

Knowledge of Antibiotic Use and Antimicrobial Resistance among Healthcare Workers at a Tertiary Hospital in Monrovia, Liberia; A Facility-Based Cross-Sectional Study

Victor Saah Taylor¹, Bluefin Masell Freeman² and Bode Irete Shobayo^{1,2*}

¹Department of Biological Sciences, College of Science and Technology, University of Liberia, Louisiana, Liberia

²Department of Technical Services, National Public Health Institute of Liberia, Monrovia, Liberia

Corresponding author:

Bode Irete Shobayo,
Department of Biological Sciences,
College of Science and Technology,
University of Liberia,
Louisiana, Liberia;
E-mail: bodeishobayo@gmail.com

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Abstract

Background: Globally, healthcare systems are currently facing a significant challenge in terms of antibiotic resistance. Healthcare workers actively participate in the process of prescribing and administering antibiotics. **Aim:** Was to assess the knowledge regarding antibiotic use and antibiotic resistance among healthcare workers working in a tertiary hospital located in Monrovia, Liberia. **Methods:** A hospital-based cross-sectional survey was carried out and study participants were selected using convenient sampling. Statistical analysis was performed by using Epidemiological information (Epi-Info) 7.2.5.0 after entering the data using Microsoft Excel 2016. **Results:** Sixty-one (61) health workers with ages ranging from 20-60 years took part in the study. The mean age of the study participants was 29.6 years (± 5 , range=27–32) with males accounting for 19 (31.1%) of the participants while 42 (68.9%) were females. Majority of participants, 38 (62.3%), reported that they never had AMR training before and only 27 (44.3%) said that antibiotics are used to treat bacterial infections. Being female (aOR: 0.45; 95% CI: 0.21–0.96) and having a high school diploma (aOR: 11.2; 95% CI: 3.94-35.1) were significantly associated with knowledge of AMR. **Conclusion:** The results of this study suggest that the knowledge of healthcare workers on Antimicrobial Resistance (AMR) was found to be generally moderate. For healthcare workers to effectively support efforts aimed at preventing antibiotic resistance, they must enhance their knowledge on antibiotic usage and Antimicrobial Resistance (AMR). The study also provides baseline data that might be utilized in the development of a program to enhance the knowledge of healthcare workers on AMR.

Keywords: Knowledge; Antimicrobial resistance; Healthcare workers; Liberia

Introduction

Since their introduction, antibiotics have been used routinely for managing infections and have improved the management of infectious diseases, resulting in reduced morbidity and mortality [1]. Recent data, however, point to a significant issue for public health because of the rise in antibiotic resistance [2,3]. The World Health Organization (WHO) has identified Antimicrobial Resistance (AMR) as among the top 10 global public health challenges to mankind [4].

Approximately 700,000 people die each year as a result of infections with antibiotic-resistant organisms, according to estimates [5,6]. Based on economic projections, these infections would result in 10 million annual deaths by the year 2050 and have a global economic impact of more than USD 1 trillion by the year 2030 [5,7,8]. Although AMR affects all countries, the impact is disproportionately greater in low and middle-income nations [9].

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Due to the high rate of diseases, inappropriate antimicrobial use, easy access to over-the-counter antibiotics, and dearth of clinical microbiology facilities for antimicrobial susceptibility testing, the challenge of antimicrobial resistance is complex in low-income countries [2,10]. AMR has substantially impeded the ability to treat diseases like tuberculosis and pneumonia, manage newborn diseases, and deliver vital therapies like chemotherapy and surgery [11,12]. People with severe illnesses are usually affected by AMR, and they frequently need antibiotic treatment. Typically, these patients receive care in healthcare centers where they interact often with other patients and staff members. As a result, there is an increased likelihood of resistance developing and then spreading both within and between patients [13,14].

Uncontrolled use of antibiotics is thought to be a major contributor to the emergence of bacteria that are resistant to antibiotics in health facilities resulting in and causing difficulties in treating patients [15-19]. Inadequate training, knowledge, attitude, prescribing practices, interactions between patients and doctors, and drug marketing are the main causes of the inappropriate use of antibiotics among Healthcare Workers (HCWs) [20]. They play a direct role the prescription and usage of antibiotics and might comply with improper patient requests or engage in improper practices, both of which raise the risk of developing antibiotic resistance [19,21,22]. Promoting awareness and providing information on responsible antimicrobial use may help healthcare providers make better judgments [23,24].

Irrational medication use in Liberia is related to systemic issues such as the high frequency of use of expired medications and insufficient numbers of trained healthcare providers. In many cases, health facility dispensaries may also be inadequately maintained and personnel may not be aware, therefore do not consult the standard treatment guidelines and essential medicines list when prescribing [25]. In research context, there is also very limited evidence on the knowledge of AMR among HCWs in Liberia regarding AMR. Such evidence could be critical for designing and implementing interventions to prevent and control AMR. This study therefore assessed the knowledge of HCWs regarding antibiotic use and AMR at the Eternal Love Winning Africa (ELWA) Hospital from January to March 2023.

Materials and Methods

Study setting and design

This was facility-based cross-sectional study conducted to assess the knowledge of HCWs regarding antibiotic use and AMR at the Eternal Love Winning Africa (ELWA) Hospital in Montserrado County, Liberia from January to March 2023. The ELWA Hospital is a private hospital and one of the country's major tertiary care facilities, with about 120 beds [26]. The institution serves a significant proportion of the people in Montserrado County which is the country's only urban county and hosts most of the healthcare facilities and

diagnostic services such as hospitals, laboratories and pharmacies.

Study population and sample size

HCWs working in the various departments of nursing, pharmacy, medicine, laboratory, and midwifery at the ELWA Hospital made up the study population. Convenience sampling was employed to select study participants based on their availability during the study period. A total of 68 participants were approached and 61 agreed to participate in the study.

Inclusion and exclusion criteria

All HCWs in the departments of nursing, pharmacy, medicine, laboratory, and midwifery at the ELWA Hospital who were available during the period of data collection and agreed to be interviewed were included in the study. HCWs who were unwilling or on leave were excluded.

Data collection

Study data were collected using a pretested semi-structured, self-administered questionnaire which was developed based on one used in previous studies but modified for this study purpose [27-29]. The questionnaire included questions about the socio-demographic characteristics of participants, and the knowledge about antibiotic use and AMR. Questionnaires were distributed to healthcare workers who worked both day and night shifts. Two nurses who work in the hospital provided assistance to the study team with the distribution and collection of the surveys.

Data measurement techniques

The study questionnaire had six questions each about knowledge regarding antibiotic use and AMR, in addition to questions on the socio-demographic characteristics of study participants. Each correct response received a score of 1 and an incorrect response received a score of 0 with the highest score for knowledge being 6. Knowledge was categorized as good ($\geq 80\%$), moderate (60% to 79%) and poor ($<60\%$).

Study variables

This study's dependent variable were knowledge regarding antibiotic use and AMR, whereas potential independent variables included age, sex, level of education and field of discipline.

Statistical analysis

The data for the study was entered and cleaned using Microsoft Excel 2016 and any inconsistencies or errors in the data were identified and rectified. Epidemiological information (Epi-Info) 7.2.5.0 was used for further analysis. The researchers conducted descriptive data analyses, which involved examining frequencies and percentages. The utilization of inferential analysis was employed to examine potential correlations between variables. The threshold for

determining statistically significant differences was established at a significance level of $p < 0.05$.

Ethical considerations

Written informed consent was obtained from each participant and ethical approval for this study was obtained from the University of Liberia Institutional Review Board (UL-IRB/JCT-CH/66/'23). To ensure the confidentiality of study participants, no personally identifiable information was collected.

participated in the study. The remaining 7 (10.3%) could not fully participate mainly due to lack of time. The mean age of the study participants was 29.6 years (± 5 , range=27–32). Males accounted for 19 (31.1%) of the participants while 42 (68.9%) were females. The majority of participants were nurses 36 (59%), followed by pharmacists 8 (13.1%), doctors 7 (11.4%) laboratory technicians 6 (9.8%) and midwives 4 (6.5%). Regarding academic qualification, most participants 28 (45.9%) were high school diploma holders followed by Bachelor's degree holders 22 (36%), and Masters' degree holders 11 (18%) (Table 1).

Results

Demographic characteristics of study participants

Out of a total of 68 HCWS who met the eligibility criteria during the study period, 61 (89.7%) of them fully

Table 1: Demographic characteristics of the study participants (n = 61).

Variable	Categories	Frequency	Percent
Age (years)	Mean=29.6 (± 5.31)	Min=20, Max=60	
	20–30	8	13.1
	31–40	23	37.7
	41–50	17	27.8
	51–60	12	19.6
Sex	Male	19	31.1
	Female	42	68.9
Highest academic qualification	High school diploma	28	45.9
	Bachelor's	22	36
	Master's	11	18
Field of discipline	Nurses	36	59
	Pharmacists	8	13.1
	Doctors	7	11.4
	Laboratory technicians	6	9.8
	Midwives	4	6.5

Knowledge of AMR among study participants

Table 2 shows that the majority 38 (62.3%) reported that they have never previously had training about AMR. Out of the 61 total participants, 37 (60.7%) and 41 (67.2%) responded that antibiotics are effective in treating viral infections and

malaria respectively. Up to 40 (65.6%) also said that antibiotics are effective in treating common cold and only 27 (44.3%) said that antibiotics are used to treat bacterial infections.

Table 2: Knowledge of participants regarding antibiotic use and AMR (n=61).

Variable	Categories	Frequency	Percent
Knowledge questions			
It is okay to self-medicate with antibiotics	Yes	24	39.3
	No	37	60.7

As a healthcare worker, it is important to be trained about AMR	Yes	23	37.7
	No	38	62.3
As a healthcare worker, I am aware of AMR	Yes	35	57.3
	No	26	43
Antibiotics can be used to treat viral infections	Yes	37	60.6
	No	24	39.3
Antibiotics are used to treat bacterial infections	Yes	35	57.4
	No	26	42.6
Antibiotics are used to treat malaria	Yes	20	32.8
	No	41	67.2

Knowledge of AMR and association with demographic characteristics

On examining the relationship between the socio-demographic characteristics and knowledge of AMR among study participants, being female ($P=0.026$), a nurse ($P=0.017$), a doctor ($P<0.001$) and having a high school

diploma ($P<0.001$) were found to be significantly associated. However, when modeled in multivariable logistic regression analysis only being female (aOR: 0.45; 95% CI: 0.21–0.96) and having a high school diploma (aOR: 11.2; 95% CI: 3.94–35.1) remained significantly associated with knowledge of AMR (Table 3).

Table 3: Association between healthcare workers' knowledge of AMR and demographic characteristics.

Variables	Categories	Knowledge		P value	AOR (95% CI)	P value
		Good (%)	Poor (%)			
Sex	Female	19 (45.2)	23 (54.8)	0.026	0.45 (0.21–0.96)	0.046
	Male	12 (63.2)	7 (36.8)	<0.748	1.65 (0.41–0.96)	0.618
Field of discipline	Nurses	20 (55.5)	16 (44.4)	0.017	1.27 (0.52–2.12)	0.646
	Pharmacists	4 (50)	4 (50)	0.615	1.26 (0.54–2.94)	0.801
	Midwives	4 (57.1)	3 (42.9)	0.73	1.12 (0.45–2.74)	0.417
	Doctors	5 (83.3)	1 (16.7)	<0.001	1.45 (0.70–3.04)	0.3
	Laboratory technicians	2 (50)	2 (50)	0.783	1.23 (0.64–2.63)	0.503
Level of education	High school diploma	10 (35.7)	18 (64.3)	<0.001	11.2 (3.94–35.1)	<0.001
	Bachelor's	16 (72.7)	6 (27.2)	0.471	1.25 (0.62–2.12)	0.428
	Master's	9 (81.8)	2 (18.1)	0.294	1.42 (0.31–0.98)	0.501

Discussion

HCWs have a crucial role in preventing the development and spread of AMR by educating patients and minimizing the spread of infections in healthcare settings, especially when treating infections by prescribing, dispensing, and administering antibiotics [30,31]. The objective of this study was to assess the level of knowledge regarding antibiotic resistance and its related aspects among HCWs. Our study has several significant findings.

This study revealed that factors such as male gender, higher level of education, familiarity with the classification of over-

the-counter medications, and field of discipline were identified as significant contributors to a strong understanding of antimicrobial resistance. Several prior research have documented that factors such as male gender, work experience, a lower number of working hours per week, and a history of antibiotic intake have been identified as influential elements in the development of a strong understanding of AMR [32–34]. In a previous study that was carried out, the associated factors such as the differences in education and training as well as professional responsibility for managing and treating infections between professional groups was also associated with knowledge of AMR;

consequently, medical doctors achieved the highest scores [35,36]. In their study, Hayat et al. found a statistically significant correlation between age, years of experience, and knowledge pertaining to AMR. Previous research has also documented that nurses with a master's degree have a more favorable disposition toward mitigating AMR. However, it is worth noting that no statistically significant association was observed between awareness of AMR and training in that study. This highlights the necessity of formulating inventive strategies and techniques to educate HCWs to promote the proper utilization of antibiotics and prevent the emergence of antimicrobial resistance.

The majority of participants (61%) thought that the irrational use of antibiotics could accelerate the emergence of antibiotic resistance. This result is marginally less than other research conducted in Namibia and Ethiopia, where up to 78.3% and 72%, respectively, of respondents believed that overuse of antibiotics could result in antibiotic resistance. While this is a positive finding, up to 37 (38%) of the participants said that the improper use of antibiotics does not hasten the development of antibiotic resistance [37-39]. This is indeed concerning because in many cases, some of these HCWs would be responsible for prescribing medications to patients and the risk for irrational prescription of antibiotics may exist.

According to the findings of our study, HCWs have a moderate level of knowledge on AMR. Similar findings were reported by Balliram et al. in 2021 in South Africa, when it was noted that pharmacists and nurses exhibited deficiencies in their knowledge, attitudes, and practices regarding AMR. The findings are also consistent with those that were reported in Nepal, which suggests that HCWs have a moderate level of knowledge, attitudes, and practices about AMR [40]. This finding indicates that further engagement with HCWs needs to take place on a level that not only raises awareness and increases knowledge but also brings about behavior change and an understanding of how to support the wider AMR stewardship within their working environment.

This study has several limitations, the most significant of which is its relatively small sample size, which is restricted to just healthcare employees at a single health facility. Because of this, it may be difficult to generalize our findings to the entirety of the country. When respondents were asked to fill out the questionnaire, social desirability bias could have taken place. In this study, we placed a strong emphasis on maintaining complete confidentiality for all of the respondents to minimize this bias.

Conclusion

The findings of this study fill an essential evidence gap in evaluating the level of knowledge of AMR among HCWs in Liberia. According to the findings, HCWs need to increase their understanding of antibiotic usage and AMR in order to successfully contribute to initiatives for the prevention of antibiotic resistance. In the context of the research setting,

the study supplies baseline data that may be used to build a program that can improve the knowledge of HCWs.

What is already known on this topic:

- HCWs are an important source of information to the patients as it relates to HBV infection and the prevention of its spread.
- Inadequate knowledge, poor attitude and bad practices by HCWs can significantly have a negative impact on the prevention of HBV infection.

What this study adds:

- The overall inadequate KAP of HCWs regarding HBV infection was inadequate.
- There is a pressing need for capacity building in IPC measures for HCWs in health facilities in Monrovia, Montserrado County.
- There is also a need for more HBV health promotion, targeted education, and training of HCWs.

Competing Interests

The authors declare no competing interest.

Authors' Contributions

BMF conceived this work and also coordinated data collection. She also contributed to writing the method section of this manuscript. BIS served as a technical research advisor on this project and led in the writing of all sections of this manuscript. SC served as the project lead and supervisor. He also did final revision and edits to this manuscript.

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