Prescription of antibiotics as a source of emerging antibiotic resistance: Knowledge, attitudes, and practices of medical staff in the Dassa-Glazoué and Savalou-Bantè's health zones (Benin, West Africa)

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Abstract

Background and Aim: Antibiotics have been some great effective molecules against infections since their discovery. The excessive use and misuse of antibiotics have resulted in a selection of antibiotic-resistant strains. Among the reasons involved, the prescription of antibiotics can be important. The present study aimed to contribute to the reduction of antibiotic resistance due to the misuse of antibiotics.

Materials and Methods: A knowledge, attitude, and practice survey of health professionals from Savalou-Bante (230) and Dassa-Glazoué (100) health zones was performed about the prescription of antibiotics.

Results: About 53% of respondents in the health zone of Savalou-Bantè were assistant nursing and only 3% of them were specialized physicians. The other respondents were physicians (3%), midwives (10%), and nurses (31%). Forty-five percent of the respondents were nurses and only 5% of them were specialized physicians in Savalou-Bantè. However, all these health professionals prescribe antibiotics. The first-line antibiotics prescribed were penicillins, cephalosporins, macrolides, aminoglycosides, and quinolones. These health professionals usually have no knowledge of the mechanism of action of these antibiotics. The antibiotics prescribed mostly were for ear, nose, and throat and upper respiratory infections (80% in Dassa-Glazoué and 79% in Savalou-Bantè). The most commonly used dosage form was tablets (58%) in the health zone of Savalou-Bantè and the injectable form in the sanitary zone of Dassa-Glazoué.

Conclusion: It is important to implement a policy of rational use of antibiotics to reduce the excessive and misuse of antibiotics and prevent antibiotic resistance.

Keywords: antibiotics, health professionals, knowledge, prescription.

Introduction

Infectious diseases and their treatments are constantly evolving. New infectious agents are regularly discovered, mainly due to the evolution of identification techniques, in particular, through the development of molecular biology and mass spectrometry [1]. Changes in the epidemiology of infectious diseases are not always explainable, but the following factors undoubtedly play an important role: Changes in climate, ecology and lifestyles, vaccinations, and finally antibiotic use [1].

Antibiotics are used in animal health, agriculture, and human health [2,3]. Excessive use and misuse of antibiotics have long been identified as responsible for the

loss of sensitivity of microorganisms to antibiotics [4]. This is a widespread phenomenon nowadays known as antibiotic resistance, which is a real public health problem affecting both developed and developing countries [2]. It is associated with high mortality and generates a significant socioeconomic burden [2,5,6]. The WHO, therefore, recommends a rational and judicious use of antibiotics, which includes requiring a prescription by a health professional of antibiotics [7].

The prescription of antibiotics requires a good diagnostic approach including the establishment of an etiological diagnosis either by isolation and identification of the infectious agent or by serological tests to establish contact with pathogen [8]. In low-resource countries, these diagnostic options are limited because, in general, there are very few health facilities and appropriate laboratories. When they exist, they are traditionally poorly equipped and only allow basic examinations such as microscopy [9]. With 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 poorly adapted. In view of this, rural areas in developing countries often do not have a specialist physician or a well-developed care protocol for prescribing antibiotics. This is the case of the Dassa-Glazoué and Savalou-Bantè health zones in the department of the hills in Benin, which do not have a microbiology department. How do these health workers prescribe antibiotics in this health zone? This is the research question that prompted us to reflect on the theme: Knowledge, attitudes, and practices of health professionals in the Dassa-Glazoué and Savalou-Bantè's health zones.

The present study aimed to contribute to the reduction of antibiotic resistance due to the misuse of antibiotics.

Materials and Methods

Ethical approval and informed consent

The participation in the survey was voluntary and anonymous. Informed consent was obtained from participants. The Benin National Ethical Committee for Health Research has reviewed and approved the study under the No.65/MS/DC/SGM/DRFMT/CNERS/SA.

Study framework

This prospective and descriptive cross-sectional study covered the health zones of Savalou-Bantè and Dassa-Glazoué located in Benin (Figure-1). The Dassa-Glazoué's health zone has 39 public health units, including 1 zone hospital, 18 health centers at the district level, and 20 remote and isolated maternity
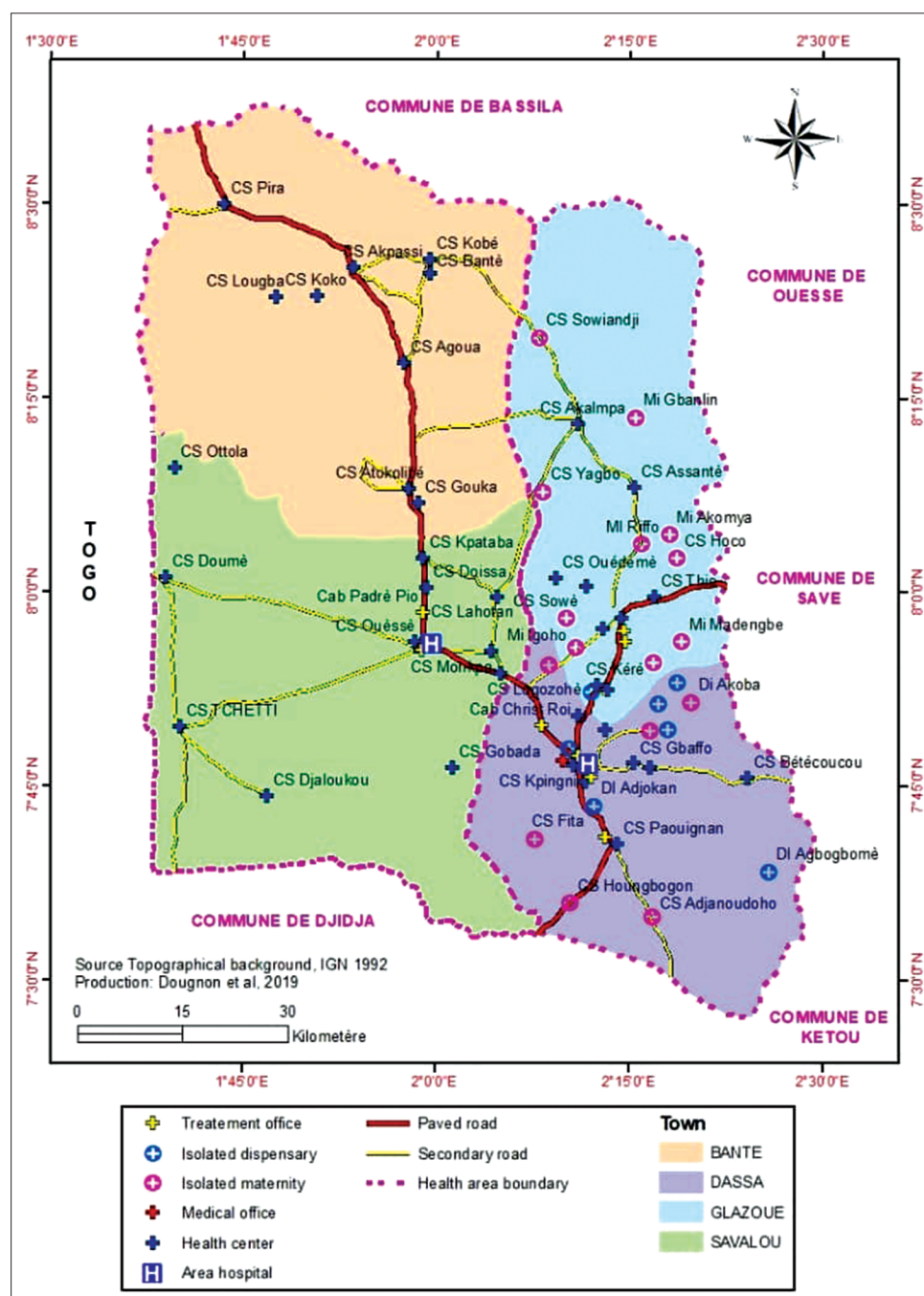

Figure-1: Geographical location of the Dassa-Glazoué and Savalou-Bantè health zones.

units/dispensaries. The Savalou-Bantè's health zone has 30 health facilities, including 21 district health centers, 5 isolated maternity units, 3 remote and isolated dispensaries, and 1 zone hospital. The remote and isolated hospitals have not been included in this study.

Study group (population and sampling)

Our study population is, therefore, represented by all professional groups who prescribe antibiotics. Radiology technicians, laboratory technicians, and pharmacy clerks were excluded from this study since they do not prescribe antibiotics. Health-care assistants, nurses, state midwives, nurses/specialists midwives, general practitioners, and specialized physicians were then involved in 230 health professionals from the Savalou-Bantè health zone and 100 from the Dassa-Glazoué health zone were targeted.

Knowledge, attitudes, and practices of health professionals

A questionnaire was administrated to health professionals met in the health centers of the Dassa-Glazoué and Savalou-Bantè health zones. This was a knowledge, attitude, and practice survey with a direct interview system to collect information from the staff. The requested information were related to the sociodemographic data about each respondent (socioprofessional category), use of the various protocols, the control of the treatment (therapeutic failures, respect duration of the treatment) knowledge of antibiotics, prescribed first-line antibiotic, dosage form and method of administration of prescribed antibiotics, knowledge about antibiotic resistance, etc.

Statistical analysis

The data obtained were entered into the Excel spreadsheet, which was used to calculate the percentages and to produce the tables and graphs.

Results

The study of the profile of the respondents showed that in the Dassa-Glazoué health zone, 45% of the respondents were nurses and only 5% of them were specialists' physicians (Figure-2). About 53% of the respondents in the Savalou-Bantè health zone were health-care assistants and 3% are specialists' physicians. The prescription of antibiotics follows a protocol in 75% of cases in the Dassa-Glazoué health zone and in 79% of cases in the Savalou-Bantè health zone. About 55% of the staff use a protocol based on bacteriological tests in the Dassa-Glazoué health zone against 37% in the Savalou-Bantè health zone. About 40% and 63% of the staff use a protocol for the dosage form (tablets or injection) in the Dassa-Glazoué and Savalou-Bantè health zones, respectively. For the dosage of antibiotics, 95% of the staff of the Dassa-Glazoué health zone use a protocol for 84% in the Savalou-Bantè health zone. Only 5% of the staff in the Dassa-Glazoué health zone require a consultation before the prescription of antibiotics and 10% for the

Savalou-Bantè health zone (Table-1). Respectively, 60% and 31% of the staff of the Dassa-Glazoué health zone and the Savalou-Bantè health zone admit having difficulties in prescribing antibiotics. However, 100% of the staff in the Dassa-Glazoué health zone and 89% in the Savalou-Bantè health zone respect the duration of the treatment. About 90% of the staff of Dassa-Glazoué health zone and 79% of the Savalou-Bantè health zone were aware that the nature of the bacteria can influence antibiotic therapy. However, 85% of the staff in the Dassa-Glazoué health zone and 79% in the Savalou-Bantè health zone admit to experiencing therapeutic failures (Table-2). The treatment failures were caused by inappropriate antibiotic selection, antibiotic resistance, and non-compliance with treatment (Figure-3). The infections for which antibiotics were most prescribed were ear, nose, and throat (ENT) and upper respiratory infections, lower
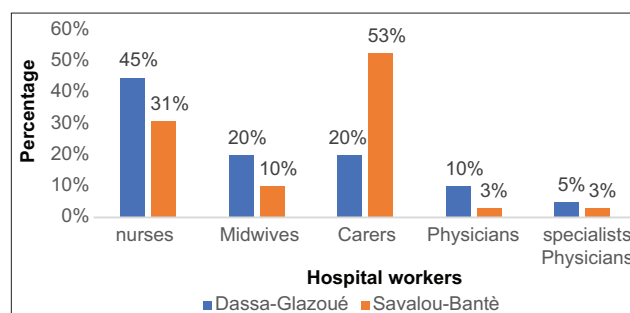
Figure-2: Distribution of respondents by hospital workers professions.
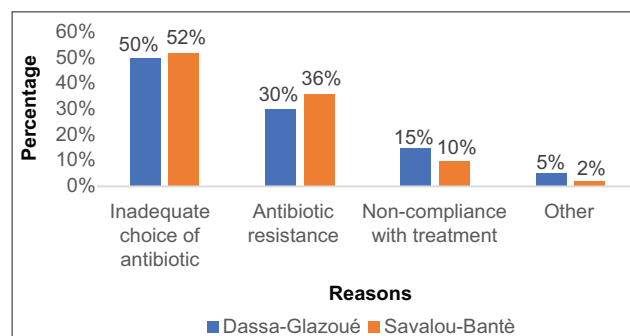
Figure-3: Causes of therapeutic failures.

Table-1: Use of a protocol for prescribing antibiotics.

Antibiotic prescription variables	Hospitals	
	Dassa-Glazoué (%)	Savalou-Bantè (%)
Antibiotic protocol	75 (75)	182 (79)
Protocol based on bacteriological tests	55 (55)	82 (37)
Protocol based on dosage form	40 (40)	145 (63)
Protocol for dosage	95 (95)	193 (84)
Consultation-based protocol	5 (5)	25 (11)
Protocol based on advice from an infectious disease specialist	10 (10)	23 (10)

respiratory infections, digestive infections, and uro-genital infections. The ones for which antibiotics are least prescribed are osteoarticular infections and eye infections (Figure-4). The most commonly prescribed first-line antibiotic families were penicillins, cepha-losporins, quinolones, and aminosides. The least pre-scribed families of antibiotics were polymyxins, rifa-mycins, monobactams, and glycopeptides. Antibiotics from carbapenem family were more prescribed in the Savalou-Bantè health zone (68%) and antibiotics from sulfonamides family were more prescribed in the Dassa-Glazoué health zone (Table-3). It should also

be noted that the antibiotics most prescribed by health professionals were the most well-known to these pro-fessionals. Antibiotics in injectable form were the most commonly prescribed in the Dassa-Glazoué health zone (55%) while in the Savalou-Bantè health zone, antibiotics in tablet were the most commonly used (58%). Generic antibiotics were the most com-monly prescribed in both centers. The health profes-sionals surveyed justify this mainly by the unavailabil-ity of specialty drugs in the area (Table-4). Most of the agents surveyed have a good knowledge of antibiotic resistance. However, much less are aware of natural resistance to antibiotics. Most of them were aware that medical practice influences the emergence of antibi-otics. Less than 50% of respondents received training on antibiotic prescribing and the concept of antibiotic resistance. These professionals recognize antibiotic resistance, especially through therapeutic failures. The antibiotic sensitivity test and the return of patients to the health center sometimes after treatment also allow them to detect antibiotic resistance. The large majority of the staff recognize that poor quality and inappropri-ate prescription of antibiotics are responsible for the development of antibiotic resistance (Table-5).
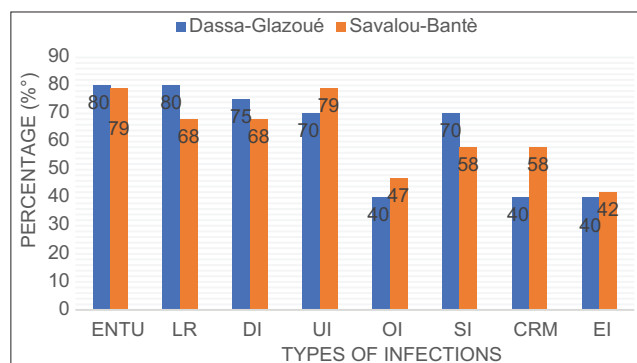
Discussion

The misprescribing of antibiotics in human therapeutics is one of the factors contributing to the misuse of antibiotics, which leads to the emergence of multiresistant germs. The present study conducted in the Savalou-Bantè and Dassa-Glazoué health zones revealed that health professionals include 53% of nurses' assistants and 3% of specialists' physicians in the Savalou-Bantè health zone and 45% of nurses and 5% of specialists in the Dassa-Glazoué health zone. However, these health professionals all prescribe antibiotics. This situation is worrying because the pre-scription of antibiotics remains the responsibility of specialists [9]. The situation is all the more serious as caregivers prescribed antibiotics. Ouedraogo *et al.* [2] obtained similar results in Burkina Faso and indicated that the prescription of antibiotics by non-specialists is

Figure-4: Infections frequently encountered for the prescription of antibiotics. ENTU= ENT and upper infections, LR = Lower respiratory infections, DI = Digestive infections, UI = Urogenital infections, OI = Osteoarticular infections, SI = Skin infections, CRM = Cerebro-meningeal infections, EI = Eyes infections.

Table-2: Difficulties in prescribing antibiotics.

Reasons for prescription	Hospitals	
	Dassa-Glazoué (%)	Savalou-Bantè (%)
Difficulty in choosing antibiotics	60/100 (60)	71/230 (31)
Antibiotic treatment based on the bacteria	90/100 (90)	182/230 (79)
Respect of treatment duration	100/100 (100)	205/230 (89)
Therapeutic failure	85/100 (85)	182/230 (79)

Table-3: First-line and well-known antibiotic families.

Antibiotic families	Hospitals			
	Dassa-Glazoué		Savalou-Bantè	
	Using in firstline (%)	Knowledge (%)	Using in firstline (%)	Knowledge (%)
Penicillins	80/100 (80)	60/100 (60)	206/230 (87)	150/230 (65)
Cephalosporins	55/100 (55)	55/100 (55)	156/230 (68)	38
Carbapenem	15/100 (15)	10/100 (10)	156/230 (68)	24
Monobactams	10/100 (10)	5/100 (5)	37/230 (16)	87/230 (10)
Quinolones	20/100 (20)	20/100 (20)	97/230 (42)	62/230 (27)
Aminoglycosides	20/100 (20)	15/100 (15)	108/230 (47)	92/230 (40)
Macrolides and related	25/100 (25)	15/100 (15)	131/230 (57)	46/230 (20)
Glycopeptides	10/100 (10)	0/100 (0)	12/230 (5)	18/230 (8)
Sulfonamides	50/100 (50)	40/100 (40)	23/230 (10)	25/230 (11)
Polymyxins	0/100 (0)	5/100 (5)	5/230 (2)	0/230 (0)
Rifamycins	0/100 (0)	10/100 (10)	35/230 (15)	25/230 (11)
Other	5/100 (5)	10/100 (10)	5/230 (2)	11/230 (5)

Table-4: Characteristics of prescribed antibiotics.

Antibiotic attributes for prescription	Hospitals	
	Dassa-Glazoué (%)	Savalou-Bantè (%)
Dosage forms		
Injectable	55/100 (55)	48/230 (21)
Tablets	25/100 (25)	133/230 (58)
Syrup	15/100 (15)	37/230 (16)
Suppository	5/100 (5)	11/230 (5)
S antibiotic specialties		
Generics	75/100 (75)	32/230 (74)
Specialties	25/100 (25)	60/230 (26)
Perception about antibiotic specialties		
Poor quality of generics	15/100 (15)	25/230 (26)
Unavailability of specialty drugs	30/100 (30)	110/230 (48)
Other	55/100 (55)	60/230 (26)

Table-5: Knowledge of antibiotic resistance.

Knowledge based on resistance	Hospitals	
	Dassa-Glazoué (%)	Savalou-Bantè (%)
General knowledge		
Antibiotic resistance	70/100 (70)	193/230 (84)
Natural resistance to antibiotics	40/100 (40)	74/230 (32)
Influence of medical practice of resistance	65/100 (65)	79/230 (79)
Training	50/100 (50)	108/230 (47)
Antibiotic resistance detection		
Treatment failed	70/100 (70)	79
Antibiogram	40/100 (40)	25
Patient return to hospital	50/100 (50)	63
Knowledge of health professionals about the factors responsible for the development of antibiotic resistance		
Inappropriate prescription	75/100 (75)	193/230 (84)
Misuse	70/100 (70)	181/230 (79)
Poor quality of antibiogram	30/100 (30)	12/230 (5)
Non-compliance of the treatment	35/100 (35)	48/230 (21)

at the origin of the emergence of antibiotic resistance. Health professionals use an antibiotic therapy protocol for the prescription of antibiotics. However, this protocol does not often take into account the results of a bacteriological examination (63%), but it is well known that the same bacterial species do not necessarily mean the same treatments and that the same signs and symptoms do not necessarily converge toward the same infection [10]. These professionals do not use a protocol for the galenic form, but follow a protocol for the dosage. Indeed, the prescription of antibiotics requires a good diagnostic approach including the establishment of an etiological diagnosis either by isolation and identification of the infectious agent or by serological tests to establish contact with pathogen [11].

Furthermore, many medical treatments involve presumptive treatment, based on data from the literature in developed countries that do not necessarily share the same microbial ecology and may, therefore, be poorly adapted [2]. It is, therefore, important to develop local antibiotic therapy protocols for the most common diseases in a multidisciplinary setting, taking into account local reality of resistance to antibiotics [12].

The study of the infections that lead these professionals to prescribe antibiotics shows that ENT and upper respiratory infections (79%), lower respiratory infections, digestive infections, and urogenital infections are the most affected. It is a common infection with many germs involved and, therefore, requires a bacteriological examination before the prescription. Tablets are the most prescribed as antibiotics (58%) in the Savalou-Bantè health zone. This makes it easier to acquire, self-medicate for subsequent infections and makes it impossible for the health professional to monitor the effectiveness of antibiotic use. Injectable forms use under the supervision of a health professional will allow better to control the use of antibiotics at the appropriate times. Furthermore, not all antibiotics are available in injectable forms [13].

The first-line prescribed antibiotics are penicillins, cephalosporins, macrolides, aminosides, and quinolones. Health workers do not have great knowledge about these antibiotics families and their mode of action. In the Savalou-Bantè health zone, there is a great use of carbapenem which is normally used in case of resistance to the third-generation cephalosporins. This observation explains the emergence of resistance through the production of BLSE and carbapenem observed in Benin [13-16]. It is also well known that the use of third-generation cephalosporins is responsible for the slight reduction in carbapenem resistance [17].

The most prescribed antibiotics are generics. This is due to the modest conditions in rural areas where specialty drugs are often not available. The same observations were made by García et al. [18], Fathi et al. [19], and Thriemer et al. [20]. However, many health professionals do not trust these generic drugs. This worrying fact is likely to affect the promotion of drugs in hospitals to allow patients to have better access to drugs, especially for those with low socioeconomic status.

These agents are still aware of the phenomenon of antibiotic resistance acquired even if natural resistance is poorly known. This explains the many cases of therapeutic failure reported. About 57% of these professionals recognize up that inappropriate antibiotic selection is responsible for therapeutic failures. About 79% also recognized that medical practice is responsible for antimicrobial resistance. As in this study, other studies highlighted the good knowledge of health professionals about antibiotic resistance and the role of medical practice in the emergence of antibiotic resistance. They, therefore, argue that understanding practitioners' knowledge and perceptions of antibiotics use and resistance could increase the effectiveness of interventions to improve the quality of antibiotic therapy in hospitals [12,21]. However, in

our study, about 50% of these agents have received training neither in the prescription of antibiotics nor on their consequences.

It is, therefore, more than important that measures be implemented to limit the inappropriate prescription of antibiotics. These measures must also include staff training on antibiotic prescribing and raising awareness among these health professionals about the consequences of inappropriate antibiotic prescribing. Furthermore, the introduction of computer systems for monitoring antibiotic resistance and prescription control would be an important support for reducing antibiotic resistance [22].

Conclusion

The rational use of antibiotics is a guarantee of good efficacy of antibiotics. The present study focused on the knowledge and practices of health-care professionals on the prescription of antibiotics, showed that the majority of antibiotics are prescribed by unqualified personnel who do not have a great deal of knowledge of antibiotics and on the consequence of their misuse. It is, therefore important that measures should be taken to monitor the prescription of antibiotics in the Savalou-Bantè health zone in particular and in Benin in general.

Authors' Contributions

VD, YC, HK, JA, HB, and LB wrote the protocol, planned the study, and supervised the work. RS and DA processed the samples under the supervision of VD and HK. All the authors reviewed the manuscript.

Acknowledgments

Competing Interests

There are no competing interests related to this work.

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