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Prescribers', Dispensers' and Users' Knowledge, Attitudes and Practices Relative to Antimicrobial Resistance in Douala, Cameroon

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Abstract: Antimicrobial resistance (AMR) is one of the most serious threats to global health today. It is now expanding exponentially in all regions of the world. Every day, new resistance mechanisms are emerging and spreading globally, compromising our ability to treat the most common infectious diseases. Given the fact that on AMR is insufficient in Cameroun our country, this study aimed to identify some determinants of AMR. A descriptive cross-sectional study was conducted. Convenience non-probabilistic sampling was chosen. Participants enrolled were: prescribers, providers and users of antimicrobials in Douala III subdivisions from Cameroun. Recruitment was done using a questionnaire, while the laboratories were described via an observation grid. The Chi 2 test was done with a significance rate of 5% and a 95% confidence interval. 300 participants and 12 laboratories were identified, the female gender was the most represented with 59%, the age group the most represented was that of 26- years and nurses represent (56%) of the prescribers. The informal sector was overwhelmingly represented by pharmacy salespersons (55%), most of whom were antimicrobial dispensers (53%). The AMR problem was perceived by the vast majority of the population as a problem in practice, locally and nationally. The management of AM waste was mainly done in dustbins, returned to the source and incinerators depending on the target (users, dispensers). The only laboratory with a quality system had an adequate technical platform for diagnosis. Standardized protocols were not available in some, nor commonly used in the mostly private laboratories. Users resorted first to street vendors, then to pharmacies and finally to hospitals. Antibiotics were the most widely used, prescribed and dispensed antimicrobials. Some baseline characteristics significantly influence antimicrobial resistance. Efforts remain to be made in all sectors such as user awareness, regulation of antimicrobial prescribing and implementation of a national action plan.

Keywords: Knowledge, Attitudes, Practices, Antimicrobial Resistance, Douala

1. Introduction

1.1. Background

Antimicrobial resistance (AMR) is a mechanism by which an infectious agent evades antimicrobials (e.g., antibiotics, antivirals, antiparasitics, or antifungals) [1-4]. AMR is a complex problem that affects both developed and developing countries [5-7]. AMR is a complex problem that affects both developed and developing countries [5-7] and is caused by many factors, including self-medication, poor compliance, lack of diagnosis, and economic needs [6-8]. Misuse of antimicrobials is one of the most significant factors contributing to antimicrobial resistance worldwide. Up to 50% of antimicrobial prescriptions are either not indicated or prescribed inappropriately, exerting biological pressure on microorganisms and leading to the development of anti-infective drug resistance, which is currently considered by WHO to be a serious threat to human health [9]. Globally, AMR (Antimicrobial Resistance) is a very sensitive issue as it affects about 500,000 people with infectious diseases [10]. The consequences can be direct or indirect. They are direct on morbidity, mortality and therapeutic cost. Antimicrobial resistance could be more deadly. It already causes about 700,000 deaths annually worldwide and is expected to cause 10 million deaths annually by 2050 [11] with almost 70%. Hence the importance of deploying strategic programmes and action plans on antimicrobial resistance at international, regional and national levels with a particular focus on countries of the South. In the United States, studies on antibiotic resistance show that it is responsible for more than 23,000 deaths and has a direct societal cost of $20 billion and an indirect cost of $35 billion. Similarly, in Europe, 25,000 deaths have been recorded at a cost of over $1.5 billion [12]. In Africa, the extent of this resistance problem is not sufficiently known because of the unavailability of data [13]. In addition, national plans to combat antimicrobial resistance are not yet well defined. It is in June 2017 that this problem has been addressed with sensitivity. Some African countries such as Cameroon, Chad have come together to implement national action plans on the fight against antimicrobial resistance [12]. In Senegal, studies have shown a high rate of resistance to antibiotics such as tetracycline, cotrimoxazole, quinolones and third generation cephalosporins [19-21]. In Morocco, it is the consumption of antibiotics that is more encountered according to International Medical Statistics (IMS) data on the development of consumption [19]. In Cameroon, there is no real national strategic plan. During the week for the proper use of antimicrobials, especially antibiotics on humans and animals on 12 November 2018, experts in the field debated the issue, at the end of which, a statement made by one of the experts was as follows: "If nothing is done, it could lead to the death of about 4.15 million people in Africa by 2050" [20]. A study done in Dschang in 2015, showed that antibiotic resistance is generally due to poverty, political imbalance, malnutrition and environmental precariousness [13]. In order to reduce morbidity and mortality from microbial infections, antimicrobial prescribing remains one of the major axes of therapeutic management for the prescriber [14-19]. It is a complex decision, influenced by medical knowledge and many determinants [18, 23-32, 35].

1.2. Objective of the Study

In order to promote the proper use of antimicrobials, it is important to know the determinants of decision-making in prescribing, using and dispensing antimicrobials, as antimicrobial resistance is undermining the prevention and effective treatment of an increasing number of infections and is thus a growing threat to public health worldwide. It requires action in all sectors across society. This study therefore ascertained the determinants related to antimicrobial resistance in Douala III, Cameroon.

2. Methods

2.1. Study Design and Period

A descriptive cross-sectional study over a seven-month period from January to August 2019 was conducted targeting antimicrobial prescribers, dispensers and users. On one hand, an inventory has been done for prescribers and dispensers. On the other hand, a cluster sampling at many degrees has been done for users; which consisted to select quarters, sub-quarters and households.

2.2. Setting, Procedures, Sampling, and Analysis

This subdivision was chosen for the following characteristics: its size, diversity of relief, cosmopolitan and heterogeneous population.

The data were collected using anonymous questionnaires (containing questions relative to respondents' sociodemographic characteristics, knowledge, attitudes and practices) addressed to prescribers, antimicrobial dispensers and users with voluntary informed consent. Data were analysed using Epi info 7.0 software. The analysis of the associated factors to knowledge, attitudes and practices was determined using the logistic regression test. Any value of $P<0.05$ was considered statistically significant at the 95% confidence interval. Ethical approval was obtained from the Ethics Committee of the University of Douala as well as administrative authorizations were obtained notably from the Regional Delegate of Public Health, the sub-divisional officer of Douala III, the managers of various private structures and some laboratories of this district prior to the study.

3. Results

The total number of respondents in this study was 598 among whom 100, 113 and 385 prescribers (doctors, nurses and others), dispensers (formal and informal sector) and users respectively.

3.1. Sociodemographic Characteristics

The respondents sociodemographic characteristics are presented on table 1 and figure 1 below.

Table 1. *Sociodemographic characteristics of participants.*

Variable		Prescribers	Dispensers	Users
		n (%)	n (%)	n (%)
Age range (years)	>40	30 (30)	14 (12.39)	23 (5.97)
	31-40	32 (32)	52 (46.02)	80 (20.78)
	≤30	38 (38)	47 (41.59)	282 (73.25)
Gender	Female	49 (49)	69 (61.06)	259 (67.27)
	Male	51 (51)	44 (38.94)	126 (32.73)
Study level	Primary	-	3 (2.65)	52 (13.51)
	Secondary	-	74 (65.49)	132 (34.28)
	Superior	-	36 (31.86)	201 (52.21)
Years of experience (years)	≤5	50 (50)	81 (71.68)	-
	>5	50 (50)	32 (28.32)	-
Dispensers' profile	Formal		38 (33.63)	
	Informal		75 (66.37)	

First of all, it is observed from this table that the most represented age range in the prescribers' and users' groups was less or equal to 30 years (38% and 73.25% respectively) and 31 to 40 years in the dispensers' group (46.02%). Oppositely, the less represented age range in the 3 groups was 40 years or more. Then, it appears that unlike prescribers, female was the most represented gender in the dispensers' and users' groups (61.06% and 67.27% respectively) and the most observed study level was the secondary level (65.49%) and the superior level (52.21%) in the dispensers group and the users group respectively. Unlike prescribers, a difference was observed in the years of experience in the dispensers group where 71.68% of the participants had ≤5 years of experience. Finally, dispensers were found to be mostly informal dispensers with a percentage of 66.37%.

Figure 1 reveals that superior student was the most represented occupation among users (41%) and nurses were the most represented profile in the prescribers group, either 55%. Concerning the dispensers' group, drug selling was not the principal occupation of 25% of them and the mostly represented occupations of this portion was Nursing (23.53%), Trading (17.65%) and Studying (17.65%).

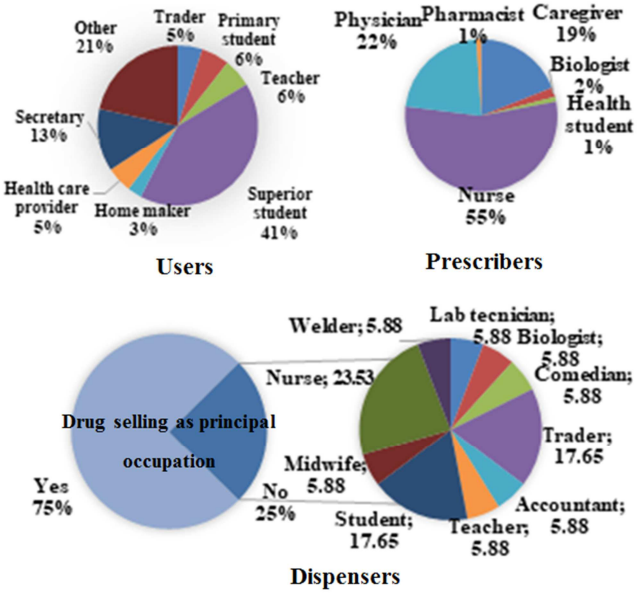
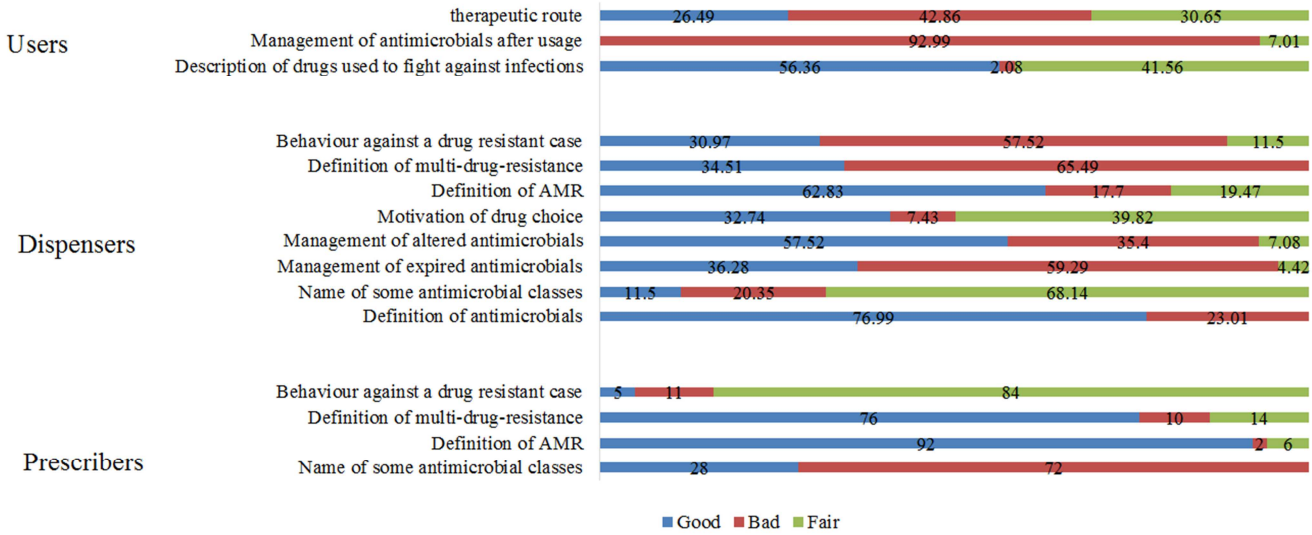


Figure 1. *Distribution of participants according to their occupation.*

3.2. Knowledge, Attitudes and Practices of Prescribers, Dispensers and Users of Antimicrobials

The distribution of the knowledge, attitudes and practices are presented in this following figure:



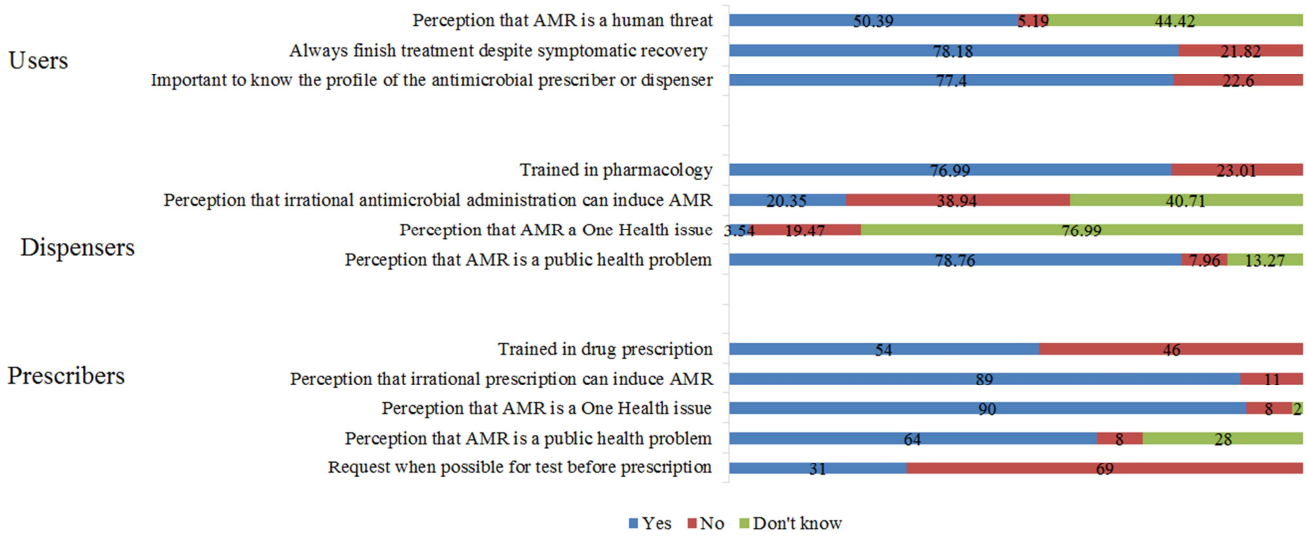


Figure 2. *Distribution of participants' knowledge, attitudes and practices.*

It can be noticed that only 54% of prescribers have been trained in drug prescription. The majority of prescribers well defined AMR (92%) and multidrug resistance (72%) but few (28%) named correctly some classes of antimicrobials and only 5% adopted good behaviours in front of a drug resistant case. Also, 89%, 90% and 64% prescribers respectively perceive the fact that: irrational antimicrobial prescription can induce AMR, AMR is a public health burden and AMR is a multi-sectorial concern but only 31% answered that they always request when possible the antimicrobial susceptibility test before prescription. Concerning dispensers, only (87/113) have followed a training session in pharmacology. A relatively greater number knew the definition of antimicrobials (87/113) and perceive the fact that AMR is a public health burden (89/113) but just few answered positively to other questions about the definition of multi-drug resistance (39/113), definition of AMR (71/113), naming some antimicrobial classes (13/113), perception that AMR is a One Health issue (4/113), perception that the irrational antimicrobial administration can induce AMR (30/113), management of altered antimicrobials (65/113), management of expired antimicrobials (41/113), motivation of the choice of antimicrobial toward a case (37/113) and the behaviour toward a drug resistant case (35/113). Concerning users, null knew the management of antimicrobials after usage and only: 102/385 followed a satisfied therapeutic route, 217/385 well described drugs used to treat infectious diseases, 194/385 perceived that AMR is a human threat, 301/385 always finish the illness treatment despite recovery and 298/385 found that it is important to know the profile of the dispenser/prescriber.

3.3. Associated Factors to the Knowledge, Attitudes and Practices of Antimicrobial Prescribers Relative to AMR

Table 2 reveals that the age range was statistically associated to knowledge; the incorrect knowledge of those in the age range (31-40) was significantly higher than those having more than 40 years (P-value = 0.0367). It can also be observed that practices are statistically associated to age range ≤30, the duration of the last training and the experience (P-value = 0.0004; 0.0373: 0.0062).

Table 2. *Distribution of associated factors to knowledge, attitudes and practices of antimicrobial prescribers by logistic regression.*

Variable		Knowledge		Attitudes		Practice	
		incorrect: n (%)	P-value, OR, 95%CI	Negative: n (%)	P-value, OR, 95%CI	Bad: n (%)	P-value, OR (95%CI)
Age range (years)	> 40	18 (60.00)	Ref	6 (20.00)	Ref	29 (96.67)	Ref
	31-40	27 (84.38)	0.0367, 3.60 (1.08-11.97)	3 (9.38)	0.2450, 0.41 (0.09-1,83)	25 (78.13)	0.0577, 0.12 (0.01-1,07)
	≤30	27 (71.05)	0.3404, 1.64, (0.59-4.50)	2 (5.26)	0.0796, 0.22 (0.04-1,19)	15 (39.47)	0.0004, 0.02 (2.76E-3-0.18)
Gender	Female	37 (75.51)	Ref	3 (6.12)	Ref	33 (67.35)	Ref
	Male	35 (68.63)	0.4444 0.71 (0.29-1.71)	8 (15.69)	0.1395, 2,85 (0.71-11.46)	36 (70.59)	0.7262, 1.16 (0.50-2.72)
Last training (years)	Never	34 (73.91)	Ref	4 (8.70)	Ref	32 (69.57)	Ref
	≤5	12 (80.00)	0.6355, 1.41 (0.34-5.88)	1 (6.67)	0.8041, 0.75 (0.08-7.28)	7 (46.67)	0.1147, 0.38 (0.12-1.26)
	>5	26 (66.67)	0.4659, 0.71 (0.28-1.80)	6 (15.38)	0.3460, 1.91 (0.50-7.33)	26 (66.67)	0.0373, 3.81 (1.08-13.41)
Experience (years)	≤5	36 (72,00)	Ref	3 (6.00)	Ref	28 (56.00)	Ref
	>5	36 (72,00)	>0.9999, 1.00 (0.42-2.39)	8 (16.00)	0.1233, 2,98 (0.74-11.99)	41 (82.00)	0.0062, 3.58 (1.44-8.91)

3.4. Associated Factors to the Knowledge, Attitudes and Practices of Antimicrobial Dispensers Relative to AMR

Table 3. *Distribution of associated factors to knowledge, attitudes and practices of antimicrobial dispensers by logistic regression.*

Variable		Knowledge		Attitudes		Practices	
		Correct: n (%)	**P-value, OR, 95%CI**	**Positive: n (%)**	**P-value, OR, 95%CI**	**Good: n (%)**	**P-value, OR (95%CI)**
Age range (years)	> 40	12 (85.71)	Ref	4 (28.57)	Ref	2 (14.29)	Ref
	31-40	46 (88.46)	0.7802, 1,28 (0.23-7.15)	17 (32.69)	0.7691, 1.21 (0.33-4.44)	12 (23.08)	0.4797, 1.80 (0.35-9,19)
	≤30	39 (82.98)	0.8085, 0.81 (0.15 4.36)	18 (38.30)	0.5078, 1.55 (0.42-5.70)	17 (36.17)	0.1365, 3.40 (0.68–17.03)
Gender	Female	59 (85.51)	Ref	26 (37.68)	Ref	19 (27.54)	Ref
	Male	38 (86.36)	0.8987, 1,07 (0.36-3.20)	13 (29.55)	0.3761, 0.69 (0.31-1.56)	12 (27.27)	0.9756, 0.99 (0.42-2.30)
Profile	Formal	37 (97.37)	Ref	29 (76.32)	Ref	13 (34.21)	Ref
	Informal	60 (80.00)	0.0348, 0.11 (0.01-0.85)	10 (13.33)	<0.0001, 0.05 (0.02-0.13)	18 (24.00)	0.2526, 0.61 (0.26-1.43)
Study level	Primary level	2 (66.67)	Ref	2 (66.67)	Ref	2 (66.67)	Ref
	Secondary level	63 (85.14)	0.4065 2.86 (0.24 34.36)	57 (77.03)	0.6807, 1.68 (0.14-19.64)	22 (29.73)	0.2143, 0.21 (0.02-2.46)
	Superior level	32 (88.89)	0.2989 4.00 (0.29 -54.73)	28 (77.78)	0.6641, 1.75 (0.14 21.88)	7 (19.44)	0.1025, 0.12 (0.01-1.53)
Experience (years)	≤5	71 (87.65)	Ref	33 (40.74)	Ref	24 (29.63)	Ref
	>5	26 (81.25)	0.3822, 0.61 (0.20-1.85)	6 (18.75	0.0310, 0.34 (0.12-0.91)	7 (21.88)	0.4070, 0.67 (0.25-1.74)

Table 3 reveals that both the knowledge and attitudes were statistically associated to the profile of the dispenser (P-value = 0.0348; 0.0001).

3.5. Users

Table 4. *Distribution of associated factors to knowledge, attitudes and practices of antimicrobial users by logistic regression.*

Variable		Knowledge		Attitudes		Practices	
		incorrect: n (%)	**P-value, OR, 95%CI**	**Negative: n (%)**	**P-value, OR, 95%CI**	**Bad: n (%)**	**P-value, OR (95%CI)**
Age range (years)	>40			15 (65.22)	Ref		
	≤30	83 (29.43)	Ref	147 (52.13)	0.2310, 0.58 (0.24-1.41)		
	31-40	18 (22.5)	0.2240, 0.70 (0.39-1.25)	29 (36.25)	0.0161, 0.30 (0.11-0.80)		
Gender	Female	62 (23.94)	Ref	135 (52.12)	Ref	236 (91.12)	Ref
	Male	39 (30.95)	0.1431, 1.42 (0.89-2.29	59 (46.83)	0.3296, 1.24 (0.81-1.89	122 (96.83)	0.0489, 2.97 (1.01-8.79)
Marital status	Single	76 (28.15)	Ref	143 (52.96)	Ref	246 (91.11)	Ref
	Married	25 (21.74)	0.1919, 0.71 (0.42-1.19)	48 (41.74)	0.0445, 0.64 (0.41-0.99)	112 (97.39)	0.0380, 3.64 (1.07-12.35)

This table reveals that attitudes were statistically associated to the age range and to the marital status (P-value = 0.0161; 0.0445). The practices were instead associated to the gender and the marital status (P-value = 0.0489; 0.0380).

4. Discussion

AMR is a relatively old public health problem that is being avoided in both developed and developing countries. It affects human, animal and environmental health. In poor countries in particular, the increased use of AMs is a direct consequence of the incidence of infectious diseases created here by poverty and poor environmental hygiene. In addition, the irrational misuse of AMs in this context creates selection pressure on pathogens that favours the generation of new strains resistant to the AMs in circulation. However, the use of AMs in practice does not by itself justify the high frequency of microorganisms and the phenomenon of AMR in developing countries. One of the consequences of this phenomenon is essentially linked to its user (super-infection that may lead to a critical state of immune-depression or even death) [14]. The present study focuses particularly on the knowledge, attitudes and practices of the different actors involved, and analyses certain aspects related to the diagnostic laboratory, in order to identify and characterise the determinants of AMR in the Douala III district. The level of knowledge of AMR is increasingly good, ranging from users, dispensers in the formal and informal sectors to prescribers. When prescribing, dispensing and using AMs, the laboratory examination comes second to the signs, symptoms and economic status of patients. The management of AMs and the strategies for combating multi-drug resistance are carried out in different ways by the various actors involved.

The majority of participants were females in each group and the largest fraction relative to age group was that lesser than or equal to 30 years old (prescribers' and users' groups) and between 31-40 years (dispensers). This supports the fact that the age distribution is pyramidal in Cameroon and drug dispensation is a profession which is mostly undertaken at advanced ages. Such results are in line with those of Essomba and *al* in a study carried out in Nkongsamba on the procurement habits of a population in a semi-rural environment [34]. 66.37% of dispensers were in the informal sector showing that informal drug dispensers are dominating in Cameroon but most of them have an acceptable educational level (secondary). There was an association between certain baseline characteristics (age, professional experience, professional profile and marital status) and familiarity with

AM and AMR depending on each stakeholder. Different participants are familiar with MAs, but the level of knowledge of MAs is different for each provider. The notions of AMR and Multi-AMR were fairly well perceived with the level of knowledge varying widely between the groups. Users, despite the fact most had a good scholar level (52.21% with a superior level), they had poor knowledge, attitudes and practices relative to antimicrobial use. These findings are contrary to those of James and *al* who presented that the knowledge level of AM users should normally be improved by prescribers as they would be better [5]. However, AMR in general is a problem for animal, human and environmental health. Hence the need to integrate all these sectors as shown by Nyerere in Ethiopia. When prescribing or dispensing AMs, preferences were predominantly focused on users (economic status, signs and symptoms) and subsequently on medical representatives. These results corroborate with those of James and *al* who stated that prescribers were only interested in the financial means (70%) of patients. [5]. Furthermore, prescribers reported that irrational prescribing of AMs would lead to the emergence of new strains of microorganisms. These findings are in line with those of Iruka and *al* who found that: Antibiotic use provides selective pressure for resistant bacterial strains; inappropriate use increases the risk of selection and dissemination of antibiotic resistant bacteria, which have a competitive advantage. [33]. The best strategy to undertake in case of AMR proposed by the prescribers is to change the treatment and extend the treatment time and only 31% required antimicrobial susceptibility testing before prescription. James and *al* also advocate hospital hygiene [5]. In addition, the study found that only 54% of prescribers weretrained in drug prescription. This observation sufficiently underlines the danger of of AMs misuse in Douala III subdivision; antibiotics being the most used and distributed contrary to the other categories (antiparasitics, antifungals and antivirals) [26]. The majority of prescriptions are motivated by signs. This finding is, however, contrary to that of the study carried out by Commeyras and *al* in Cameroon, who found that 53% of prescriptions were dictated by the test [22]. In 73.51% of cases, users resort to dispensers in the informal sector who do not master antimicrobials and operate clandestinely despite all the restrictive laws in force. Moreover, 53% of the latter declare that they operate solely for profit. This is similar with the study by Pouillot and al (which showed that informal sector providers had a higher level of education (50%) [36]. The process of managing waste and AOS (leftovers and expired products), which is an important link in the fight against AMR, differed from one sector to another, but the majority of each group was in the dustbin. These results are in line with those presented in the OPEN ACCESS journal in 2013, which suggested that basic hygiene and sanitation should be improved to reduce the spread of micro-organism resistance. Users of AMs have as their first recourse the informal sector; we must note that laboratory examinations were not done beforehand; this could really have a major impact on the treatment which will be done here without specificity and whose major consequence may be super-infection. This is in line with the findings of Moses Osen et al. [37]. Diagnosis is a key area in the fight against AMR. Regarding the level of bench separation, we noticed that only laboratories with culture that has an acceptable or good level of bench separation [1]. Standardised protocols were not commonly used in these facilities; this could favour the evolution of the AMR problem. This is the case reported by Ouedraogo et al, who say that the lack of infrastructure for etiological diagnosis and antibiotic resistance assessment could favour AMR. Indeed, the prescription of AMs requires a good diagnostic approach including the establishment of an etiological diagnosis either by isolation and identification of the infectious agent or by serology tests to establish contact with the pathogen [38]. In low-resource countries, these diagnostic options are limited because there are usually very few health facilities with appropriate laboratory facilities. When they do exist, they are usually poorly equipped and only allow for basic examinations such as microscopy. In these conditions, most treatments are presumptive and based on literature data from developed countries that do not necessarily share the same microbial ecology and may therefore be inappropriate [38].

The significantly high incorrect knowledge (P-value <0.05) of prescribers aged between 31 and 40 years old may be linked to the fact that they have a lower experience relative to social independence as compared to those aged above 40 years old which most often constitute a stressing source due to responsibilities in their nuclear and extended families. The non-significant difference observed between prescribers aged below 31 years old and those above 40 years old maybe due to the massive use of internet (via mobile phones) for documentation by this first group as noticed during the study. It is may be for this same reason that the bad practices were significantly lower in the age group: ≤30 years old. The significant association between the practices and both the professional experience and the duration of the last training in drug prescription highlights the fact that continuous training is required. This study also highlights the fact that knowledge and attitudes are statistically associated to the dispensers' profile showing that informal dispensers considerably concerned with AMR in Douala III due to lack of academical training. The findings according to the fact that in the users group bad practices were significantly associated to male gender and married individuals are not surprising since in this context, it frequently and empirically observed that men observed lesser hygiene measures in favour of money save, mostly married ones who despite their significant lower negative attitudes, must multiply financial entries to afford their relatively loader responsibilities.

5. Conclusion

It was important for us to note that AMR is a problem for which the actors have in turn a crucial share of responsibility (prescribers, dispensers and users). There was for certain baseline characteristics a significant influence with the knowledge of the populations and that could favour AMR.

Informal dispensers were used as first-line referrals in cases of discomfort due to the economic problems of users. The management of drug waste or AMs was not done in the right way which would further contribute to the problem of AMR especially in the environment and thus affect human and animals. This evidence demonstrates that in order to better fight against this phenomenon the different investigators should come back to the ONE HEALTH approach (human, animal and environmental). The determinants (mostly sociodemographic characteristics) of prescribers', dispensers' and users' knowledge, attitudes and practices relative to AMR were varying from one group to the other, but globally, age group, marital status, gender and training duration were determinants in particular cases.

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