			
Yes	85 (65.4)	23 (65.7)	62 (65.2)
No	36 (27.7)	10 (28.6)	26 (27.4)
Does not know	9 (6.9)	2 (5.7)	7 (7.4)
<b>11. Do you think antibiotics can stop working?</b>			
Yes	94 (72.3)	24 (68.6)	70 (73.7)
<b>12. Do you know how often a new antibiotic is developed?</b>			
Every Month	14 (10.8)	6 (17.1)	8 (8.4)
Every 6 months	6 (4.6)	2 (5.7)	4 (4.2)
Every year	12 (9.2)	4 (11.4)	8 (8.4)
Every 3 years	4 (3.1)	1 (2.9)	3 (3.2)
Every 5 years	1 (0.8)	0 (0.0)	1 (1.1)
There has not been in the last 10 years	3 (2.3)	1 (2.9)	2 (2.1)
Does not know	90 (69.2)	21 (60.0)	69 (72.6)
<b>13. Do you think infections spread between people and pets?</b>			
Yes	119 (91.5)	33 (94.3)	86 (90.5)
No	5 (3.9)	0 (0.0)	5 (5.3)
Does not know	6 (4.6)	2 (5.7)	4 (4.2)

**Notes:** <sup>a</sup>The question admits multiple answers. <sup>b</sup>The correct profile was established by selecting at least one of the following categories: "When we get tonsillitis", "when I have pain to urinate", "when I have an infected wound". The wrong profile was set with the selection of at least one of the missing categories. <sup>c</sup>The correct profile was established with the option: "Bladder infections". The wrong profile was set with the selection of at least one of the missing categories.

emerged: Vaccines ("To vaccinate the animals" - 40-year-old woman) and entomological control ("Control of pests and ticks" - 59-year-old man). Regarding bacterial resistance, in the respondents who said they had heard about antibiotic resistance, two categories emerged: Resistance of the body to antibiotics due to immunity ("If a person consumes a lot of antibiotics, it no longer has an effect on them, they become immune to the antibiotic" - 38-year-old woman), and adverse effects ("It is an allergy that causes problems, that is what I understand" 41-year-old woman).

On the other hand, the population that responded knowing about the adverse effects generated by antibiotics presented two relevant emerging responses: It affects the immune response ("Lower defenses" - 34-year-old woman) and bacterial resistance ("Bacterial resistance" - 31-year-old woman). Finally, regarding the question about infections that can be transmitted between people and domestic animals, three emerging categories stood out: Sexually transmitted infections and urinary tract infections ("Urinary infections, syphilis, gonorrhea" - 63-year-old man), allergic reactions ("Rhinitis that can be caused by the animal" - 26-year-old man) and fomites or close contact ("The hairs of cats, sometimes there are people who give dogs spikes" - 56-year-old woman).

## Attitudes

Among the items evaluated in attitudes, 55.4% (72/130) indicated that they decided to go to the Health Promotion Company (HPC, entities that manage the provision of health care in Colombia) when they presented fever or suspected infection, however, 21.5% (28/130) decided to go to the pharmacy. Additionally, 73.1% (95/130) reported that they finished the treatment prescribed by the doctor, 36.9% (48/130) of the population suspended treatment when there was improvement of health. Finally, 43.8% (57/130) of the participants agreed with keeping antibiotics in their home for the treatment of some infections (Table 3).

In general, similar frequencies were observed in the responses of patients and their household contacts. However, the results showed that 45.7% (16/35) of the patients went to the hospital when they had a fever, compared to 9.4% (9/95) of the household contacts. Also, a larger number of patients agreed to keep antibiotics at home. Additionally, 45.3% (43/95) of the household contacts took medications recommended by a pharmacist, against 25.7% (9/35) of the patients (Table 3).

**Table 3** Attitudes About the Antibiotic Use and Antimicrobial Resistance of Hemodialysis Patients and Their Household Contacts

Questions	All Participants (n=130) n (%)	Patients (n=35) n (%)	Household Contacts (n=95) n (%)
<b>14. Where do you go if you have a fever or suspected infection? <sup>a</sup></b>			
Pharmacy	28 (21.5)	5 (14.3)	23 (24.2)
Hospital	25 (19.2)	16 (45.7)	9 (9.4)
Neighborhood medical center	4 (3.1)	1 (2.9)	3 (3.2)
Where a relative	3 (2.3)	1 (2.9)	2 (2.1)
HPC	72 (55.4)	21 (60.0)	51 (53.7)
Nowhere	16 (12.3)	2 (5.7)	14 (14.7)
Other	6 (4.6)	0 (0.0)	6 (6.3)
<b>15. When you are given treatment for several days, do you take all the pills that the doctor prescribes?</b>			
Yes	95 (73.1)	26 (74.3)	69 (72.6)
No	35 (26.9)	9 (25.7)	26 (27.4)
<b>16. When you are given treatment for several days, do you stop when you get better?</b>			
Yes	48 (36.9)	14 (40.0)	34 (35.8)
No	82 (63.1)	21 (60.0)	61 (64.2)
<b>17. Do you keep medications in your home?</b>			
Yes	89 (68.5)	30 (85.7)	59 (62.1)
No	41 (31.5)	5 (14.3)	36 (37.9)
<b>18. Do you agree to keep antibiotics in the house for any infection?</b>			
Yes	57 (43.8)	12 (34.3)	45 (47.4)
No	73 (56.2)	23 (65.7)	50 (52.6)
<b>19. Are there people in the neighborhood who prescribe antibiotics for any illness?</b>			
Yes	29 (22.3)	12 (34.3)	17 (17.9)
No	85 (65.4)	17 (48.6)	68 (71.6)
Does not know	16 (12.3)	6 (17.1)	10 (10.5)
<b>20. Do you take the medications that the pharmacist recommends?</b>			
Yes	52 (40.0)	9 (25.7)	43 (45.3)
No	71 (54.6)	22 (62.9)	49 (51.5)
Does not recommend anything	7 (5.4)	4 (11.4)	3 (3.2)

**Note:** <sup>a</sup>The question admits multiple answers.

## Practices

Regarding practices, it was found that 23.9% (31/130) of the population reported that someone in the family prescribed medication. Among the most mentioned relatives, mothers were found with 22.6% (7/31), followed by siblings and uncles, both with 12.9% (4/31). The main reasons why they had been prescribed antibiotics were for urinary tract infections 24.6% (32/130), to treat flu infections 20.8% (27/130) and for tonsillitis 17.7% (23/130). In addition, the results show that 97.1% (34/35) of the patients received antibiotic prescriptions from physicians, against 73.7% (70/95) of household contacts, who also received prescriptions from pharmacists. The frequencies in other items were similar between the two groups (Table 4).

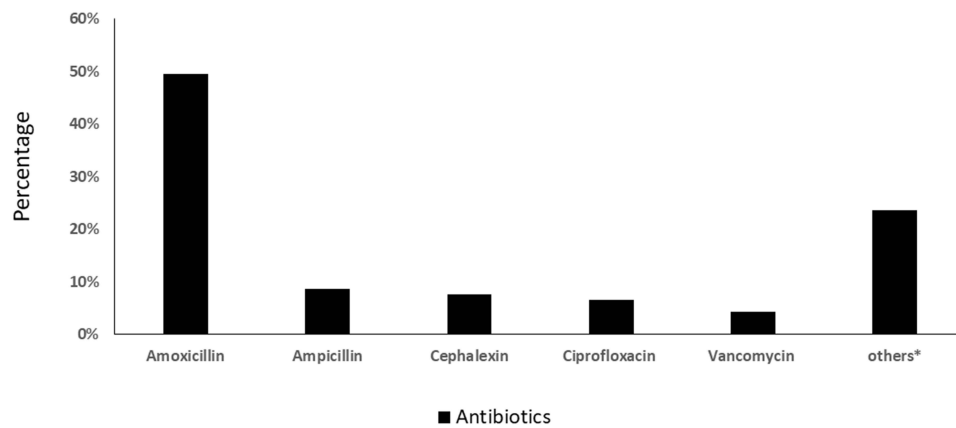
**Table 4** Practices Regarding the Antibiotic Use and Antimicrobial Resistance of Hemodialysis Patients and Their Household Contacts

Questions	All Participants (n=130) n (%)	Patients (n=35) n (%)	Household Contacts (n=95) n (%)
<b>21. Does anyone in your family prescribe medications such as antibiotics?</b>			
Yes	31 (23.9)	8 (22.9)	23 (24.2)
No	97 (74.6)	27 (77.1)	70 (73.7)
Does not know	2 (1.5)	0 (0.0)	2 (2.1)
<b>22. Who has prescribed antibiotics to you? <sup>a</sup></b>			
The doctor	104 (80.0)	34 (97.1)	70 (73.7)
The pharmacist	28 (21.5)	4 (11.4)	24 (25.3)
Friends	2 (1.5)	0 (0.0)	2 (2.1)
Relatives	31 (23.9)	5 (14.3)	26 (27.4)
Myself	9 (6.9)	2 (5.7)	7 (7.4)
Other	5 (3.9)	5 (14.3)	0 (0.0)
<b>23. Why have you been prescribed antibiotics? <sup>a</sup></b>			
Tonsillitis	23 (17.7)	5 (14.3)	18 (18.9)
Diarrhea	16 (12.3)	2 (5.7)	14 (14.7)
Flu	27 (20.8)	6 (17.1)	21 (22.1)
Urinary infection	32 (24.6)	7 (20.0)	25 (26.3)
Earache	7 (5.4)	1 (2.9)	6 (6.3)
Does not remember	12 (9.2)	4 (11.4)	8 (8.4)
Other	64 (49.2)	23 (65.7)	42 (44.2)
<b>24. When was the last time you took antibiotics?</b>			
Does not remember	35 (26.9)	9 (25.7)	26 (27.4)
At the moment	16 (12.3)	7 (20.0)	9 (9.4)
Last month	11 (8.5)	4 (11.4)	7 (7.4)
In the last 6 months	32 (24.6)	5 (14.3)	27 (28.4)
Last year	16 (12.3)	6 (17.1)	10 (10.5)
Over a year ago	14 (10.8)	3 (8.6)	11 (11.6)
Never	6 (4.6)	1 (2.9)	5 (5.3)
<b>26. Where do you get antibiotics? <sup>a</sup></b>			
In pharmacy	80 (61.5)	20 (57.1)	60 (63.1)
From the home medicine cabinet	1 (0.8)	0 (0.0)	1 (1.1)
In a chain store	2 (1.5)	0 (0.0)	2 (2.1)
The HPC gives them	71 (54.6)	25 (71.4)	46 (48.4)
Other	7 (5.4)	2 (5.7)	5 (5.3)

**Note:** <sup>a</sup>The question admits multiple answers.

**Abbreviation:** HPC, Health Promotion Company.





**Figure 2** Antibiotics used by the study population. \*Category composed of azithromycin, penicillin G benzathine, penicillin, clindamycin, metronidazole, dicloxacillin, erythromycin, gentamicin, lincomycin, meropenem, piperacillin, tetracycline.

Regarding the consumption of antibiotics, 12.3% (16/130) of the participants were undertake antibiotic at the time of the study; of which 37.5% (6/16) were hemodialysis patients and 62.5% (10/16) were household contacts. Historically, 45.4% (59/130) had used antibiotics in the last 6 months. In this sense, it was observed that the 5 antibiotics most used by the participants were amoxicillin, ampicillin, cephalexin and ciprofloxacin (Figure 2). However, 12.3% (16/130) of the participants confuse antibiotics with other types of medication since they mentioned having used analgesics, anti-inflammatories, and antihistamines. Regarding the acquisition of antibiotics, 61.5% (80/130) acquired antibiotics at the pharmacy, which is similar in both groups; however, 71.4% (25/35) of patients get antibiotics in HPC, against 48.4% (46/95) of household contacts (Table 4).

## Discussion

The findings of this study provide a broad overview of the knowledge, attitudes and practices related to the use of antibiotics and bacterial resistance in hemodialysis patients and general community. These results show the need to promote greater education in the population, which contributes to improving knowledge on this subject, and to impact the problem of bacterial resistance. In general, it was possible to demonstrate a low knowledge in this population about antibiotics, their use and antimicrobial resistance. However, a considerable proportion of the participants was aware that the constant use of antibiotics can cause a decrease in their therapeutic action. This work provides information that would allow establishing efficient actions to increase knowledge and improve the proper management of antibiotics to prevent bacterial resistance.

Regarding knowledge, even though 54.6% of the population mentioned at least one antibiotic, it should be noted that 12.3% confuse antibiotics with other types of medication or chemical compounds. These results are similar to those obtained in a study conducted in Nepal, where approximately 12% to 15% of the population referred to paracetamol and antacids as antibiotics.<sup>11</sup> In another study carried out in 2015 among pilgrims during the Hajj, 11.2% of the respondents mentioned that paracetamol and/or aspirin were antibiotics.<sup>6</sup> On the other hand, a study carried out in China, in parents of pediatric patients, found that 46.5% of the surveyed population believed that anti-inflammatories and antibiotics were the same type of medicine.<sup>7</sup> These results show the importance and the need to carry out educational campaigns in order to improve knowledge in the communities about antibiotics and their use, as well as to differentiate them from other types of medication and thus be able to reduce their unnecessary and inappropriate use.

On the other hand, among the best known antibiotics used by the study population are beta-lactams, particularly amoxicillin, similar to that described in studies conducted in Jordan and Tanzania<sup>12,13</sup> likewise, in a study in Colombia on self-medication with antibiotics, where the most purchased antibiotic was amoxicillin.<sup>14</sup> This may be due to the fact that antibiotics from the beta-lactam group are the most widely used in clinical practice, given their safety, easy access and broad spectrum of action.<sup>15,16</sup> In the Latin American context, despite the regulations in some countries, the easy

acquisition of some antibiotics without medical prescription is a frequent fact, which can favor selection pressure and the dissemination of resistant bacteria in the community.

In our study, it was also possible to observe that around 80% of the population, both patients and household contacts, did not correctly identify the situations in which antibiotics should be used and when have a therapeutic effect. Additionally, it was found that 66.6% of the population agrees to provide antibiotics to children with feverish symptoms; which contrasts with a study carried out in China where 81.2% of the population considered that the use of antibiotics is not necessary in this situation.<sup>7</sup> The findings of our research show a great lack of knowledge on the part of the participants and coincide with a survey carried out by the WHO in 2015, which showed that between 28% and 70% of the respondents incorrectly identified the situations in which they should use antibiotics as treatment.<sup>17</sup> Likewise, other studies have reported that between 54.5% and 63% of the population think that antibiotics could cure infections commonly caused by viral agents.<sup>6,18</sup> In particular, the use of antibiotics in infections caused by nonbacterial agents, both in hospital settings and in the community, has favored the selection of bacteria resistant to antibiotics. This situation may be related to multiple factors, including inadequate prescription by health personnel and the empirical administration of antibiotics, especially in populations with diagnostic limitations and barriers to access to health systems.<sup>9,13</sup> In this sense, Colombia is one of the countries in Latin-America with a high proportion of acute febrile illnesses caused by different etiological agents and where the use of antibiotics is presented as first-line treatment. Additionally, it could be explained because the population is unaware of the difference between the microorganisms that cause infection, as well as that antibiotics are only recommended to treat bacterial infections, which can increase unnecessary and inappropriate self-medication.<sup>19</sup>

On the other hand, 60% of the population reported having heard about antimicrobial resistance; however, among the emerging categories of importance, it was found that some participants referred to bacterial resistance as the body's resistance to antibiotics by immunity. These results are similar to those described in quantitative studies carried out in different countries, where they show that between 55% and 85% of those surveyed believe that the human body becomes resistant to antibiotics.<sup>17,19–21</sup> Additionally, similar results have been documented in qualitative studies, in which the study population referred to the concept of antibiotic resistance as the property of the body to become resistant to the action of the antibiotic by immunity.<sup>22,23</sup> The concept of antimicrobial resistance is also commonly confused in our population with adverse effects or hypersensitivity reactions such as allergies; however, the participants also defined accepted concepts of antibiotic resistance. This misconception about antimicrobial resistance has been the subject of information campaigns by PAHO/WHO during the World Awareness Week on Antibiotics and Bacterial Resistance.<sup>24</sup> In addition, some researchers suggest that health professionals should implement communications with a brief and simple language on the subject, in order to avoid confusion in the population to intervene.<sup>20</sup> Even the lack of knowledge of the definition of bacterial resistance, a high percentage of the study population 72.3% believes that antibiotics can stop working and 43.8% that the frequent use of these drugs can cause them not to work for future infections. These results are similar to those reported in a study conducted in Ghana, where it was observed that approximately 65% of the population consider that the frequent use of antibiotics increases the risk of developing bacterial resistance.<sup>25</sup>

Regarding attitudes, it was found that more than half of the respondents completed the cycle of antibiotic treatment prescribed by the doctor, which coincides with results reported in studies carried out in Thailand, China, Kuwait, and Mozambique.<sup>18,26–28</sup> Some reasons why people do not complete the prescribed antibiotic treatment have been described in the literature, among them, are i) improvement of symptoms, ii) forgetting to take the doses at the established times and iii) abandonment of treatment due to the appearance of adverse effects.<sup>18,29,30</sup> In this sense, our results showed that approximately one-third of the population reported discontinuing antibiotic treatment when there was an improvement in symptoms. The lack of adherence to treatment can cause therapeutic failures that can lead to complications in the health of the individual, as well as the increase in the selection pressure of resistant bacteria. On the other hand, it was found that 43.8% of the population agrees with keeping antibiotics in their home, showing greater frequency in patients. This could increase the probability of using and recommending the use of antibiotics without a medical prescription for any type of infection inappropriately. In this sense, it is necessary to carry out studies in different regions of Colombia that evaluate the different factors associated with self-medication with antibiotics in both the urban and rural communities.

When we inquired about the practices related to the antibiotic consumption, it was found that 45.4% of the participants had consumed antibiotics in the last 6 months; of which 23.7% (14/59) were patients; however, the antibiotic consumption in household contacts was also high. This can be explained by the fact that CKD patients have a high consumption of antibiotics due to their underlying conditions.<sup>3</sup> On the other hand, the high consumption in household contacts could be related to the use of antibiotics in infections where are not required. The doctor was the largest prescriber of antibiotics; however, the “prescription” of these medicines by relatives and pharmacists is frequent. Particularly in Colombia, antibiotics are usually recommended and purchased at the pharmacy without a prescription,<sup>14,31</sup> which is consistent with the results of this study. Even though there are decrees in the country that regulate the sale of antibiotics under medical prescription, it is necessary to strengthen public policies that regulate the free sale of antibiotics, considering the limitations of access to the health system in some areas of the country.

Importantly, this study was able to demonstrate how KAP-based studies provide information on the problem of bacterial resistance in the study population; in this particular case, they allow education strategies to focus on aspects related to correct use of antibiotics and their differentiation from other medications, the different types of microorganisms, the causes of bacterial resistance and the actions that patients and their relatives can take to prevent their emergence.

Among the limitations of this study is the information bias of the instrument (interviewee bias, memory bias on the part of the interviewees, and interviewer bias). Furthermore, it is important to note that CKD patients may have prior knowledge about antibiotic use and antimicrobial resistance due to their constant contact with medical staff and their experiences treating infections.

## Conclusion

The results of this study show that there are many gaps in knowledge about bacterial resistance and the use of antibiotics, which could lead to an increase in their consumption and the selection pressure of resistant bacteria. Likewise, strong self-medication and a lack of adherence to treatment were evidenced. In addition, it is necessary to improve practices on the acquisition and sale of antibiotics in the community as well as in pharmacies, which highlights the need for more active surveillance regarding the consumption of these medications and an improvement in public policies that guarantee controlled access to them. This work allows designing and executing educational interventions specifically aimed at our study population, in turn improving the understanding of the problem of antibiotic resistance in the community. Finally, it is necessary to carry out KAP studies on the use of antibiotics in different cities of the country, towns and in rural areas where there are limitations in access to the health system, which would allow the implementation of educational strategies that make this problem visible.

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## Disclosure

The authors have no conflicts of interest to declare for this study.

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