ORIGINAL RESEARCH

Antimicrobial Consumption in Community Pharmacies in Uyo, Akwa Ibom State, Nigeria

Orebiyi EP[1*], Usifoh SF[2], Udoh IE[3], Ebong I[4], Ekuma AE[5] and Awofisayo SO[3].

[1]Department of Pharmacy, University of Uyo Teaching Hospital, Uyo, Akwa Ibom, Nigeria; [2]Department of Clinical Pharmacy and Pharmacy Practice, University of Benin, Benin City, Nigeria; [3]Department of Clinical Pharmacy and Biopharmacy, Faculty of Pharmacy, University of Uyo, Uyo, Nigeria; [4]Department of Internal Medicine, Division of Cardiovascular Medicine, University of California Davis, Sacramento, CA 95817, USA; [5]Department of Medical Microbiology and Parasitology, University of Uyo, Uyo, Nigeria.

Address for correspondence:
Dr. Ekaette Paul Orebiyi
Department of Pharmacy, University of Uyo Teaching Hospital, Box 860, Uyo, 520003, Uyo Nigeria.
Email: eorebiyi@yahoo.com; ekaet2016@gmail.com

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ABSTRACT

Background: Unnecessary antibiotic use is a major cause of emergence of antimicrobial resistance. The complex mechanisms associating antibiotic use and resistance are further complicated by irrational prescribing and antimicrobial overuse.
Objective: This research investigated antimicrobial consumption practices, and cost expenditures in the community including the resultant effects among patients who purchased drugs from pharmacies in Uyo, Akwa Ibom State.
Methods: A prospective observational study was conducted in 38 community pharmacies using a two-stage cluster sampling method from the mapped political wards (11) in Uyo city. A total of 660 questionnaires were distributed to patients over 3-months. Data was analyzed using SPSS Version 23.0. Results were presented as tables and charts.
Results: A total of 546 respondents participated in the study achieving a response rate of 82.7%. The most commonly consumed antimicrobials were antibiotics 385 (54.8%) followed by antimalarials 246 (35.0%). In the class of antibiotics, fluoroquinolones 179 (23.28%) and beta-lactams 157 (20.42%) were frequently purchased. The antimicrobial encounter rate was different ($P<0.05$) among the pharmacies with mean value of 25.95% (4.43% to 47.87%). The cost expenditure on antimicrobials was also different ($P<0.05$) among the pharmacies with mean value of 30.54% (12.78 % to 66.67%). Drug therapy problems included wrong drug combinations 80 (14.7%), adverse effects 3 (0.5%), polypharmacy 45 (8.3%) and a non-adherence rate of 17.0%.
Conclusion: Antimicrobial consumption rates in Uyo LGA are high. Antimicrobial encounter rate and expenditure was different across various pharmacies. The antibiotic classes, fluoroquinolones and beta-lactams were the most commonly consumed antimicrobials.

Keywords: Antimicrobial consumption; Community pharmacies; Antimicrobials; Cost expenditure; Uyo

INTRODUCTION

There are increasing daily challenges associated with antimicrobial use particularly, the class of antibiotics because of resistance reports detected from laboratory screening and testing for infections. These test results pose challenges as well as increased costs of treatments for different infections. Despite the growing

worldwide attention to antimicrobial resistance (AMR), limitations in understanding the burden, distribution and determinants of AMR at the population level have highlighted the importance of population-based approaches to assess the association between antimicrobial use and AMR in humans and animals[1,2]. There is scarce literature about antibiotic consumption in Uyo, Akwa Ibom State and other parts of Nigeria.

Antibiotic use is a known risk factor for the emergence of antibiotic resistance, but demonstrating the causal link is challenging because of the complex relationships between antibiotic use and emergence or spread of AMR[3-5]. In developing countries, the causes of AMR are complex[6]. Antimicrobial prescription and consumption behaviour monitoring provides insight and tools needed to inform therapy decisions, assess public health consequences of antimicrobial misuse and evaluate impact of resistance prevention interventions. As an advocacy resource at the local or national level, the European Surveillance of Antimicrobial Consumption Program (ESAC) has demonstrated that monitoring of antimicrobial use patterns and costs is a crucial factor for driving political commitment to successful campaigns to contain resistance, particularly when surveillance of antimicrobial use is enhanced by surveillance of resistance[7-12].

Community pharmacies are regarded as primary healthcare centers where there are likely cases of irrational use of antibiotics and possible non-prescription-based sales. The pattern of antimicrobial consumption practices, cost expenditures in the community and the subsequent effects in patients who purchased drugs from pharmacies in Uyo, Akwa Ibom State was assessed. The objective of this study was to investigate antimicrobial consumption practices and cost expenditures in the community including the resultant effects among patients who purchased drugs from pharmacies in Uyo, Akwa Ibom State.

METHODS

Study location

This study was carried out in Uyo local government area (LGA), the capital of Akwa Ibom State, in south-southern Nigeria. It has a land mass of 156,000 km^2 and estimated population of 456,972[13].

Study design and Sampling method

This was a prospective observational study. A sample size of 642 was calculated using the Krejcie and Morgan formula for sample size determination[14]. Thirty-eight Pharmacies were selected from 79 registered pharmacies in Uyo LGA using a two-stage cluster sampling method. The pharmacies were mapped into the 11 Wards in Uyo LGA and three pharmacies were selected from each Ward and four from the five largest Wards. Clients patronizing the selected pharmacies and pharmacy superintendents were involved in the study. Fourteen pharmacies were purposively selected from the 38 for assessment of antimicrobial cost expenditures.

Participant recruitment

All visitors to the selected pharmacies were approached to be screened for participation in the study. All eligible and consenting persons were administered a detailed questionnaire encompassing biodata, presenting complaints, drugs purchased, and other information.

Inclusion Criteria

All adults 18 years and above who purchased antimicrobials by prescription or otherwise, from the pharmacy were enrolled, upon consent.

Exclusion Criteria

Caregivers who were not consuming the antimicrobials themselves, were excluded from this study.

Study Instrument

The study instrument was a 36-point questionnaire developed by the researchers

to provide information on socio-demographic data, pharmaceutical dosage type, antimicrobial type, cost and regimens, adherence data, drug taking and storage habits. The questionnaire was pre-tested on twenty-two subjects and then adjusted as the Test Instrument, and subsequently utilized to conduct the study. Additionally, antimicrobial drug sales and total drug sales for 3 months were computed by the superintendents of the participating pharmacies.

Instrument administration

Participants were educated on the purpose of the study and informed consent obtained prior to the interview. Data collection forms were also distributed to the 38 pharmacists for the required additional information. Information gathering was completed using face-to-face interviews by pharmacists and pharmacy students. There were trainings for the interviewing team of enumerators, feedbacks and meetings at monthly intervals. The study instrument was administered over a period of 3 months between March and May, 2019. Adherence and outcome were assessed by phone calls placed to the participants one week after purchase of antimicrobials.

Data analysis

Completed questionnaires were coded and data inputted into MS EXCEL and transferred to Statistical Product and Service Solution (SPSS) Version 23 (IBM Inc., USA) for analysis. Data was expressed in percentages, means and presented in tables, bar and pie charts.

Cost spent on purchasing antimicrobials (CSP) was calculated as percentage antimicrobial cost per pharmacy as follows:

$$CSP = \frac{Average\ Total\ cost\ of\ antimicrobials\ dispensed\ in\ 3\ month}{Average\ Total\ cost\ of\ drugs\ sold\ in\ 3\ months}$$

…… Equation 1[15].

This formula was adapted from secondary school mathematical formula. It was calculated monthly as percentages and mean monthly percentages were obtained.

Antimicrobial encounter rate (AER), defined as proportion of patients purchasing Antimicrobials per Pharmacy, was also calculated using the adapted mathematical formula:

$$AER = \left(\frac{Number\ of\ patients\ who\ bought\ antimicrobial\ agents}{Number\ of\ patients\ who\ bough\ \ drugs}\right) * 100$$

…….. Equation 2[15].

Monthly AER was calculated for each month of the study.

Prescriptions (and drug purchases) were labelled as right or wrong by a Clinical pharmacist based on whether drugs requested were suitable for the indication. Tables, bar graphs and pie charts were used to display results. Differences between more than two groups were analyzed by one-way and two-way ANOVA.

Ethical approval

The study was approved by the University of Uyo Institutional Health Research Committee (Ref: UU/CHS/IHREC/VOL.1/005). A statement of confidentiality was given prior to study commencement. Informed Consent was received from all the study participants prior to study participation. Authorization for participation was also received from the community pharmacies prior to enrolment. No identifying data was collected from the participants.

RESULTS

Socio-demographic characteristics of the respondents

Out of 660 questionnaires distributed, 546 questionnaires were completed and returned to achieve a response rate of 82.7%. Majority of the respondents were male (52.4%) and 40.8% were between 26-35 years old. Characteristics of the study participants are shown in Table 1.

Table 1: Demographic Profile of the respondents (N=546)

Variables	Frequency	Percentage (%)
Gender		
Male	286	52.4
Female	260	47.6
Age		
18-25	171	31.3
26-35	223	40.8
36-45	103	18.9
46-55	39	7.1
56-65	10	1.8
Marital status		
Married	170	31.1
Single	334	61.2
Divorced	19	3.5
Widowed	23	4.2
Level of Education		
No Formal Education	25	4.6
Primary Education	46	8.4
Secondary Education	112	20.5
Tertiary Education	363	66.5
Occupation		
Civil servant	123	22.5
Unemployed	82	15.0
Student	128	23.4
Self-employed	103	18.9
Retired	13	2.4
Public servant	36	6.6
Business/Trading	61	11.2
Monthly Income/Allowance		
No response	96	17.6
less than 10,000	119	21.8
10,000 -19,999	88	16.1
20,000 - 29,999	27	4.9
30,000-39,999	38	7.0
40000-49,999	44	8.1
50,000-59,999	32	5.9
60,000-69,999	14	2.6
70,000-79,999	14	2.6
80,000-89,999	72	13.2
Greater or equal to 90,000	2	0.4
Place of Residence		
No response	19	3.5
Rural	88	16.1
Urban	439	80.4

Antimicrobial consumption

The classes of antimicrobials purchased by respondents include antimalarials, anti-tuberculosis agents, systemic antimycotic agents, antiviral agents, and others (Figure 1). Fifty-two different antimicrobial agents were purchased by participants in this study. The most common types of

antimicrobial agents purchased by participants were artemisinin combination antimalarials (27.96%), fluoroquinolones (23.28%), beta-lactams (20.42%), imidazoles (5.59%) and macrolides (4.16%), shown in Table 2. Most participants in the study purchased a single antimicrobial agent (61.5%) followed by two agents (28.4%), three agents (2.2%), and four or more agents (1.3%), shown in Figure 2.

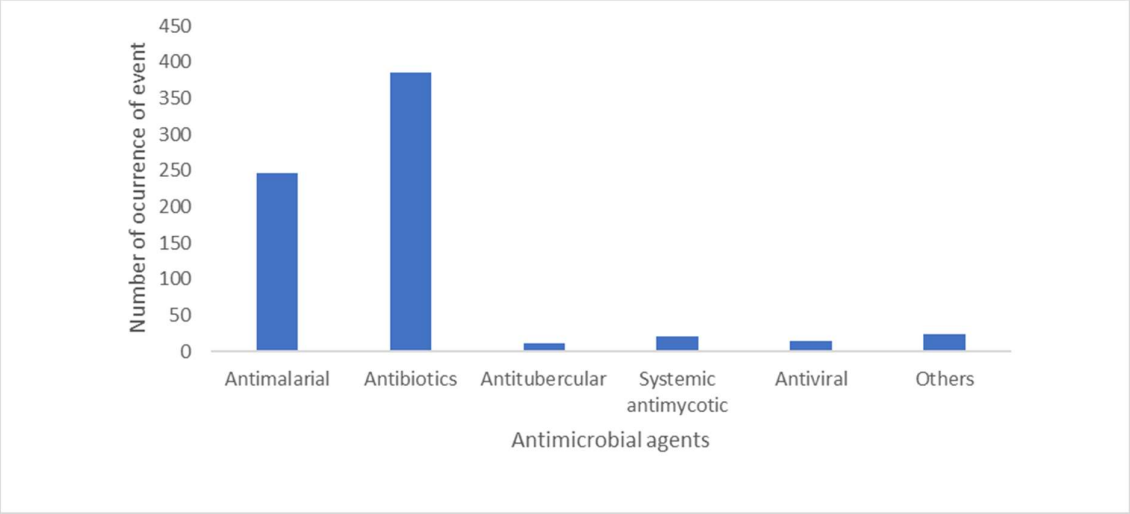

Figure 1: Consumption rates of antimicrobial classes

Table 2: Consumption rate of participants by antimicrobial types

Antimicrobials	N=769	Percentage
ACT antimalarials	215	27.96
Fluoroquinolones	179	23.28
Beta-lactams	157	20.42
Imidazoles	43	5.59
Macrolides	32	4.16
Tetracyclines	25	3.25
Antifungals	25	3.25
Other Antimalarials	19	2.47
Chloramphenicol	15	1.95
Aminoglycosides	12	1.56
Co-trimoxazole	11	1.43
Antivirals	9	1.17
Lincomycin	4	0.52
Nitrofurantoin	4	0.52
Others	19	2.47

The 3-month antimicrobial encounter rate is shown in Table 3. The mean antimicrobial encounter rate ranged from 4.43 ± 7.68% to 41.91 ± 6.51% while the overall mean encounter rate was 25.95 ± 16.61%.

Quality indicators of antimicrobial use

The quality indicators assessed showed that 52.2% of participants made use of screening tests while 66.7% of prescriptions were assessed to be correct for the stated indication (Table 4).

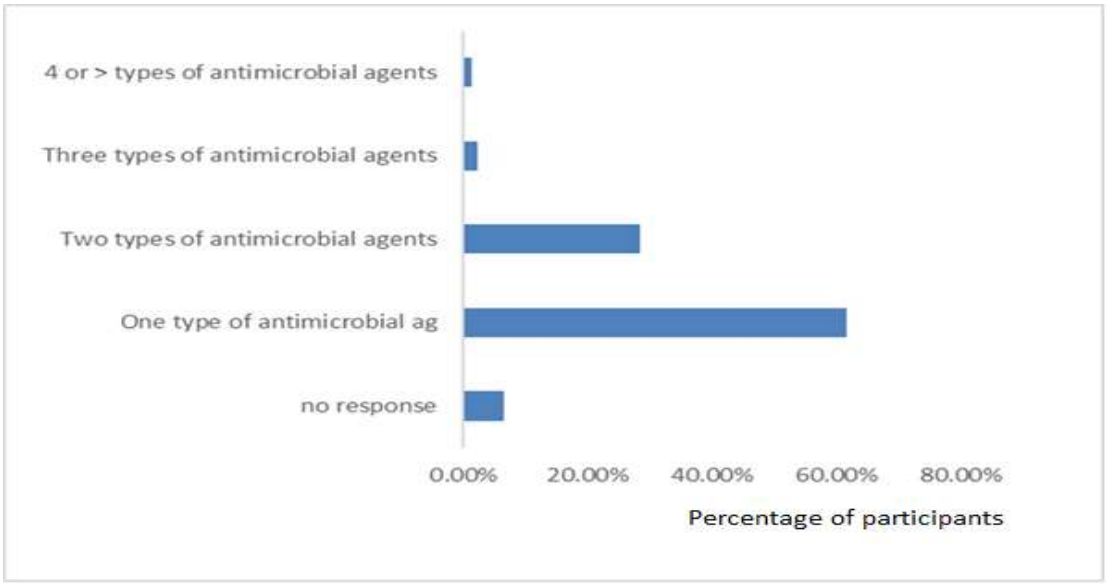

Figure 2. Antimicrobial classes showing monotherapy versus polytherapy

Table 3: Mean antimicrobial encounter rate of participating Pharmacies

Pharmacies	Mean±.SD%	*p*-Value
Pharmacy 1	33.73 ± 1.41	0.05
Pharmacy 2	41.91 ± 6.51	
Pharmacy 3	24.09 ± 3.72	
Pharmacy 4	15.47 ± 1.51	
Pharmacy 5	29.48 ± 3.83	
Pharmacy 6	47.87 ± 7.24	
Pharmacy 7	16.99 ± 0.36	
Pharmacy 8	39.63 ± 10.25	
Pharmacy 9	15.97 ± 15.39	
Pharmacy 10	32.94 ± 29.56	
Pharmacy 11	12.81 ± 11.19	
Pharmacy 12	23.31 ± 20.19	
Pharmacy 13	24.67 ± 27.30	
Pharmacy 14	4.43 ± 7.68	
Total	25.95 ± 16.61	

All participants were followed up via phone calls and majority of those who reported their outcome (26.6%) said they experienced improvement in symptoms (Table 4) while 81.4% reported adherence to their antibiotic regimen one week after procurement of the medication.

Antimicrobial cost

The mean monthly cost of antimicrobials purchased at the different pharmacies over the 3-month period ranged from N76,533.33 to N3,282,172.33 while the percentage antimicrobial cost ranged from 12.78% to 66.67% as shown in Table 5.

Table 4: Quality indicators for antimicrobial use

Variables	Frequency	Percentage
Respondents did Test, X-rays or Scans		
No	261 (47.8)	47.8
Yes	285 (52.2)	52.2
Right or Wrong Drug based on their indication		
Not decided	102	18.7
Right drug	364	66.7
Wrong Drug	80	14.7
Outcomes of antimicrobial treatment		
Resolved/recovered/much better	139	25.5
Improved (fair)	145	26.6
Worsened	16	2.9
Adverse event recorded	3	0.5
Failure/no change	14	2.6
New symptoms observed	6	1.1
No response/Blank	223	40.8

Table 5: Cost spent on purchasing antimicrobials (CSP) at Pharmacies

Pharmacies	Mean total cost of antimicrobials purchase per Pharmacy (N)	Mean total cost of all drug purchase per Pharmacy (N)	Percentage antimicrobial cost per Pharmacy	*p*-value
Pharmacy 1	169,923.33	850,426.67	19.98	0.05
Pharmacy 2	880,900.00	1,872,535.00	47.04	
Pharmacy 3	783,333.33	5,900,666.67	13.28	
Pharmacy 4	371,666.67	1,490,166.67	24.94	
Pharmacy 5	1,810,276.67	5,420,103.33	33.40	
Pharmacy 6	3,282,172.33	6,621,343.67	49.57	
Pharmacy 7	374,801.67	2,569,455.00	14.59	
Pharmacy 8	360,686.67	1,017,232.00	35.46	
Pharmacy 9	196,476.00	1,427,120.00	13.77	
Pharmacy 10	200,000.00	483,333.33	41.38	
Pharmacy 11	268,333.33	2,100,000.00	12.78	
Pharmacy 12	723,560.00	1,085,285.74	66.67	
Pharmacy 13	251,666.67	1,350,000.00	18.64	
Pharmacy 14	76,533.33	209,316.00	36.56	
Total	**9,673,796.67**	**32,396,984.08**	**30.54**	

DISCUSSION

There are prior reports of antimicrobial consumption data in hospital settings[16,17] but little or no information is available in the community setting. Antimicrobials are frequently consumed in community settings, but definitions of drug use patterns are complex. This study set out to provide empirical data about antimicrobial consumption in communities in Uyo, Akwa Ibom State, information that is not currently available in literature though the need for this data is supported by previous studies[18,19]. The study showed that antimicrobial consumption and expenditure differ between pharmacies. The cost expenditure on antimicrobials across pharmacies in our

study was 30.54%. This implies on the average, that one-third of drug purchases in pharmacies in Uyo LGA are antimicrobials. Increased antimicrobial consumption percentages (44% - 97%) have also been reported in other studies[20,21]. The number of patients and their characteristics, pharmacy size and clinical knowledge of the pharmacist were observed to contribute to the consumption differences. Some of the pharmacies recorded consumption values as high as 66.67%, implying the need for interventions to increase education and promote judicious use of antibiotics.

The mean antimicrobial encounter rate was equally different amongst the pharmacies with a mean value of 25.95%. The high variability in the encounter rates within the study group should be investigated in future studies. A study at the University of Uyo Teaching Hospital, Uyo had reported an overall antimicrobial prevalence rate of 62.4% in the wards[22]. A prior study conducted in the rural town of Sahaswan in Northern India had also revealed that antibiotics accounted for 16.7% of medications used for self-medication[23]. The study showed that expenditure on antimicrobial purchases represented one third of total expenditure spent in pharmacies. Of the antimicrobials purchased, antibiotics were most commonly consumed (54.8%), while antimalarials (35.0%) were the next most frequently consumed agents. Fluoroquinolones were the most commonly prescribed antibiotic (23.28%) followed by beta-lactam antibiotics (20.42%) while the least purchased antibiotics were of the lincosamide group (0.5%). A study carried out in Poland, had reported very high levels of antibiotic prescribing, where broad spectrum antibiotics alone contributed to 25.81% of the total antibiotic consumption when compared to 0.68% in Finland[24]. This study showed higher estimates for fluoroquinolone and beta-lactam consumption than that obtained in Poland. Another study in India which assessed extent and pattern of antibiotic use in a tertiary care facility reported the high tendency for use of injections and antibiotic combinations at 36% unlike rates reported in UK and US (18% and 20%) respectively[25]. In this study, among the clients of pharmacies purchasing antimicrobials, 31.5% consumed dual combinations whilst 39.8% study participants consumed two or more than two antimicrobial agents. There is also increasing use of antimicrobial combinations similar to what was reported in the Indian study[25]. Artemisinin combination therapies (ACTs) were the most frequently consumed antimalarial (27.96%). However, treatment with single agents like Fansidar® and proguanil were still documented by 2.5% of the study participants which is a much lower value for these monotherapies than before.

A cross sectional study in northern Tanzania had reported irrational use of antibiotics to include prescription of incorrect doses, self-medication and treatment of non-bacterial illness and attributed increasing resistance to commonly available antibiotics to be a direct consequence of irrational antibiotic use[26]. Findings from this study demonstrated failure to refer patients with skin/soft tissue infections, inappropriate antimalarial combinations with antibiotics, wrong route of drug administration such as that reported with parenteral alpha, beta-artemether administered through the intravenous route, polypharmacy, wrong drug or wrong drug combinations as factors associated with irrational use of antimicrobials in the community. Three cases of adverse events were reported, and negative outcomes of antimicrobial therapy included worsening symptoms, treatment failure and development of new symptoms. Absence of diagnostic testing before drug use also reduced quality use of antimicrobials.

The study has strengths. This is a prospective study and the first to evaluate antibiotic use in Uyo LGA. The rigorous methods and face to face interview approach applied to data collection promotes reliability of the information collected in this study. The study also has some limitations. Being a descriptive study, it could not account for

confounding factors that could possibly affect antimicrobial usage and cost expenditures across various pharmacies.

CONCLUSION

Antimicrobial consumption rates in Uyo LGA are high. The antimicrobial encounter rate and expenditure were different across various pharmacies. The antibiotic classes, fluoroquinolones and beta-lactams were the most commonly consumed antimicrobials. Training of community pharmacists and staff and their engagement in antibiotic stewardship programmes is key to promoting judicious antibiotic use. Regular surveillance of antimicrobial use in communities will provide useful data that will inform government policies regarding antimicrobial use.

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