Infection and Drug Resistance

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ORIGINAL RESEARCH

Evaluation of Doctors' Knowledge, Attitudes, Behaviors, Awareness and Practices on Rational Antimicrobial Stewardship in a Training and Research Hospital in Mogadishu-Somalia

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Introduction: Historically, antimicrobials have been used to treat microbial illnesses in humans and animals. But throughout this time, antibiotics that had been successful against particular microorganisms started to lose their effectiveness due to rising inappropriate use brought on by ignorance, negligent attitudes, and improper methods. Our goal in conducting this study was to ascertain the knowledge, attitudes, and practices of doctors with relation to the use of antibiotics in light of the growing global and Sub-Saharan African problem of antimicrobial resistance.

Methods: In a tertiary hospital in Mogadishu, Somalia, a cross-sectional survey study was carried out to assess experts' and research assistants' knowledge, attitudes, behavior, awareness, and practices regarding the use of antibiotics and antibiotic resistance. A questionnaire consisting of 2 sections and 22 questions was applied to the participants on a voluntary basis.

Results: Among the 202 doctors that participated in the study, 49 (24.3%) were specialists, and 153 (75.7%) were assistants. Prescriptions for one to ten antibiotic boxes per week on average were reported by 146 respondents (72.3%). Of the physicians, just 27 (13.4%) did not require assistance when prescribing an antibiotic. The most often accessed sources of support were experts in infectious diseases (43.1%) and national/international antimicrobial guidelines (32.2%). The top three factors contributing to antibiotic resistance in Somalia include misuse of antibiotics (61.4%), unnecessary prescriptions written by doctors (44.6%), and an absence of infectious disease specialists in most institutions (44.1%).

Conclusion: As an alarming level of antimicrobial resistance has been observed globally in recent years, the results of our survey will help educate our doctors by gauging their perceptions, attitudes, and knowledge about rational antibiotic use in Sub-Saharan Africa. This will provide better patient outcomes.

Keywords: antimicrobial resistance, Sub-Saharan Africa, microorganism, prescription, Infectious disease, knowledge

Introduction

Antimicrobial resistance (AMR) is a serious public health issue that has a direct impact on global economic development. The annual death rate is estimated to reach about 10 million if no strategy to tackle this issue is devised until 2050, with poor countries in Africa and South Asia leading the way, as these regions are most severely affected by the negative impacts of AMR.[1] The disproportionate rise in the inappropriate use of antibiotics that has been observed recently is a consequence of research carried out in low- and middle-income countries, which makes them unique targets for AMR intervention.[2–5] Around 1.27 million deaths globally were directly linked to bacterial AMR in 2019 alone. Sub-Saharan Africa (SSA) (23.5 deaths per 100,000 people) and

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South Asia (21.5 deaths per 100,000 people) had the highest AMR-related fatality rates. In terms of deaths per 100,000 inhabitants, Western SSA led the world with 27.3, followed by Eastern, Central, and Southern SSA.[6]

The primary cause of pathogen resistance to antimicrobial agents is the overuse and/or incorrect application of these agents in agriculture, the environment, animals, and human health.[7,8] In addition to improper or excessive use of antibiotics, other factors that contribute to the emergence of resistance include unclean water, poor sanitation and hygiene, insufficient infection prevention and control in healthcare facilities, issues with accessibility, including the use of newly developed antibiotics worldwide, and noncompliance with current laws.[9]

According to the Food and Agriculture Organization of the United Nations, the World Health Organization (WHO), and the World Organization for Animal Health, AMR poses a significant risk to human and animal health in the future and will have an adverse effect on the environment. Actually, WHO has recognized this issue as one of the most critical public health concerns, and numerous other organizations have likewise adopted a stance by developing a range of preventative and control guidelines and initiatives.[10–12] Actually, AMR is a process that can arise spontaneously. However, in certain instances, owing to their inadequate awareness of the matter, health professionals may unintentionally contribute to the process. Even if people's main concern is improving treatment outcomes, a number of variables, including improper prescriptions, excessive consumption, treatment for longer periods of time than necessary or insufficient use, and the use of antibiotics without a doctor's recommendation, significantly contribute to the emergence of AMR.[1,13,14] In this ongoing, challenging battle against microbes, prescribers are the most significant target group, and their competencies and necessary knowledge have really been established. Possessing a robust and comprehensive antimicrobial information infrastructure is the foundation for healthcare professionals' reasonable and proper tendency to prescribe antibiotics. For this reason, WHO stresses that a key component of lowering antibiotic resistance is ongoing education for physicians and medical students regarding sensible antimicrobial management.[15–19] Selecting the narrowest spectrum antibiotic that is effective in treating any infection, avoiding unnecessary and/or prolonged prophylaxis, initiating treatment following culture and antibiogram results if feasible, determining the ideal dose in terms of quantity, interval, and duration, and, of course, patient compliance are all critical to maintaining the arsenal we have.[20] Undoubtedly, the individual writing the prescription is not the only source of this issue. The perspectives of patients and other healthcare professionals also reveal a number of issues. To use a very basic illustration, the notion that antibiotics constitute a panacea must be dispelled.[21,22]

This study was conducted to investigate the knowledge, attitudes, behavior, awareness, and practices of medical professionals about the use and prescribing of antibiotics in a hospital in Mogadishu/Somalia.

Materials and Methods

Our hospital, which has 250 public beds, is one of the biggest research and education facilities in SSA. It provides treatment for a variety of ailments, ranging from simple to critical, to both adults and children. Emergency care, outpatient clinics, inpatient care, burn units, dialysis, adult emergency intensive care unit (ICU), ICU for general and cardiology, ICU for newborns and pediatric age, physical therapy, and dental care units are all available. The Infection Control Committee, a sizable group in our institution, is responsible for carrying out antimicrobial drug protection protocols. The survey was conducted cross-sectionally, distributed in printed form, between October 1 and October 30, 2023. Before having the subjects complete the questionnaires, the researchers notified them and got their agreement. Participation was anonymous and entirely optional. Of the 206 physicians in our hospital, a total of 202 physicians (98.05%) from different branches, including 49 specialists and 153 research assistants, who agreed to participate in the study were included in the study.

Questionnaire Content

The research survey consisted of a total of 22 questions prepared by the authors: in the first part, questions related to demographic information and occupational information; in the second part, there were questions about the frequency of antimicrobial prescribing, the sources used when prescribing drugs, the AMR problem in the world, in Somalia and in one's own hospital, resistant microorganisms, the issues taken into consideration when prescribing antimicrobials, and the attitudes and behaviors of the patient regarding the level of informing them about the drug.

Ethics Approval

The study was approved by the local ethics committee of Mogadishu Somali Turkey Recep Tayyip Erdoğan Training and Research Hospital (Date: 22/08/2023, Number: 820/15131). Participants also provided written informed consent. Additionally, I would like to point out that our research adheres to the Declaration of Helsinki.

Statistical Analysis

Descriptive statistics were calculated for characteristics of patients. Categorical data were presented as numbers and percentages. We tested factors in univariate analyses; potential associations of knowledge, attitudes, and perceptions with participants' age, gender, years of practice, and type of specialty (internal, pediatric, intensive care vs surgical) were evaluated using the Pearson chi-square and $p < 0.05$ was considered statistically significant. All analyses were performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp. Armonk, NY: USA. Released 2017).

Results

Participants

Of the 202 doctors participating in the study, 153 (75.7%) were research assistants and 49 (24.3%) were specialists. Of the participants, 154 (76.2%) were men and 174 (86.1%) were between the ages of 25 and 39. Physicians working in surgical sciences made up 78 (38.6%) of the participants, followed by physicians working in internal sciences 73 (36.1%), ICUs 27 (13.4%), and pediatric clinics 24 (11.9%). After graduation, 140 doctors, or 69.3% of the total, completed a course on rational antibiotic usage. A total of 146 respondents (72.3%) reported prescribing one to ten antibiotic boxes on average each week. Of the doctors, just 27 (13.4%) did not need help while writing an antibiotic prescription. Infectious diseases specialists (43.1%) and national/international antimicrobial guidelines (32.2%) were the most frequently consulted sources of assistance. Additional demographic and personal antimicrobial preference data are displayed in Table 1.

Table 1 Sociodemographic/Professional Characteristics and Antibiotic Use Preferences of the Participants

Participants (n:202)		**n (%)**
Gender	Male	154 (76.2)
	Female	48 (23.8)
Age group	18–24 year	28 (13.9)
	25–39 year	174 (86.1)
Department	Internal sciences	73 (36.1)
	Surgical sciences	78 (38.6)
	Intensive care	27 (13.4)
	Pediatric department	24 (11.9)
Profession duration	0–3 year	146 (72.3)
	>3 year	56 (27.7)
Profession position	Research Assistant	153 (75.7)
	Specialist	49 (24.3)

(*Continued*)

Table 1 (Continued).

Participants (n:202)		n (%)
Education about rational antibiotic use	Yes	140 (69.3)
	No	62 (30.7)
How many times do you prescribe antibiotics in a week?	1–10 boxes	146 (72.3)
	>10 boxes	56 (27.8)
How frequently do you require help in selecting antibiotics?	Never	27 (13.4)
	Sometimes	137 (67,8)
	Most of the time	33 (16.3)
	Almost always	5 (2.5)
Which sources of information do you consult when choosing antibiotics?(multiple options can be ticked)	Myself	39 (19.3)
	Internet-based sources	36 (17.8)
	National/international antimicrobial guidelines	65 (32.2)
	Journal/textbook	38 (18.8)
	Local hospital guidelines	34 (16.8)
	Peers/senior colleagues	41 (20.3)
	Infectious Disease specialists	87 (43.1)
	Others	5 (2.5)

Knowledge, Attitudes, Behaviors, Awareness and Practices on Rational Antimicrobial Stewardship

Antibiotic resistance was viewed as an global issue by 120 participants (59.4%), and as a hospital-specific issue by 104 participants (51.5%). The overuse of antibiotics in society (61.4%), doctors' inappropriate prescriptions (44.6%), and the lack of infectious disease specialists in most hospitals (44.1%) are the top three causes of antibiotic resistance in Somalia. Effectiveness, suitability, safety, and cost were ranked by the participants as being in order of significance when prescribing antibiotics, from strong to weak. Methicillin-resistant *Staphylococcus aureus* (MRSA) was selected by 108 respondents (53.5%), as the most significant resistant microbe for a hospital (Table 2).

Table 2 Knowledge, Attitudes, Behaviors, Awareness and Practices on Rational Antimicrobial Stewardship

Questions	Participants (n=202)	n (%)
Antibiotic resistance is a global problem?	I do not know	6 (3.0)
	It's not	8 (4.0)
	Maybe	68 (33.7)
	Certainly	120 (59.4)
Antibiotic resistance is a problem for this hospital?	I do not know	8 (4.0)
	It's not	12 (5.9)
	Maybe	78 (38.6)
	Certainly	104 (51.5)

(*Continued*)

Table 2 (Continued).

Questions	**Participants (n=202)**				**n (%)**
What do you think might be the causes of antibiotic resistance in Somalia? *(multiple options can be ticked)*	I think there is no antibiotic resistance problem in Somalia				12 (5.9)
	Overuse rate in hospitalized patients				75 (37.1)
	Overuse rate in the community				124 (61.4)
	Unnecessary prescription by doctors				90 (44.6)
	Prescribing unnecessary antibiotics to animals				20 (9.9)
	Application in the wrong dose and/or time				58 (28.7)
	Most hospitals do not have an Infectious Diseases doctor				89 (44.1)
	Inadequate hospital infection control				64 (31.7)
	Inadequate Patient Follow-up				58 (28.7)
	Inadequate diagnostic support				40 (19.8)
	Lack of immunization				21 (10.4)
	Low-quality antimicrobials				54 (26.7)
Please list the factors you pay attention to when using antibiotics from 1 to 4 in order of importance.	***Effectiveness***	***1***	***2***	***3***	***4***
		111 (55.0)	53 (26.2)	27 (13.4)	11(5.4)
	Safety	21 (10.4)	40 (19,8)	75 (37.1)	66 (32.7)
	Suitability	50 (24.7)	67 (33.2)	59 (29.2)	26 (12.9)
	Cost	20 (9.9)	42 (20.8)	41 (20.3)	99 (49.0)
Which of the following(s) do you think is the most important resistant microorganism for a hospital?*(multiple options can be ticked)*	Methicillin-resistant *Staphylococcus aureus*				108 (53.5)
	Vancomycin resistant *Enterococcus*				36 (17.8)
	Pan-resistant *Acinetobacter baumannii*				16 (7.9)
	Extended Spectrum Beta-lactamase positive *E. Coli/ Klebsiella spp* (ESBL +E.Coli/Klebsiella)				56 (27.7)
	All of them				46 (22.8)
	None of them				1 (0.5)

Upon evaluating the information that doctors offered to the patient on the antibiotics they prescribed, it was found that the majority of the information concerned the administration technique (76.2%), duration (65.8%), and usage period (57.9%). It was found that they either rarely or never provided information about drug adverse effects, drug interactions with food, drug interactions with other drugs, and the drug's mechanism of action (Table 3).

The following circumstances were found to be the most prevalent ones that doctors consider when prescribing antibiotics: the patient's medical history (72.8%), age (62.4%), weight (37.6%), social security and economic position (37.1%), and education level (34.1%) were found to be useful factors (Table 4).

The rate of antibiotic prescription for more than 10 boxes (packages) was found to be considerably lower (p:0.007) when we compared the weekly amount of antibiotic box prescribing. The comparison's noteworthy fact showed that female physicians often write fewer prescriptions. Likewise, younger physicians in the 18–24 age range do not write prescriptions for more than 10 boxes of antibiotics in a single week (p:0.002). The most frequently mentioned option as

Table 3 Types of Information Given to the Patient About Antibiotics by Physicians

Information Type	Always n (%)	Often n (%)	Sometimes n (%)	None n (%)
Usage	154 (76.2)	27 (13.4)	19 (9.4)	2 (1.0)
Usage time	133 (65.8)	32 (15.8)	33 (16.3)	4 (2.0)
Usage period	117 (57.9)	44 (14.9)	30 (14.9)	11 (5.4)
Drug/drug interactions	27 (13.4)	48 (38.6)	78 (38.6)	49 (24.3)
Drug/food interactions	19 (9.4)	47 (23.3)	78 (38.6)	58 (28.7)
Drug side effects	37 (18.3)	44 (21.8)	97 (48.0)	24 (11.9)
The mechanism of action of the drug	22 (10.9)	39 (19.3)	39 (19.3)	102 (50.5)

Table 4 The Factors That Affect You While Prescribing Antibiotics

Factors	*Not effective* n *(%)*	*Medium effective* n *(%)*	*Effective* n *(%)*
Patient's Age	40 (19.8)	36 (17.8)	126 (62.4)
Patient's Gender	113 (55.9)	41 (20.3)	48 (23.8)
Patient Weight	46 (22.8)	80 (39.6)	76 (37.6)
Social Security/Economic Status	52 (25.7)	75 (37.1)	75 (37.1)
Demands and Expectations	52 (25.7)	100 (49.5)	50 (24.8)
Medical History	16 (7.9)	39 (19.3)	147 (72.8)
Educational Status	65 (32.2)	68 (33.7)	69 (34.1)
Traditions and Beliefs	74 (36.6)	60 (29.7)	68 (33.7)

information source was Infectious disease specialist. Despite the fact that individuals who got professional guidance tended to administer a little less antibiotics overall, the difference was not statistically significant (p:0.322). The second most often consulted source was found to be guidelines, and it was found that those who followed the guidelines prescribed antibiotics more frequently than those who did not (p:0.019) (Table 5).

Table 5 Demographics, Professional Characteristics and the Frequency of Prescribing Antibiotics

Characteristics (n=202)	**n (%)**		
	Group I (n=146)	**Group II (n=56)**	**p value***
Gender			
Male	104 (71.2)	50 (89.3)	0.007
Female	42 (28.8)	6 (10.7)	
Age group			
18–24 year	27 (18.5)	1 (1.8)	0.002
25–39 year	119 (81.5)	55 (98.2)	

(*Continued*)

Table 5 (Continued).

Characteristics (n=202)	n (%)		
	Group I (n=146)	Group II (n=56)	p value*
Profession duration			
0–3 year	110 (75.3)	36 (64.3)	0.116
>3 year	36 (24.7)	20 (35.7)	
Department			
Internal sciences	51 (34.9)	22 (39.3)	0.283
Surgical sciences	62 (42.5)	16 (28.5)	
Intensive care	18 (12.3)	9 (16.1)	
Pediatric department	15 (10.3)	9 (16.1)	
Profession position			
Research assistant	113 (77.4)	40 (71.5)	0.376
Specialist	33 (22.6)	16 (28.5)	
Education about rational antibiotic use			
Yes	100 (68.5)	40 (71.5)	0.686
No	46 (31.5)	16 (28.5)	
Information source; Infection Disease Specialist			
Yes	66 (45.2)	21 (37.5)	0.322
No	80 (54.8)	35 (62.5)	
Information source; Guidelines			
Yes	40 (27.4)	25 (44.6)	0.019
No	106 (72.6)	31 (55.4)	

Group I: prescribe antibiotics 1–10 boxes in a week, Group II: prescribe antibiotics >10 boxes in a week, * Pearson's chi-square test.

Looking at the frequency of needing assistance while selecting antibiotics, we can conclude that doctors in internal medicine and critical care require a lot more assistance than pediatricians (p:0.004). As predicted, specialists reported needing less assistance (p:0.028). We may state that people who use guidelines as a source of knowledge require less assistance (p:0.044) (Table 6).

We discovered that young physicians had considerably higher MRSA awareness in the section as resistant causatives were asked (p:0.014). The more experienced doctor group significantly offered a significantly higher answer (p:0.009), even though the answer "all of the microorganisms" was shown to be significantly less common in both age groups. In the "all of the microorganisms" response group, similar noteworthy numbers were discovered for individuals with more than three years of job experience (p:0.049). A significant correlation between answers to resistant bacteria and other variables was not seen, with the exception of those already indicated. It is evident that those who had prior antibiotic training utilized antibiotics when comparing them to people who had taken antibiotics for themselves during the past year (p:0.010) (Table 7).

Table 6 Demographics, Professional Characteristics and the Frequency of Need for Information in Choosing Antibiotics

Characteristics (n=175)	n (%)		
	Need for information in choosing antibiotics		
	Sometimes (n=137)	Most of the time/always (n=38)	p value*
Gender			
Male	104 (75.9)	32 (84.2)	0.277
Female	33 (24.1)	6 (15.8)	
Age group			
18–24 year	19 (13,9)	5 (13.2)	0.910
25–39 year	118 (86.1)	33 (86.8)	
Profession duration			
0–3 year	99 (72.3)	29 (76.3)	0.618
>3 year	38 (27.7)	9 (23.7)	
Department			
Internal sciences	38 (27.7)	19 (50.0)	0.004
Surgical sciences	61 (44.5)	11 (28.9)	
Intensive care	18 (13.1)	8 (21.1)	
Pediatric department	20 (14.6)	0	
Profession position			
Research assistant	99 (72.3)	34 (89.5)	0.028
Specialist	38 (27.7)	4 (10.5)	
Education about rational antibiotic use			
Yes	98 (71.5)	31 (81.6)	0.213
No	39 (28.5)	7 (18.4)	
Information source; specialist			
Yes	64 (46.7)	18 (47.4)	0.943
No	73 (53.3)	20 (52.6)	
Information source; guidelines			
Yes	53 (38.7)	8 (21.1)	0.044
No	84 (61.3)	30 (78.9)	

Notes: *Pearson's chi-square test.

Discussion

According to our study, the top three responses to the question about the most dangerous resistant bacteria for a hospital were, in order, "MRSA, ESBL + E.Coli/Klebsiella, and all of the microorganisms". Naturally, "all of the microorganisms" would be our expectation for the response to this query. It's also important to recognize that people with less professional

Table 7 Demographics, Professional Characteristics and the Frequency of Resistant Microorganisms and Own Antibiotic Usage Rate

Characteristics (n=202)	n (%)		
	The most important resistant microorganism for a hospital?		
	No	Yes	p value*
Age group	**Methicillin-resistant *Staphylococcus aureus***		
18–24 year	7 (7.4)	21 (19.4)	0.014
25–39 year	87 (92.6)	87 (80.6)	
Profession duration	**Methicillin-resistant *Staphylococcus aureus***		
0–3 year	66 (70.2)	80 (74.1)	0.541
>3 year	28 (29.8)	28 (25.9)	
Age group	**All of the microorganisms**		
18–24 year	27 (17.3)	1 (2.2)	0.009
25–39 year	129 (82.7)	45 (97.8)	
Profession duration	**All of the microorganisms**		
0–3 year	118 (75.6)	28 (60.9)	0.049
>3 year	38 (24.4)	18 (39.1)	
Antibiotic Education	**Own antibiotic use in the last 1 year**		
Yes	56 (60.2)	84 (77.1)	0.010
No	37 (39.8)	25 (22.9)	

Notes: * Pearson's chi-square test.

expertise tend to be less aware of resistant causatives. Furthermore, it was discovered that the young age group had a relatively low "all of the microorganisms" reaction. On the other hand, the fact that younger physicians displayed a considerably higher awareness of MRSA is encouraging for the future. Surgical branches identified the most frequent MRSA response as the cause of the danger, but no meaningful correlation was observed between them and other clinics.

Unfortunately, by giving affirmative answers to patients' improper demands and coercion or by making mistakes because they lack awareness and competence, healthcare personnel who write prescriptions might occasionally directly contribute to AMR. Medical professionals, residents, and students should all receive AMR-related training.[23] It is challenging to assess the financial cost that AMR places on nations, although it is thought to be rather significant.[24] The cost of battling resistant infections is estimated to be around €1.5 billion yearly, and AMR is responsible for over 25,000 documented fatalities in Europe each year.[25]

Globally, there were approximately 450,000 instances of multidrug-resistant or rifampicin-resistant tuberculosis in 2021; tragically, 191,000 of these cases were fatal. We may have to cope with this sickness in the years to come.[26] Drastic changes need to be made to the way physicians prescribe and the idea of rational antibiotic usage implemented.[27]

Antimicrobial stewardship programs have the potential to promote broad and rational use of antibiotics in healthcare settings. Therefore, the development of resistance can be avoided, treatment expenses and hospital stays can be decreased, and antimicrobial prescriptions that are not necessary can be avoided.[28] Because microorganisms exchange genes with one another, resistance mechanisms spread and, as a result, resistance to some broad-spectrum antibiotics (such carbapenems and third-generation cephalosporins) has begun to emerge.[29,30]

The development of ESBL genes is linked to resistance to third-generation cephalosporins; gram-negative enteric bacilli that produce ESBLs are present in 14% of human colonizations worldwide, and this number is rising by 5.4% year.[31] Twenty percent of antibiotic prescriptions in Europe were found to have no justification, according to a point prevalence research.[32]

In order to prevent, diagnose, and treat infectious diseases, Mendelson and Matsoso[33] identified the following categories: restricting easy access to antibiotics; minimizing the use of antimicrobials by prescribing the appropriate medications through infection control and monitoring; and encouraging cutting-edge biotechnological developments for infection diagnosis and control, in the production of next-generation antimicrobials or vaccines.

Interventional studies have been carried out in the last few years with the goal of influencing doctors' beliefs, attitudes, and knowledge about prescription.[34] A Malaysian study found that physicians' prescribing practices could be altered by consistent training initiatives and following the most recent antimicrobial guidelines. In fact, the burden of AMR in healthcare facilities might decrease as a result. It was underlined once more in this study that continuous monitoring of antimicrobial usage and the implementation of tougher regulations are necessary to combat AMR.[35]

Antibiotic resistance was deemed a national issue by 95% of assistant doctors in a study including two university hospitals in France and Scotland. Poor hand hygiene and prolonged antibiotic use, which are the two main causes of resistance development, were not considered significant concerns in this study. Rather than employing antibiotic restriction tactics, they discovered alternatives like enhancing education, creating policies, and enabling access to an infectious illness expert to provide healthier prescriptions.[27]

Participant perceptions of AMR as a major issue at the national and institutional levels were 94.3% and 91.3%, respectively, in a web-based survey carried out in 2010 in five different hospitals with the aim of improving antibiotic use. Despite the fact that 86.5% of respondents reported having gotten an antibiotic prescription one month prior, they felt that their education on the topic was inadequate. As in the previous trial, they concluded that rather than local antibiotic limitations, specialized training, guidelines, and assistance from the antimicrobial management team would be more beneficial.[36]

Surgeons sought more advice than other doctors when prescribing antibiotics ($p<0.001$), according to a study done at a university hospital with 179 specialists and assistant physicians from 5 other specialties besides pediatrics. Participant overuse of antibiotics was acknowledged by 88%. Ninety six percent stated that there was an AMR problem at the national level, 93% stated that there was an AMR problem in their own institutions, and 97% stated that rational use of antibiotics would reduce the resistance problem. Researchers discovered that residents had gotten more training on the use of antibiotics than experts had the year before (p:0.001), and 90% of respondents thought that further training need to be given.[34]

According to our current survey, 69.3% of participants received education on rational antibiotic usage after graduation. One unexpected finding was that individuals who underwent training had a greater rate of antibiotic use in the previous year. We discovered that female physicians and those in the 18–24 age range prescribed 10 or more boxes of antibiotics at a considerably lower rate each week. It is possible to conclude that these two categories contributed positively to AMR by being somewhat more watchful and cautious when giving antibiotics. Those who sought information from an Infectious diseases specialist the most often prescribed slightly fewer antibiotics, although the difference was not statistically significant. The guidelines are the second most often consulted resource, and physicians who utilize it prescribe more antibiotics than those who do not. Compared to the surgical and pediatric branches, internal medicine and intensive care require more information and consultation. The statistical difference can be interpreted as these departments need more training compared to pediatrics, and they care more about the subject because they are closer and more prone to it compared to surgical branches. The primary factors physicians considered when prescribing antimicrobials were the patient's medical history, age, and weight. Upon reviewing the details they provided regarding the antibiotics they recommended for the patient, we discovered that the administration technique, duration, and frequency were the primary determinants of effectiveness. In contrast, there was a dearth of information supplied about adverse effects, the medicine's mechanism of action, drug interactions with food, and drug interactions with other drugs. The natural outcome is that doctors cannot give patients comprehensive knowledge on antibiotics because

there are fewer doctors per capita in developing nations than in industrialized ones. This leads to a reduction in the amount of time dedicated to patient care.

The use of any broad-spectrum IV antibiotics without first consulting a specialist in infectious diseases is prohibited by the infection control committee of our institution. According to a systematic review on the topic, this kind of protection and restriction system has the highest success rates (66–87%) and is at least three times more successful than persuasive practices in lowering costs, resistance issues, and the unnecessary use of antibiotics.[37] Remarkably, a recent meta-analysis found that antibiotic protection programs led to reductions in resistance rates, particularly for *Pseudomonas* species.[38] According to a different study, the rate of ESBL-producing *Enterobacteriaceae* family members other than *Pseudomonas* species dramatically dropped following the restriction of carbapenem-derived antibiotics.[39] All of these results demonstrate the need for antimicrobial protection and limitation measures to be implemented going forward, demonstrating their worth and importance on par with education in safeguarding the environment and next generation.

As per the participants in our study, AMR is a worldwide issue that affects not only hospitals and their home nations but the entire globe. Moreover, the most frequent causes of AMR in Somalia are the general population's inappropriate use of antibiotics, doctors' needless prescriptions, and the lack of an Infectious diseases specialist in many institutions. Awareness on this issue is satisfactory for our research. Furthermore, the fact that participants place the highest value on effectiveness and the lowest value on cost when prescribing antibiotics is an extremely significant and encouraging finding for science, even in the face of SSA's dire economic circumstances and inadequate health insurance.

Progress on the plans is not substantial because of issues like low morale, unstable politics, inadequate intersectoral cooperation and coordination, infrastructure issues, problems with quality and monitoring assurance systems, inadequate surveillance network, inadequate health system, and staff shortages, as well as national action in SSA (of which we are a part).[10,40]

As previously noted, SSA has the highest rates of AMR-related mortality; yet, because of the insufficient data flow, preventing this issue is a challenging task. The measures to be applied at the national level are crucial in this conflict, based on data gathered from SSA nations. Our greatest allies, aside from surveillance, will be infection control and preventive techniques as well as ongoing education initiatives.[1]

Strengths/Limitations

To the best of our knowledge, our study is the first thorough investigation of antibiotic awareness in Somalia that includes assistant and specialist physicians. The fact that doctors from many specialties are included in the study lends it strength. Since this facility is one of the best equipped hospitals in SSA and can execute a wide range of complex procedures and interventions, we believe that our study is important.

A few of the study's drawbacks must be mentioned. Despite confidentiality being guaranteed, social desirability bias may have affected survey replies. However, conclusions should not be generalized and should be interpreted cautiously because cultural and local epidemiology factors may have shaped the responses.

Conclusion

Our survey's results will help us by pointing out the areas in which our doctors' knowledge of antibiotic management is lacking, which will inform the preparation and execution of our interventions. Consequently, our goals are to reduce the incidence of antibiotic resistance and improve patient outcomes.

Recent years have seen alarmingly high rates of AMR, making the prudent use of antibiotics essential to combating this issue on a worldwide scale. For the purpose of developing plans, it is imperative to include several country-specific factors such as mortality rates, AMR rates, annual antibiotic consumption, surveillance data, and epidemiological data. Owing to the scant data that was transferred from SSA, research on the topic is quite helpful; possibly more of them with greater participant numbers would be beneficial. Apart from releasing programs that restrict or safeguard against antibiotic usage, continuing education on responsible use of antimicrobials should also be continued to provide ongoing services.

Ethics Statement

This study was approved by the local ethics committee of Mogadishu Somali Turkey Recep Tayyip Erdoğan Training and Research Hospital (Date: 22/08/2023, Number: 820/15131).

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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