Analysis of Knowledge and Practice on Antibiotics Prescribing with Physicians in Hospitals Goma, RD Congo

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Abstract

Background: Improving good practice in antibiotics use is critical in challenging antimicrobial resistance. This study assessed knowledge and practices regarding antibiotic prescribing in children by physicians in both public and private health care in Goma, East of the Democratic Republic of Congo, a low-income country.

Methods: A cross-sectional study using self -administered questionnaires was applied.

Results: 147 physicians from twenty-five health care providers in the city of Goma participated in the study. More than three-quarters [85.7% (n=147] were General Practitioners from primary health care settings. More than two-thirds of the participants had over five years' experience. In approximately three-quarters of cases [72.1%, (n=147)], the participants declared lack of recent training on antibiotic prescribing. In the five clinical situations posed to the participants, antibiotics prescribing practice was felt to be inappropriate or unnecessary in 15 to 80%. Antibiotic prescribing for symptoms of cough and fever, yellowish sputum, odynophagia, cold and flu and fever, positive "Thick smear" test and fever were categorized as unnecessary or inappropriate. An incorrect response concerning the susceptibility of *Staphylococcus* Methicillin-Resistant (MRSA) was demonstrated in more than three-quarters in General Practitioners [76.4%, (n=123)] compared to less than half in Specialists [41.2%, (n=123)] (p=0.00). With regard to *Enterococcus* susceptibility, an incorrect response was noted in more than three-quarters in both General Practitioners and Specialists. A number of internal factors or determinants in health care institutions (Publics and Privates sectors) were noted to restrict good practice in antibiotics prescribing. Factors contributing to poor to practice in antibiotics prescribing were the uncertainty in the diagnosis, physicians who had only practiced in private hospitals and clinics and frequent antibiotics stock shortage in public or semi-public hospital. In more than a third of physicians, antibiotics resistance was not perceived as a problem in their daily practice or as a public health problem.

Conclusions: Hospitals in Goma demonstrated inappropriate antibiotic prescribing practice. Strategies and policies such as Antimicrobial Stewardship and socio-anthropological approach need to be explored.

Keywords: Knowledge, Practice, Antibiotic prescribing, Goma hospitals

Introduction

Development of antimicrobial resistance is an increasing global health care problem word-wide (WHO, 2014). In this context, the issue of appropriate antibiotic prescription arises (Auta et al., 2019). Changes in antibiotic prescribing patterns need changes in physicians' practice and behavior. The best practice in antimicrobial prescribing are broadly related to a physicians' knowledge on the topic (García et al., 2011; Thriemer et al., 2013; Goulet et al., 2009). However, both internal and external determinants from health care systems or from patients can affect a physician's prescribing practice of antibiotics (Cotter & Daly, 2007; Feron et al., 2009).

Several studies in Europe (Faure et al., 2009; Porretta et al., 2003), the USA (Fleming-Dutra et al., 2016) and other countries (McDonagh et al., 2018) have shown that in 20-50 % of cases, the antibiotics prescribed by Physicians were either inappropriate or unnecessary. In high income countries (Dellit et al., 2007; Bruce et al., 2009; Nathwani, 2006), guidelines have been developed and implemented for good practice of Antimicrobial prescribing. The situation is more serious in low-income countries where there is no Antimicrobial Stewardship and a lack of perception of the emerging problem (Ajibola et al., 2018).

Few studies in Africa assessing physicians' knowledge and practice of antibiotics prescribing have been carried out (Thriemer et al., 2013; Vlieghe et al., 2009; Cohen et al., 2017). In general, antibiotics prescribing would were based on empirical evidence or on physicians' experiences (Wise & Piddock, 2010). To our knowledge, in Democratic Republic of Congo (DRC), only one study on Knowledge, Attitude and Practice (KAP) regarding antibiotics prescribing among medical doctors and students has been carried out before (Thriemer et al., 2013).

In Nord Kivu province, East of DRC, no study assessing physicians' Knowledge and Practice on antibiotics prescribing is yet available.

Considering the implication of antimicrobial resistance word-wide (WHO, 2014) and difficulty producing new generations of antibiotics (El Sayed et al., 2009), antibiotic use needs to be rationalized. Good prescribing practice in antibiotics is the key in antimicrobial resistance challenge.

In order to explore and improve good practice in antibiotic prescribing by physicians for children in hospitals in Goma, we have conducted a survey to assess the level of physicians' knowledge and practice.

We collated information on factors which could impact the good prescribing practice in terms of physicians and institutions. We also aimed to assess physicians' beliefs about the consequences of antimicrobial resistance.

Methods

Study Design and Setting

This was a cross-sectional study using a questionnaire distributed to physicians in both public and private health care institutions.

It was carried out between May and August 2019, in Goma, North Kivu province, East of the Democratic Republic of Congo.

Respondents

The participants were physicians, in either public or private health care institutions in Goma, who were involved in pediatric care (see Table 1).

Table 1. Public, semi-public and private health care institutions concerned by the Study

Public or semi-public Hospitals and Hospitals centers	Number of Public Doctors	Private Hospitals and Clinics	Number of Private Doctors
Hôpital Provincial du Nord Kivu (HPNK)	49	Heal Africa,	44
HGR Charité Maternelle (HGRCM)	33	CIMAK	7
HGR Virunga (HGRV)	10	CAMELIAS	4
Hôpital Kyeshero	15	Belle vue	4
Hôpital Bethesda	14	DOCS LG	5
Police nationale	10	DOCS -RDC	4
Mont carmel	5	SMUR	2
Muungano Résurrection	4	CEDIGO	6
Providence	3	Wellness	4
Kahembe	2	DIMAGELO	3
		CNSS	1
		Ste RITA	1
		DGDA	2
		OSAM	1
		CMC	3
Total	145	Total	91

Data Collection and Survey Instrument

Data collection model was modeled on previously published studies (García et al., 2011; Thriemer et al., 2013; Goulet et al., 2009; Cotter & Daly, 2007; Feron et al., 2009) taking into account the local considerations and the pediatrics context. The questionnaire was validated by the research team and was piloted on three physicians who were not included in the study. The questionnaire was distributed and collated by one of the authors (EBT). Each participant responded anonymously.

Variables

Selected variables were based on literature (WHO, 2014; Auta et al., 2019; García et al., 2011; Thriemer et al., 2013) and were adapted to the local context.

Variables were grouped by the following categories:

The first group presented the basic profile of physicians including hospital affiliation, department, level of physicians' qualification (general practitioner- or specialist), and number of years of experience.

The second group explored the level of physicians' knowledge in common clinical situations and evaluated the choice of antibiotics prescribed, known antimicrobial susceptibility, and the optimum duration of treatment with antibiotics.

The third explored the reason for antibiotics being prescribed, for example, use of guidelines, personal experience, discussion with peers, and microbiology laboratory advice.

The fourth group looked at physicians' perceptions of antibiotic resistance and the reasons that might affect why antibiotics were prescribed; for example, diagnostic uncertainty, earlier self-medication with antibiotic without improvement, patient expectations for antibiotics desire to keep good relations to the patient, the lack of bacteriology laboratory, and shortage of antibiotics.

Data and Statistical Analyses

Data were encoded and analysed with the software package IBM SPSS statistics version 23. Proportions were compared using the Pearson Chi 2 test or exact Fisher test. Odds ratio (OR) were calculated considering the category of variables having the lowest relative frequency. For quantitative variables, means and/or medians were compared with the ANOVA or Mann-Whitney tests. The threshold for statistical significance was 0.05.

Ethical Considerations

The study was approved by Université Libre des Pays des Grands Lacs (ULPGL) ethics committee (Ref/N°:001/CE/ULPGL/MK/2019) in accordance with Helsinki Declaration principles. The participants were both informed by a written consent formulary.

Results and Discussion

Participants' Profiles

A total of 147 physicians [62.28% (n=236] working in the twenty-five health care institutions in the city of Goma participated in the study. More than three-quarters [85.7% (n=147] were general practitioners. Physicians working in public hospitals represented two-third of the total participants. More than two-thirds of physicians reported having professional experience of more than five years. Approximately three-quarters of participants [72.1%, (n=147)], declared a lack of recent training on antibiotics prescribing.

Table 2. The general profile of physicians who accepted to participate in the survey on knowledge and practice on antibiotics prescribing in Goma, August 2019

Parameters	**%**
Numbers of Heath care institutions n=25	
Publics or semi-public hospitals	60.5
Private Hospitals or clinics	39.5
Qualification of physicians n= 147	
General practitioners	85.7
Specialistes	14.3
Number of years of experience of physicians n=147	
< 5 years	36.1
≥ 5years	63.9
Department n = 147	
General consultation	49.0
Paediatrics – Neonatology	18.4
Surgery	17.7
Emergency and intensive care	6.8
Others: ORL, Maternity, SMUR	8.2
Recent training on antibiotics prescribings n =147	
Yes	27.9
No	72.1
Last training period on antibiotics prescribings n=147	
< 1year	14.3
1-5 years	33.3
≥ 5 years	15.6
No training in the last five years	36.7

Knowledge and Doctors' Antibiotics Prescribing Practice

In the five clinical situations posed to the participants, antibiotics prescribing practice was felt to be inappropriate or unnecessary in 15 to 80 %. This was dependent on the level of physicians' qualification and different work locations (Tables 3 and 4).

Table 3. Antibiotics prescribing based on different symptoms and certain bacterial susceptibility according to the physicians' departments

Symptoms, regimen of antibiotics treatment and susceptibility of certain bacterial strains	**Departments**			
	Pediatrics-Neonatology %	General-consultations and other services %	OR (IC à 95%)	*P*-value
Flu, cold and Fever n=143				0.75
No	66.7	69.8	1	
Yes	33.3	30.2	0.86 (0.71 -1.04)	
Cough and sputum production n=145				0.50
No	18.5	24.6	1	
Yes	81.5	75.4	0.69 (0.56 -0.86)	
Diarrhea for 4 days in child n=138				0.19
No			1	
Yes				
Odynophagia n=139				0.71
No	25.9	29.5	1	
Yes	74.1	70.5	0.68 (0.98-1.01)	
Fever + GE + n=143				0.12
No	85.2	70.7	1	
Yes	14 .8	29.3	2.38 (1.91-2.97)	
Regimen to treat an infant of 18-month with diarrhea n=136				0.01
None of the regimen proposed	100	81.7	-	
Amoxicillin clavulanic acid, TMP/SM, metronidazole	0.0	18.3	-	
Regimen to treat an acute group A β hemolytic *streptococcus* pharyngitis n=136				0.07
None of the regimen proposed	16.0	5.4	1	
Amoxicillin -clavulanic acid 80mg/kg po twice a day for 14 days or Azithromycin 20mg/kg once for 7- 10 days or Penicillin V 200 - 400.000UI hourly 6 -8 for 3 days or Cefuroxim 20mg/kg once for 2 days.	84.0	94.6	3.33(2.41-4.60)	
MRSA susceptibility n=123				0.01
None of the antibiotics proposed	48.0	23.5	1	
Amoxicillin clavulanic acid, Cefotaxim, Ceftriaxon, metronidazole	52.0	76.5	3.00 (2.48-3.64)	
***Enterococcus* susceptibility n=125**				0.32
None of the antibiotics proposed	4.5	11.7	1	
Ciprofloxacin, Cefotaxim, Ceftriaxon	95.5	88.3	0.35 (0.25- 0.50)	

We did not observe a difference in knowledge and practice between physicians in pediatrics services and physicians in other services, except in the management of diarrhea. All physicians in pediatrics services recommended only rehydration, zinc supplements and electrolytes, compared to non-pediatric physicians who recommended an additional antibiotic regimen with amoxicillin or amoxicillin-clavulanic acid or trimethoprim /sulfamethoxazole or metronidazole.

More than nine out of ten general practitioners and more than three-quarters of specialists gave an incorrect response to the regimen for treating acute pharyngitis caused by Group A beta-hemolytic *Streptococcus.*

We noted incorrect responses regarding certain bacteria's susceptibility to specific antibiotics, in particular, *Staphylococcus* Methicillin-Resistant (MRSA) and *Enterococcus.* An incorrect response for MRSA was noted in more than three-quarters of General Practitioners [76.4 %, (n=123)] versus less than half in Specialists [41.2%, (n=123)]. With regard to *Enterococcus* susceptibility, incorrect responses were noted in more than three-quarters [88.2-89.8%, (n=123)] of both General practitioners and Specialists.

Basis or References for Antibiotics Prescribing Practice

When comparing General practitioners and Specialists antibiotic prescribing practice, there was a difference in the use of guidelines, level of experience and use of peer knowledge (Table 5). Specialists have the best knowledge and good antibiotics prescribing practice compared with General practitioners.

Table 4. Analysis of physicians' knowledge on antibiotics prescribing and certain bacterial susceptibility according to their qualification

Symptoms, regimen of antibiotics treatment and certain antibiotics resistance strains	**Physicians' qualification**			
	Specialistes %	General practitioners %	OR (IC à 95%)	*P*-value
Flu, cold and Fever n=143				0.94
No	70.0	69.1	1	
Yes	30.0	30.9	1.04 (0.86 -1.26)	
Cough and sputum production n=145				0.34
No	15.0	28.8	1	
Yes	85.0	75.2	0.46 (0.37-0.57	
Diarrhea for 4 days in child n =138				0.19
No	95.0	83.9	1	
Yes	5.0	16.1	3.64 (2.62-5.07)	
Odynophagia n=147				0.42
No	21.1	30.0	1	
Yes	78.9	70.0	0.62 (0.51-0.76)	
Fièvre avec GE + n=143				0.02
No	95.0	69.9	1	
Yes	5.0	30.1	8.18(5.97-11.20)	
Regimen to treat an infant of 18-month with diarrhea n=136				0.92
None of the antibiotics regimen proposed	15.1	14.3	1	

Amoxicillin clavulanic acid, TMP/SM, metronidazole	84.9	85.7	1.06 (0.83-1.36)	
Regimen to treat an acute group A β hemolytic streptococcus pharyngitis n=136				0.00
None of the regimen proposed	23.8	4.3	1	
Amoxicillin -clavulanic acid 80mg/kg po twice a day for 14 days or Azithromycin 20mg/kg once for 7- 10 days or Penicillin V 200 -400.000UI hourly 6 -8 for 3 days or Cefuroxim 20mg/kg once for 2 days.	76.2	95.7	6.95 (4.95-9.75)	
MRSA susceptibility n=123				0.00
None of the antibiotics proposed	58.8	23.6	1	
Amoxicillin clavulanic acid, Cefotaxim, Ceftriaxon, metronidazole	41.2	76.4	4.62 (3.81-5.60)	
Enterococcus susceptibility n =125				0.84
None of the antibiotics proposed	11.8	10.2	1	
Ciprofloxacin, Cefotaxim, Ceftriaxon	88.2	89.8	1.18 (0.89-1.56)	

Table 5. The practical or reference basis to prescribe antibiotics in children according to the physicians' qualification

The reference basis to prescribe antibiotics in children	**Physicians' qualification**			
	Specialistes %	General practitioners %	OR IC à 95%)	*P*-Value
International guideline n=147				0.07
Yes	71.4	15.9	1	
No	28.6	84.1	13.20 (10.61-16.42)	
National or local Protocoles n=147				0.95
Yes	52.4	53.2	1	
No	47.6	46.8	0.96 (0.81-1.15)	
Clinical and para clinical evidences n=147				0.06
Yes	61.9	80.2	1	
No	38.1	19.8	0.40 (0.32-0.49)	
Culture and sensitivity n=147				0.52
Yes	28.6	22.2	1	
No	71.4	77.8	1.40 (1.14-1.72)	
Own Professional experience n=147				0.04
Yes	47.6	25.4	1	
No	52.4	74.6	2.74 (2.26-3.30)	
Advice of an delegate of pharmaceutical companies n=147				
Yes	0.0	2.4	-	0.47
No	100	97.6	-	

Institutional Factors or Determinants that Negatively Impact Antibiotics Prescribing Practice

A number of internal factors or determinants in health care institutions (Publics and Privates sectors) were noted to restrict good practice in antibiotics prescribing. These included the uncertainty in the diagnosis or lack of confidence in medications level of experience and frequent antibiotics stock shortage in public or semi-public hospitals (Table 6).

Table 6. Factors or determinants that negatively impact antibiotics prescribing practice in physicians according to the public or private health care sectors

Factors or determinants impacting antibiotics prescribing practice in physicians	Publics Sectors Hospitals %	Private Hospitals and clinics %	OR (IC à 95%)	*P*-Value
Uncertainty in the diagnosis n = 147				0.02
No	43.8	25.9	1	
Yes	56.2	74.1	2.23 (1.84-2.69)	
Direct demand for antibiotics by patients to the physicians n=147				0.76
No	71.9	74.1	1	
Yes	28.1	25.9	0.89 (0.73-1.09)	
Previous use of antibiotics by patient without improvement n = 147				0.20
No	36.0	25.9	1	
Yes	64.0	74.1	1.60 (1.32-1.95)	
Long life Professional experience n=147				0.07
No	61.8	46.6	1	
Yes	38.2	53.4	1.85 (1.55-2.21)	
Desire to maintain a good relationships with the patient n=147				0.20
No	88.8	94.8	1	
Yes	11.2	5.2	0.43 (0.30-0.61)	
Frequent antibiotics stock shortage d'antibiotiques n=147				0.00
No	38.2	62.1	1	
Yes	61.8	37.9	0.37 (0.31-0.45)	
The provision of antibiotics considered less effectives n=147				0.86
No	68.5	67.2	1	
Yes	31.5	32.8	1.06 (0.88-1.28)	
Non-availability of bacteriology laboratory n=147				0.34
No	43.8	51.7	1	
Yes	56.2	48.3	0.73 (0.61-0.86)	
Recourse of non-Hospital pharmacy by patients n =144				0.25
No	57.6	67.3	1	
Yes	42.4	32.7	0.66 (0.55-0.79)	

Although most of the physicians surveyed consider antibiotics resistance a major health problem at a national or global level, more than a third of participants did not perceive this as a public health problem in their hospital or in their daily practice (Figure 1).

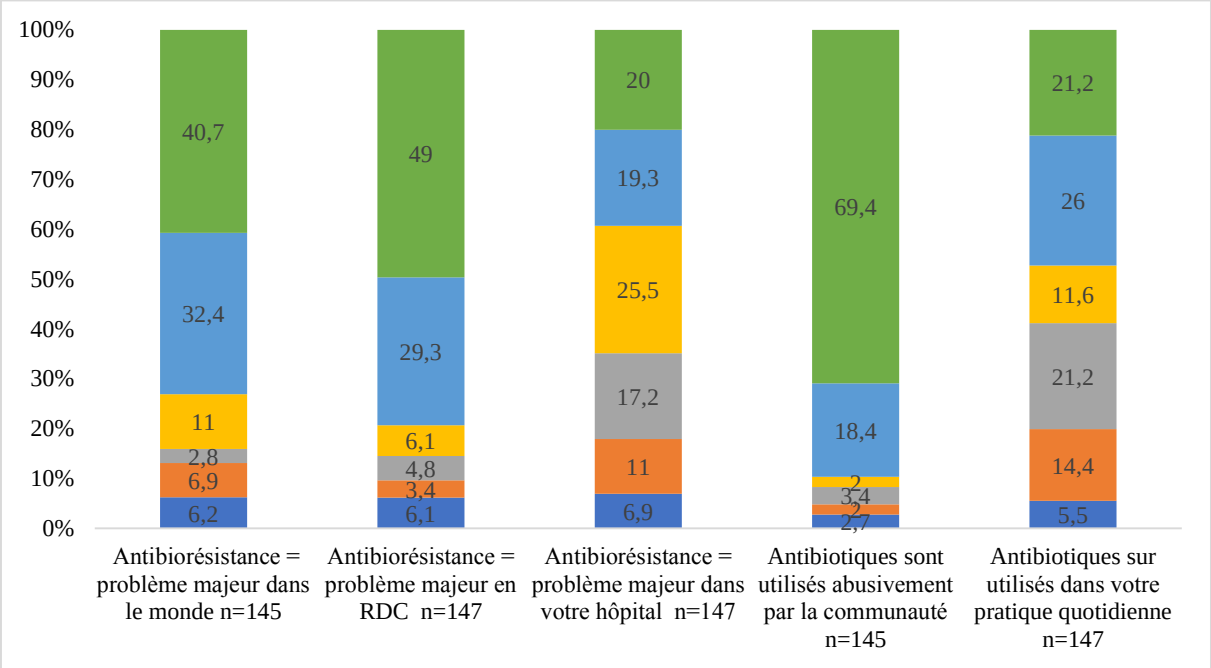

Figure 1. Perception of the problematic and the phenomenon of antibiotics resistance by physicians in Goma

Our study is the first to compare attitudes and practices amongst different groups of physicians working in different environments in DRC. Our study importantly covers the issue of Knowledge, Attitude and Practices (KAP) of antibiotics prescribing by physicians in the region. Other KAP studies have compared KAP in antibiotic prescribing between students and physicians (Thriemer et al., 2013; Ajibola et al., 2018; Vlieghe et al., 2009).

Our data confirms findings by other groups worldwide, that there is a large variation in the knowledge of how to manage common pediatric diseases in these other studies, the rate of antibiotic prescription was considered inappropriate or unnecessary in 20 to 50 % of cases (Faure et al., 2009; Porretta et al., 2003). Others describe a rate of 21.4% for cases of rhino pharyngitis and 45.5% in bronchitis (Wise & Piddock, 2010; El Sayed et al., 2009). One American study found that 56 % of children presenting with pharyngitis were given an antibiotic prescription even if the cause was felt to be viral (Fleming-Dutra et al., 2016).

Our data highlights the low level of awareness regarding antibiotics susceptibility for certain bacteria such as *Staphylococcus* Methicillin-Resistant (MRSA) or *Enterococcus sps*. This potentially could negatively impact antimicrobial use and resistance as there is no appropriate bacteriological control to match the local bacterial strain profile. Other groups have shown an adverse outcome in relation to certain bacteria in African regions (Ajibola et al., 2018; Cassir et al., 2012; Falagas et al., 2013). Physicians should have a good knowledge of these bacteria, in particular *Enterobacteriaceae* carbapenemase producing organisms, third-generation Cephalosporin (C3G) resistant organisms and MRSA, respectively integral part of WHO priority 1 (critical) and priority 2 (high) in term of research for new generations of antibiotics.

The implementation of guidelines and consensus views on antibiotic prescribing practices has enabled higher income countries to regulate their management policy on antibiotics prescribing (Fleming-Dutra et al., 2016; Dellit et al., 2007; Bruce et al., 2009). In

our study, the policies used by physicians to inform antibiotic use are not as robust using peer discussions rather than national or international consensus. These policy frameworks can present limitations due to the fact that they can be subjective and not based on local epidemiology. In more than three-quarter of cases, general practitioners did not use any policies (Chiappini et al., 2014).

In many High income settings, there are hospital based Antimicrobial Stewardship Teams to promote a rational use of antibiotics (Tacconelli et al., 2018; Davey et al., 2015; Gilchrist et al., 2015). Such teams are not available in low -middle-income-countries (LMIC).

In several other studies, direct demand for antibiotics by patients appear to be significantly associated with antibiotic prescriptions (Thriemer et al., 2013, Cotter & Daly, 2007; Feron et al., 2009). Our findings were similar with no difference between private and public institutions. This suggests a need for patient education and empowerment. If this is not acted on, these factors may lead to preventive antibiotic prescribing rather than therapeutic with the risk of a major emergence of resistant bacteria strains (Ajibola et al., 2018; Cassir et al., 2012; Zarb et al., 2012).

Our study demonstrates a lack of understanding of the problem of antibiotic resistance in over a third of participants. Antibiotic resistance was not perceived as a public health problem in their hospitals or in their daily practices. A lack of awareness of bacterial ecology as well as the lack of a bacteriology laboratory in most hospitals may be a factor. This is a common situation with lack of insight into the quality of care being provided (Tartari et al., 2019).

Recent studies (Davey et al., 2015; Huttner et al., 2019; Colman et al., 2019) propose socio anthropologic approach as a tool for behavioral change. This theory predicts therefore, that self-monitoring combined with one or more of the techniques that are theorized to have synergistic effects: observation, training, education, feedback, goal setting, and action planning. This approach could help to promote more appropriate behavior regarding the use of antibiotics.

Our study involved 147 participants, however a further [37.72%, (n=236)] refused to participate in the study. This may introduce a bias. Reasons for refusal to participate were not collated but may be variable: lack of interest, lack of time, lack of awareness of problem

Involvement of all local physicians is vital in the recognition and prevention of inappropriate use of antibiotics.

Conclusions

East of DRC is affected by inappropriate antibiotic prescribing practices. Improving good practice in antibiotics use needed to challenge antimicrobial resistance. Our study provides original data in this domain and highlights how training and behavior change management is required to improve the situation. Strategies and policies such as Antimicrobial Stewardship and socio-anthropological approaches should be explored to reduce this major public health problem.

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Competing Interests

All the authors declare that they have no competing interest.

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