

Knowledge, Attitude and Practice of antibiotics Resistance survey among healthcare professionals in selected health centers in Greater Monrovia, Liberia

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ABSTRACT

Background: Antimicrobial resistance is a global challenge as it leads to a high risk of mortality and a more vital economic issue. Many programs and research have been implemented to improve the irrational use of antibiotics associated with reducing antimicrobial resistance.

Objectives: This cross-sectional study aims to evaluate the knowledge, attitude, and practice of anti-microbial resistance survey among health workers from two selected health centers in Liberia - Redemption Hospital and the John F. Kennedy Medical Centre.

Methods: The cross-sectional study used a survey questionnaire on antimicrobial resistance. One hundred and twenty-six health workers comprised of physicians, pharmacists, and nurses were recruited from the two health centers.

Results: A response rate of N = 29 (physicians), N = 16 (pharmacists) and N = 81 (nurses) was achieved for the health workers respectively. The results show that antibiotic is fundamentally used in the treatment of viral infection, 93.1% (N=27) of the physicians, 87.5% (N=14) of the pharmacists, and 77.8% (N=63) correctly responded to the questions. About 86% (N=25) of physicians, 81% (N=13) of the pharmacists, and 61.7% (N=50) disagree that antibiotic resistance is not an issue in Liberia. The proportion of health workers who agreed that antibiotics are not the ideal medication in the curing of fungal infections are 86% (N=25) physicians, 75% (N=12) pharmacists, and 64% (N=52) nurses. Relative to the testing, health workers' knowledge of antimicrobial resistance, 37.9% (N=11), 43.8% (N=7), and 32.1% (N=26) of the physicians, pharmacists, and nurses respectively agreed that bacteria that are resistant to antibiotics could be spread from person to person.

Conclusions: This study revealed important information on knowledge, attitude, and practice of physicians, pharmacists, and nurses about AMR that could be useful for designing a knowledge base research.

Keywords: Greater Monrovia, Antimicrobial resistance, antibiotics, Health workers, John F. Kennedy Medical Centre, Redemption Hospital, Liberia

Background

The World Health Organization has labeled antimicrobial resistance (AMR) is a global health threat that could affect every human and animal. A meta-analysis of antibiotic resistance of 40-selected journals has associated AMR with a high risk of mortality and more significant economic issues. Another systematic review of 15 selected journals correlated AMR to social deprivations in refugee camps, transits centers, and detentions facilities (Nellums, et al., 2018). Finally, revision of 120-journal within the sub-region (West Africa) identifies the illiteracy of the population to accept the emergence of AMR (Bernabe, Langendorf, Ford, Ronat, & Murphy, 2017).

The lack of knowledge on the emergence of AMR could post public severe health issues in the region where infectious disease is alarming. Antimicrobial resistance (AMR) is a challenge that faces both developed and developing nations, preferentially affecting low- and middle-income countries (Ying, et al., 2013). Antibiotics' inappropriate and overuse have increased resistant bacterial strains and adverse reactions, and economic burden on the national health system (Preethi & Lakshmi, 2017; Shehadeh et al., 2012).

Antimicrobial resistance (AMR) has become a severe global problem, especially showing adverse outcomes in low- and middle-income countries (Okeke, et al., 2005). The extra dosages or irrational consumption or prescribing of antibiotics will result in the presence of bacterial strains but also causes numerous adverse effects and reactions in our body (Preethi & Lakshmi, 2017). Drug paddlers selling antibiotics and citizens getting antibiotics as over-the-counter (OTC) drugs in Liberia pose a severe threat to multiple resistance problems. Notwithstanding, with the lack of enforcement on the regulation concerning prescription, over the counter (OTC) sales (Reardon, 2014; Morgan, Okeke, Laxminarayan, Perencevich, & Weisenberg, 2011) and environmental disposal of antibiotics which rank as a top priority (Gothwal & Shashidhar, 2015; Preethi & Lakshmi, 2017), resistance will remain a critical factor in especially developing nation like Liberia. The lack of susceptibility study before prescribing for patients also seems a significant factor of resistance in a country like Liberia, which is associated with resistance. Antibiotics' inappropriate and overuse have increased resistant bacterial strains and adverse reactions and economic burden the national health system (Preethi & Lakshmi, 2017; Shehadeh, et al., 2011). Therefore, knowledge about the driving forces behind antibiotics prescription is needed, and such information can be obtained employing a knowledge attitude and practice (KAP) survey (Garcia, et al., 2011). Therefore, the objective of the study is to evaluate the Knowledge, Attitude, and Practice of antibiotics Resistance survey among healthcare professionals in the selected health center in Greater Monrovia, Liberia

Methods

Study Area. The study was conducted using a cross-sectional study using a self-administered questionnaire that focused on antibiotics use and resistance from March to June 2019. The study was conducted in the

Redemption Hospital located on Bushrod Island, New Kru Town, and the John F. Kennedy Medical Health Centre in Sinkor, Monrovia, Liberia.

Study Population. The study consisted of a cross-sectional survey of Physicians, Pharmacists, and nurses recruited to participate from selected health sectors in Greater Monrovia, Liberia. The study recruited 126 health workers in three health sectors within Greater Monrovia. The recruitment of the health workers was geographically done in Greater Monrovia. A self-administered questionnaire was used to collect information among health workers.

Recruitment. The study recruited 126-health workers from both health facilities to take part in the antimicrobial resistance knowledge, attitude, and practice (KAP) survey. Recruitment criteria were based on medical doctors, nurses, and pharmacists working at Redemption Hospital and John F. Kennedy hospital involved with prescribing, dispensing, and patient counseling.

Procedure. The data was collected at the two hospitals, and the questionnaire was distributed to the participant to answer what they knew, and the questionnaire was returned after 2 minutes. The questionnaire was answered on the spot to avoid bias in answering the questions. The questionnaire's content was based on a previous survey described in the WHO (García, et al., 2011; Tevatia, Chaudhry, Rath, & Dodwad, 2016). Before release, it was reviewed by the Co-supervisor and later the Head supervisor to assess the relevance and wording of the questions and the accuracy. Answer from the knowledge, attitude, and practice will score 2-point for correct responses from health workers. From the survey, the participants or health workers will be categorized as knowledge, attitude, and practice of antibiotics. The self-evaluation results were later compared with the actual understanding of antibiotics (Pavydė, et al., 2015).

AMR Knowledge Assessment. There have been various approaches, some of which are educational program among the public and medical sectors concerning antibiotic resistance and relative health problems and prevention methods (Chen, 2005; Grigoryan, et al., 2007). An educational investigative study done in Vietnam and Thailand showed improved knowledge among health workers on reducing low-dose antibiotic dispensing behavior (Chalker, Ratanawijitrasin, Chuc, Petzold, & Tomson, 2005). The pharmacist's education on the rational use or dispensing of antibiotics is critical on the improvement of antimicrobial resistance (Apisarntharak, Tunpornchai, Tanawitt, & Mundy, 2008).

A study from Spain, Brazil, and Peru showed that over 90% of physicians saw AMR as problematic universally and nationally (Guerra, Pereira, Neves, Cardo, & Correa, 2007; Garcia, et al., 2011; San Francisco, et al., 2013). In another study, there was a significant difference among physicians and nurses on AMR knowledge ($p = 0.001$).

On the contrary, a small number of the participants concluded that AMR was problematic in hospitals (Bayeh, Mulugeta, & Wondemagegn, 2014) The results are similar to a study shown in three countries, Sudan, India, and DR Congo (Kheder, 2013; Qavi, et al., 2010; Thriemer, et al., 2013).

In addition, it appears that the knowledge of healthcare providers would be a persuading factor in the direction of behavior to dispense or prescribe antimicrobials. Insufficient knowledge does lead to misuse or overuse of antimicrobials. Improving the knowledge of antimicrobial stewardship by physicians, pharmacists, and other healthcare providers could improve their practice.

A 9-item quiz was administered to health workers at both health facilities – the Redemption Hospital and the John F. Kennedy Medical Centre. Health workers received 2 points for each correct answer. Topics of the knowledge assessment included the rational use of antibiotics, antimicrobial resistance, and a general question relating to antimicrobial resistance in Liberia.

AMR Attitude and Practice Assessment. The more appropriate practice and use of antibiotics could help fight against the proliferation of antimicrobial resistance. A study conducted showed that 95% of its study population reported that the proper use of antibiotics, education regarding the use of antibiotics, and patient care could help reduce the risk of AMR (Pham-Duc, et al., 2019; Firouzabadi & Mahmoudi, 2019). Therefore, the education of the research participants is vital in the understanding of AMR.

Statistical Analyses. The data was analyzed using SPSS version 26. Summary statistics were calculated to describe the sample profile. The outcome variables of interest were the results in (a) score of the quiz on AMR knowledge, (b) score of the quiz on AMR attitude, and (c) practice of AMR.

Chi-square and t-tests were used to detect differences between the health workers for categorical and continuous variables (transformed to improve normality if necessary). Paired t-tests were used to compare the knowledge assessment scores. The outcome variables of interest were the change in scores from health workers in a) knowledge, b) attitude and c) practices. The researcher used linear models for group differences in the changes quiz scores controlling for potential confounding variables.

Results

Sample characteristics. A total of 126 health workers were included in this study. Of the 126 health workers, 29 (69% male, 31% female) were physicians, 16 (50% male, 50% female) pharmacists, and 81 (17.3% male, 82.7% female) nurses (Table 1). The distribution of gender between the three types of health workers was statistically significant; $p < 0.001$. From table 1, 51.7% of the physicians, 50% of the pharmacists, and 37% of the nurse's year of experience were 6 – 10 years, respectively. There were no significant differences between the health workers found for health facility and service years.

Table 1: Demographic data profile of health workers

Variable	Health Workers			p-Value (chi-square)
	Physicians N (%)	Pharmacists N (%)	Nurses N (%)	
Health Facility				
- Redemption	16 (55.2)	11 (68.7)	47 (58.0)	0.66 (0.83)
- JFK Medical Centre	13 (44.8)	5 (31.3)	34 (42.0)	
Gender				
- Male	20 (69.9)	8 (50.0)	14 (17.3)	0.0001 (27.9)
- Female	9 (31.0)	8 (50.0)	67 (82.7)	
Service Year				
- 0 – 5 Years	11 (37.9)	4 (25.0)	23 (28.4)	0.15 (6.74)
- 6 – 10 Years	15 (51.7)	8 (50.0)	30 (37.0)	
- > 10 Years	3 (10.3)	4 (25.0)	28 (34.6)	

Knowledge of Antibiotics. There was no significant difference in the knowledge score between the physicians, pharmacists, and nurses on the response (Table 2). However, the results, 41.4% (N=12), 31.3% (N=5), and 49.4% (N=40) of physicians, pharmacists, and nurse,s respectively, correctly responded to the application of antibiotics in the management of bacterial infections. When asked as to whether an antibiotic is fundamental in the treatment of viral infection, 93.1% (N=27) of the physicians, 87.5% (N=14) of the pharmacists, and 77.8% (N=63) correctly responded to the questions. About 86% (N=25) of physicians, 81% (N=13) of the pharmacists, and 61.7% (N=50) disagree that antibiotic resistance is not an issue in Liberia. The proportion of health workers who agreed that antibiotics are not the ideal medication in the curing of fungal infections are 86% (N=25) physicians, 75% (N=12) pharmacists, and 64% (N=52) nurses. Relative to the testing, health workers' knowledge on antimicrobial resistance, 37.9% (N=11), 43.8% (N=7), and 32.1% (N=26) of the physicians, pharmacists, and nurses, respectively agreed that bacteria that are resistant to antibiotics could be spread from person to person.

Table 2: Knowledge on antibiotics between health workers

Question	Health Workers						p-Value (Chi-square)
	Physicians		Pharmacists		Nurses		
	Agree N (%)	Disagree N (%)	Agree N (%)	Disagree N (%)	Agree N (%)	Disagree N (%)	
The probability that an antibiotic works for all conditions	29 (100)	-	14 (87.5)	2 (12.5)	71 (87.7)	9 (11.1)	0.37 (4.25)
Antibiotics effective in bacterial infection	12 (41.4)	16 (55.2)	5 (31.3)	11 (68.8)	40 (49.4)	39 (48.1)	0.60 (2.76)
Antibiotics effective in viral infection	-	27 (93.1)	2 (12.5)	14 (87.5)	14 (17.3)	63 (77.8)	0.15 (6.73)
Antibiotics effective in protozoa infection	5 (17.2)	21 (72.4)	-	14 (87.5)	21 (25.9)	52 (64.2)	0.22 (5.76)
Antibiotics effective in fungal infection	3 (10.3)	25 (86.2)	3 (18.8)	12 (75.0)	24 (29.6)	52 (64.2)	0.25 (5.35)
Antibiotics effective on common cold	1 (3.4)	27 (93.1)	1 (6.3)	13 (81.3)	10 (12.3)	68 (84.0)	0.34 (4.54)
Antibiotics effective in malaria treatment	26 (89.7)	2 (6.9)	12 (75.0)	4 (25.0)	55 (67.9)	19 (23.5)	0.16 (6.64)
Antibiotics might cause allergies that could cause death	26 (89.7)	1 (3.4)	14 (87.5)	2 (12.5)	62 (76.5)	15 (18.5)	0.28 (5.03)
Antibiotics always effective in the treatment of the same infection in the future	6 (20.7)	18 (62.1)	5 (31.3)	8 (50.0)	39 (48.1)	35 (43.2)	0.09 (8.01)
Antibiotic resistance does not issue in Liberia	3 (10.3)	25 (86.2)	3 (18.8)	13 (81.3)	21 (25.9)	50 (61.7)	0.09 (8.19)
Bacteria that are resistant to antibiotics can spread from person to person	13 (44.8)	11 (37.9)	6 (37.5)	7 (43.8)	40 (49.4)	26 (32.1)	0.90 (1.07)

Figure 1 represents the knowledge score of health workers on antibiotic and antimicrobial resistance from the two health facilities. There are nine questions on knowledge, and each question represents two marks. A score of 0 to 6 was categorized as poor knowledge, 8 to 10 as fair, 12 to 14 as good, 16 as Very good, and 18 as excellent. Over 5% of the nurses from the Redemption Hospital have excellent knowledge of antibiotics as compared to the less than 5% of the nurses from the J.F.K. Medical Centre. 32% of physicians, 42% of pharmacists, and 28% of nurses from Redemption Hospital have good knowledge compared to physicians, pharmacists, and nurses from the J.F.K. Medical Centre. Therefore, the proportion of health workers (Figure 1) from the Redemption Hospital have good knowledge of antibiotic use and resistance, including the ability to identify each antibiotic resistance problem.

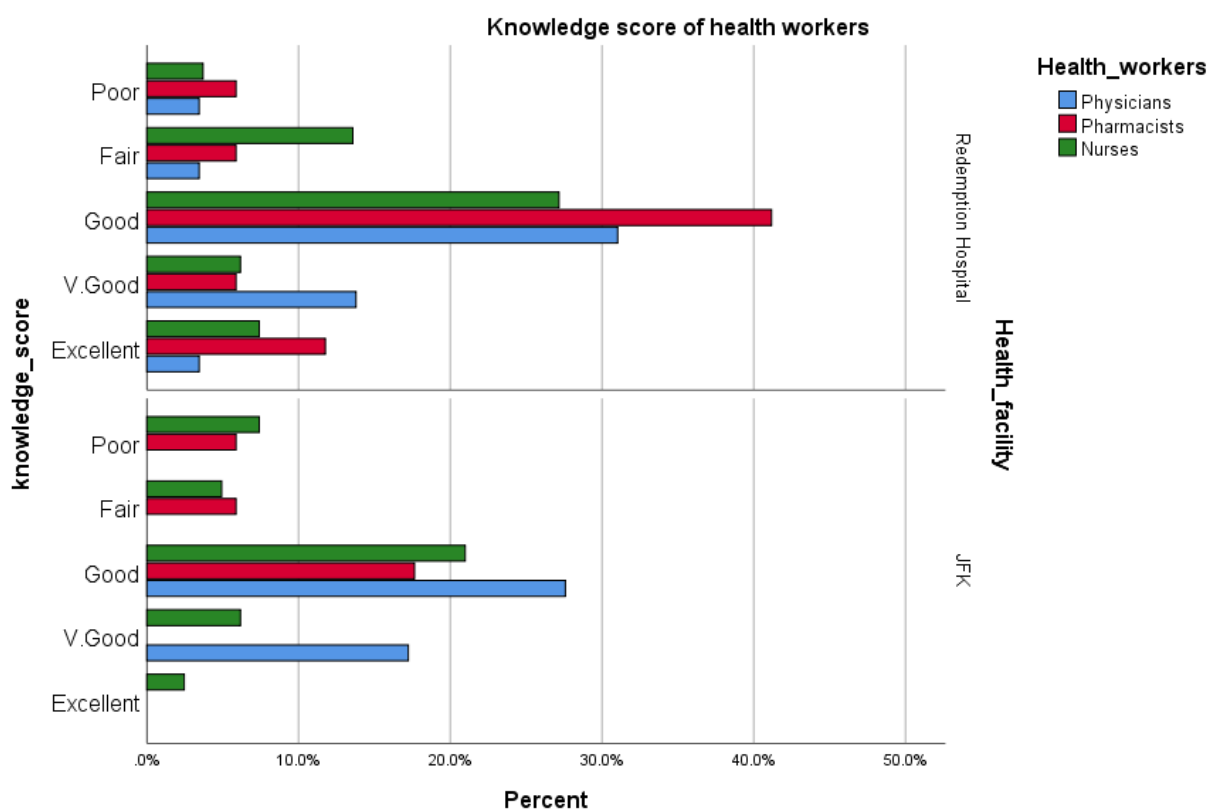


Figure 1 : comparison of knowledge score between the physicians, pharmacists, and nurses from the Redemption Hospital and the John F. Kennedy Medical Centre.

Attitude on antimicrobial resistance. Table 3 on the attitude of health workers on the use of antibiotics depicts a significant difference between 20.7% of the physicians, 56.3% of pharmacists, and 38.3% of the nurses on the administration of antibiotics before laboratory tests. However, over 90% of health workers agreed to conduct Laboratory tests before prescribing antibiotics (Figure 2). There were no significant differences among the health workers who try to educate their patients on the usage of antibiotics.

Table 3 : Attitude results between health workers

Question	Health Workers									p-Value (Chi-square)
	Physicians			Pharmacists			Nurses			
	No N (%)	Yes N (%)	Sometim e N (%)	No N (%)	Yes N (%)	Sometim e N (%)	No N (%)	Yes N (%)	Sometim e N (%)	
Do you conduct laboratory tests before prescribing antibiotics	2 (6.90)	6 (20.7)	21 (21.0)	3 (18.8)	9 (56.3)	4 (25.0)	10 (12.3)	31 (38.3)	40 (49.4)	0.04 (9.73)
Allow a patient only to take a dose of antibiotics they can afford	19 (65.5)	4 (13.8)	6 (20.7)	15 (93.8)	-	1 (6.3)	60 (74.1)	12 (14.8)	9 (11.1)	0.23 (5.60)
Educate your patient on the use of antibiotics	1 (3.4)	21 (72.4)	7 (24.1)	-	14 (87.5)	2 (12.5)	6 (7.4)	62 (76.5)	13 (16.0)	0.56 (2.99)
I educate my patients to discontinue the use of antibiotics	1 (3.4)	24 (82.8)	4 (13.8)	-	15 (93.8)	4 (13.8)	2 (2.50)	68 (84.0)	11 (13.6)	0.86 (1.30)

Figure 2 represents the attitude score of health workers on antibiotic and antimicrobial resistance from the two health facilities. A KAP score for antibiotic-related attitude was created. There are four questions on knowledge, and each question represents two marks. A score of 0 to 2 was categorized as poor knowledge, 4 to 6 as good, and 7 to 10 as very good. From the figure, the nurses from both health facilities have the same attitude, poor. Approximately 38% of the nurse from Redemption Hospital have a good attitude toward the distribution or usage of antibiotics compared to 26% of the nurses from J.F.K. Medical Centre. Physicians from both health facilities have a good attitude on the distribution or prescription of antibiotics. However, pharmacists from the Redemption were knowledgeable

From Figure 2, the proportion of the health workers with the right attitude and practice to antibiotic use and resistance survey was marginal.

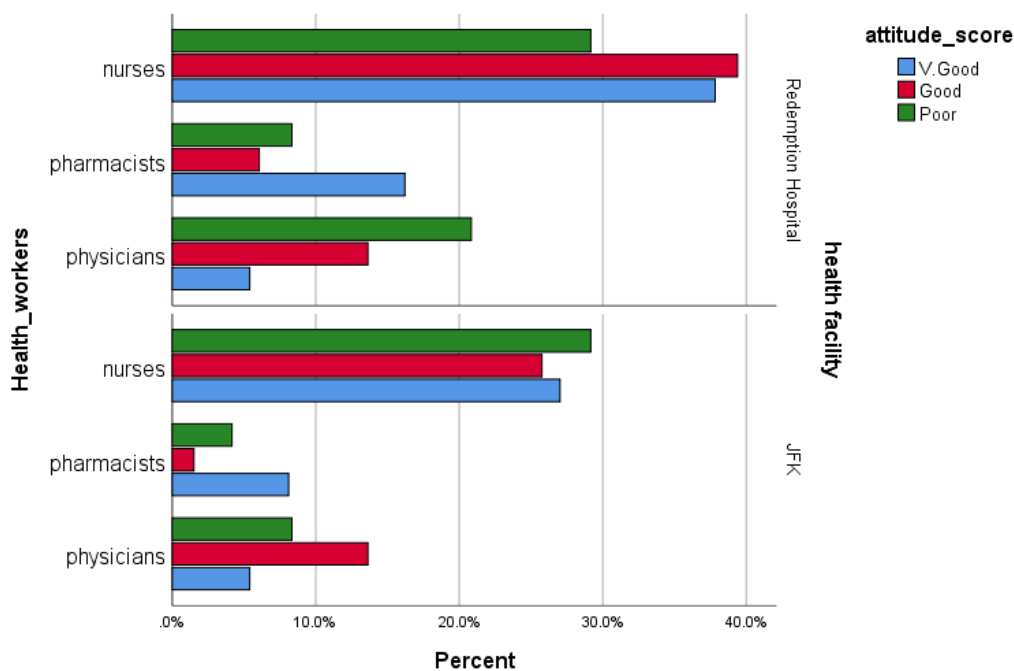


Figure 2 : comparison of attitude score between the physicians, pharmacists. And nurses from the Redemption Hospital and the John F. Kennedy Medical Centre

From Table 4 on the practice associated with an antibiotic prescription, the health worker from the Redemption Hospital and the John F. Kennedy Medical Centre prescribe antibiotics to cure various illnesses. From Table 4, 96.6% of the physicians, 100% of the pharmacists, and 97.5% of the nurses prescribe antibiotics, respectively. The more frequently prescribed antibiotics (Figure 5) by health facilities' health facilities are amoxicillin, ampicillin, ceftriaxone, benzyl pen, and doxycycline. The prescribed antibiotics were associated with curing the more frequent infectious disease such as UTI, gonorrhea, and PID (Figure 1).

Table 4 : Antibiotics prescribing practice by health workers

Question	Health Workers						p-Value (Chi-square)
	Physicians		Pharmacists		Nurses		
	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	
Do you prescribe antibiotics for your patient?	1 (3.4)	28 (96.6)	-	16 (100)	2 (2.5)	79 (97.5)	0.77 (0.54)

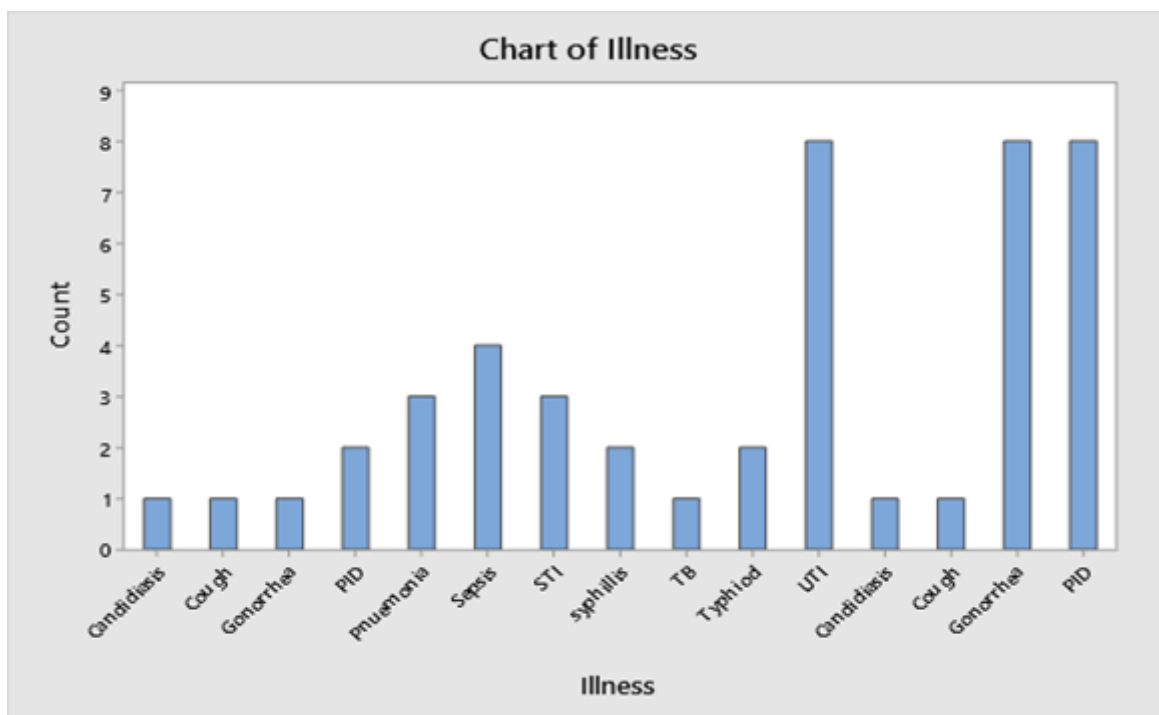


Figure 1: Common illnesses that health workers prescribe antibiotics during their practice.

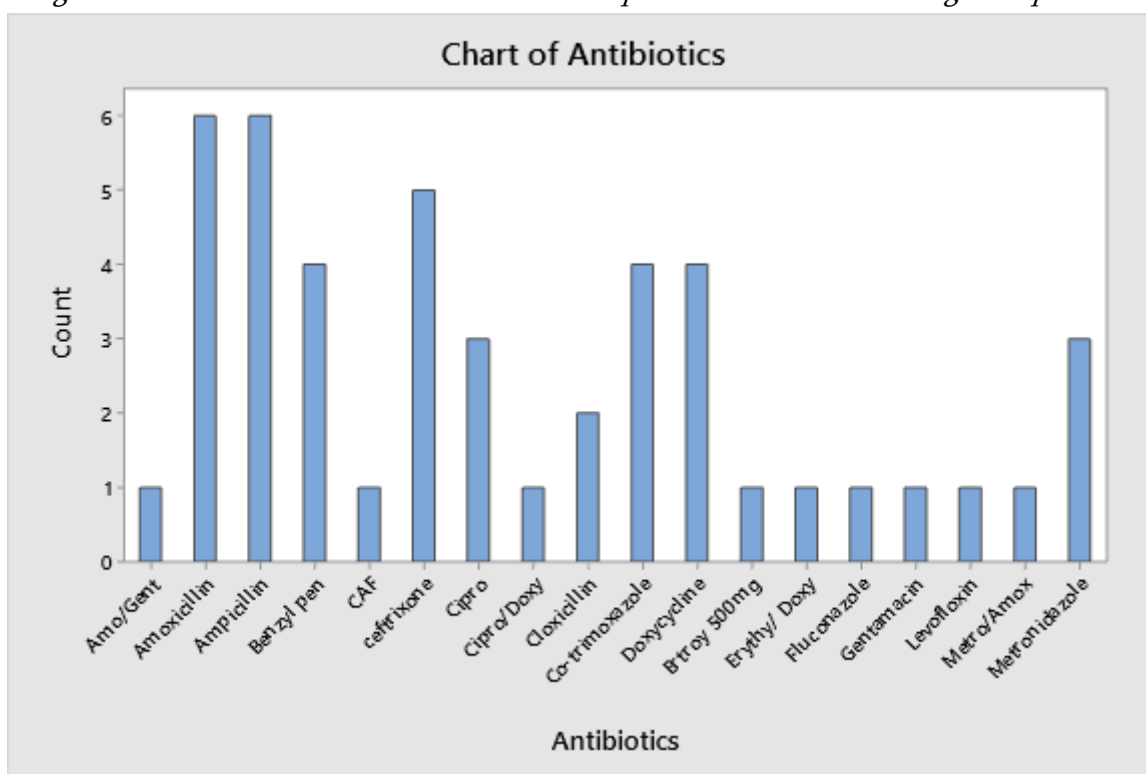


Figure 2: the most everyday antibiotics use across all participants in their practice

Discussion

the knowledge, attitude, and practice in prescribing and using antibiotics remain a challenge in many African countries. To the researcher's knowledge, this study is the first to investigate the knowledge, attitudes, and practice concerning antimicrobial resistance among health workers in two (2) public tertiary hospitals and how these medications are prescribed and dispensed. The demographics show that pharmacists were the least number of health care providers who participated in the survey. This could be because pharmacists have not been regarded as health care providers over the years and, hence, were left with the task of supply chain management in countries like Liberia. With this old perception, there is a whole stage of pharmacists seen at health facilities around the country, and sometimes not a single pharmacist would be represented.

To manage infectious diseases appropriately in the future, the cautious use of antimicrobials is crucial in both developed and underdeveloped countries. Therefore, in assessing their responsibility for rationalizing the use of medicines, pharmacists are critically placed to enhance the appropriate use of antimicrobials to reduce AMR, which is increasingly recognized as a threat across countries (Howard, Ashiru-Oredope, & Gilchrist, 2018).

Most health care providers interviewed were knowledgeable about AMR. In addition, most prescribers knew that the antibiotics could be used for viral infection and agreed that antibiotics are a problem in Liberia and other countries. However, there was a significant gap in the knowledge of antibiotic use among the health professionals, with all showing statistical significance importance. This gap bridged as the lack of knowledge of appropriate antimicrobial agent use must likely lead to inappropriate antibiotic practice and subsequent antibiotic resistance (Poku, et al., 2017).

Many different factors, such as current health care systems influence antibiotic use and misuse in various parts of the world (Parker & Mattick, 2016; Malla, et al., 2014). Lack of diagnostic tests at health facilities is likely to affect adherence to disease treatment procedures to prevent AMR. The results from the study are comparable to a study conducted in Ghana in which almost all the prescribers interviewed knew that antibiotics are used to manage bacterial infections (Poku, et al., 2017).

While it is true that health workers outperform in the knowledge and attitudes components of the survey, their comparatively poor performance in the practice section of the survey is concerning the laboratory. At the same time, many of the respondents do not sometimes request laboratory reports before prescribing antibiotics. This may be because many health care providers in this study work across other health centers in the country (Liberia) and prescribe antibiotics in these health centers or Primary Health Centres (PHC) settings as a precautionary measure to compensate for diagnostic uncertainty due to lack of availability of point-of-care analytical tests, unfortunate infection control, and inadequate sanitation practices (Kotwani, Wattal, Katewa, Joshi, & Holloway, 2010).

The study shows finding that amoxicillin is the most presumptively prescribed antibiotic and this study is similar to reports of other studies that indicate that the first generation of penicillin is mostly prescribed by many health care professionals (HCPs) (Kamulegeya, William, & Rwenyonyi, 2011; Poku, et al., 2017). On the other hand, another study done in Ethiopia shows that participants considered amoxicillin, penicillin, and cloxacillin as the least effective antibiotics related to drug-resistant bacteria (Abera, Kibret, & Mulu, Wondemagegn, 2014) Growing evidence has shown that numerous gram-negative organisms are developing resistance to amoxicillin, and the frequent presumptive use of it may have a role in the developing resistance (Ready, et al., 2004).

Most health care providers interviewed were knowledgeable about AMR. Most prescribers knew that the antibiotics could not be used for viral infection and agreed that antibiotic is a problem in Liberia as in other countries. The theoretical knowledge about antibiotics' effects ranged from very good to excellent (Figure 6). It was noted that 93.1% of the physicians, 81.3% of the pharmacist, and 84.0% of the nurses agreed that antibiotics were not associated with the treatment of the common cold. This gap must be bridged as the lack of knowledge of appropriate antimicrobial agent use for the common cold is likely to lead to inappropriate antibiotic practice and subsequently lead to antibiotic resistance (Poku, et al., 2017). The result suggests that health workers in Liberia responded similar to health workers in a KAP study in Peru (García, et al., 2011). However, the attitude score (Figure 6) range from poor to very good among the health workers.

Conclusion

This study revealed important information on the knowledge, attitude, and practice of physicians, pharmacists and nurses about AMR implemented in a low-income country like Liberia. Most showed excellent knowledge and attitude. However, most of them showed contrary practice towards it. In this survey, HCPs in hospitals had a significant difference gap in KAP on antimicrobial resistance. The result also highlighted that the majority of the participants with good KAP practice are those with a high level of years in clinical practice.

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