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Research Article

Evaluation of Prescribing Indicators in Children Under the Age of Five Years at the Bambey Referral Health Center (Senegal)

Oumar Bassoum[1, 2, *], Walter Fuller[3], Maty Diagne Camara[1, 2], Adama Sow[1, 2], Ndeye Fatou Ndiaye[4], Mamadou Makhtar Mback é Leye[1, 2], Ibrahima Seck[1, 2]

[1]Department of Preventive Medicine and Public Health, Faculty of Medicine, Pharmacy and Odontology, Cheikh Anta Diop University, Dakar, Senegal

[2]Insitute of Health and Development, Cheikh Anta Diop University, Dakar, Senegal

[3]Assistant Regional Director Cluster, World Health Organization Regional Office for Africa, Brazzaville, Republic of Congo

[4]Faculty of Medicine, Pharmacy and Odontology, Cheikh Anta Diop University, Dakar, Senegal

Abstract

In Senegal, data on the responsible use of medicines in the paediatric population are poorly documented at the level of primary health care services. The aim of this study was to assess prescribing indicators in children under five years of age in the Bambey health center in Senegal. This was a retrospective study. The study population consisted of prescriptions for children seen in outpatient consultations between January 1 and June 30, 2021. The sample size was 600 prescriptions selected according to a simple random sampling stratified by month. Data were collected between June and August 2021. Data were analyzed using descriptive statistics. The mean age of the children was 24±19 months. Diseases of the respiratory system accounted for 41%. The number of drugs prescribed was estimated at 1,284; the average number per prescription was 2.14. The percentages of drugs prescribed under international non-proprietary names and according to the national essential medicines list were 32.32% and 66.82% respectively. In addition, 63.2% of prescriptions contained antibiotics, of which 70.2% belonged to the Access group of the AWaRe classification of antibiotics. Injectables were used in 1.5% of cases. This study showed that prescribing practices at the Bambey health center are generally irrational, with excessive use of antibiotics in particular. Among the consequences, the most serious is antibiotic resistance. Interventions to promote the proper use of drugs seem necessary. In addition, further studies, including an assessment of the availability of Access group antibiotics, should be considered in order to gain a better understanding of the problem of antibiotic resistance.

Keywords

Prescribing Indicators, Children, Senegal, AWaRe Classification of Antibiotics

[*]Corresponding author: oumar.bassoum@ucad.edu.sn (Oumar Bassoum)

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1. Introduction

According to the World Health Organization (WHO), responsible use of medicines means "prescribing the most appropriate product, obtained on time and at an affordable price for all, dispensed correctly and administered in the appropriate dosage and for the appropriate length of time" [1]. Conversely, according to the Lancet Commission on Essential Medicines Policies, irrational use of drugs can manifest itself in four ways: overuse, underuse, misuse and unnecessary use of very expensive drugs [2]. According to the WHO, the main forms of irrational prescribing include the use of too many drugs per patient (polypharmacy), inappropriate use of antimicrobials, unnecessary use of injectable products, and non-compliance of prescribing practices with therapeutic guidelines [1].

It has been established that more than half of all medicines are prescribed, distributed or sold inappropriately, and that 50% of patients do not take them correctly. In addition, a third of the world's population and more than half of Africans do not have timely access to quality essential medicines [3, 4]. In Africa, factors linked to poor access to medicines include inadequate human resources, financial constraints, the high cost of drugs available on the market and poor stock management [4]. The consequences are both clinical and economic. Clinically, they include the emergence and spread of antimicrobial resistance, the occurrence of adverse drug reactions, and drug interactions. In economic terms, it means catastrophic drug costs for patients and society [5].

It is in this context of poor access to essential medicines that universal health coverage is one of the targets of goal 3 of the sustainable development agenda. The essential conditions for achieving this target are access to and rational use of essential medicines [6, 7].

The WHO recommends monitoring the use of medicines, notably by means of outpatient prescribing indicators [8]. These indicators assess the prescribing practices of health workers. The WHO has defined five such indicators. These are the average number of medicines prescribed per prescription (<2), the proportion of medicines pre-scribed by generic name (100%), the proportion of prescriptions with at least one antibiotic (<30%), the proportion of prescriptions with at least one injectable product (<10%) and the proportion of medicines prescribed on an essential medicines list or formulary (100%) [8]. A systematic review of studies carried out between 1995 and 2015 in countries of the WHO African region showed that these indicators were not in line with WHO recommendations. Practices were reflected in polypharmacy, high use of antibiotics and injectables, and low adherence to the concept of generic essential medicines [9].

Senegal has set up a pharmaceutical regulatory agency, the Senegalese Pharmaceutical Regulatory Agency (ARP), and has developed policy documents such as the National Essential Medicines List (NEML) and the guidance on therapeutic equivalence. Despite this, studies have shown that the indicators are not up to standard. Indeed, a study carried out among the general population in Senegal's second largest city (Thiès) revealed that the average number of drugs per prescription was 2.52, and that the proportion of drugs prescribed in international non-proprietary names (INNs) was 7% [10]. Another study carried out on a paediatric population aged 0-14 years in the reference health center of the Dakar center health district also revealed irrational practices, resulting in high antibiotic use (41.5%). In contrast, only 1.3% of prescriptions contained at least one injectable product [11]. One of the limitations of these two studies is that children under the age of five years are under-represented. Another limitation is that these studies were conducted in urban areas. The other regions, however, are quasi-rural. In addition, most prescriptions were written by paramedical staff, including nurses and midwives. It was against this backdrop that the need arose for a study to contribute to the responsible use of medicines in primary care services. The aim was to evaluate prescribing indicators in the Bambey health district's reference health center.

2. Materials and Methods

2.1. Study Setting

The Senegalese health system is a pyramidal structure with three levels (central, intermediate and peripheral). The peripheral level corresponds to the operational level, i.e. the health district. Primary health care is delivered here, in most cases by paramedical staff consisting of nurses and midwives. The district is made up of a main health center, around which revolve a network of health posts and secondary health centers. The Bambey health district follows the administrative entity of the department of the same name. In 2019, the population is estimated at 385093 inhabitants. It belongs to the Diourbel medical region, some 160 km from Dakar [12].

2.2. Type and Period of Study

This was an observational, retrospective and evaluative study. Data were collected from June to August 2021.

2.3. Study Population

This study concerned prescriptions for children under five years of age.

2.4. Sampling

This study concerned prescriptions for children under the age of five years treated on an outpatient basis between January 1 and June 30, 2021. Vaccines and parapharmaceutical

products were not included.

According to WHO recommendations, the sample size is at least 600 consultations. This size is considered sufficient to produce accurate estimates [8].

As the study period runs from January to June 2021, a stratified sampling plan was drawn up. The month is the stratum. The sample is divided into 100 prescriptions per month. A simple random sample was then taken within each stratum from the complete list of all prescriptions.

2.5. Data Collection

Data were collected from June to August 2021 using a form in which the elements required for the study were recorded. This activity was carried out by a pharmacy student under the supervision of a public health specialist. The interviewer was made aware of the study's objectives and trained to fill in the form.

The form corresponds to the WHO form, adapted to the context of the study.

The variables collected were

1. socio-demographic characteristics: age, sex
2. diagnosis
3. anthropometric characteristics: weight, height
4. information on prescribed treatment: name of drug(s), prescription with at least one antibiotic (yes/no), prescription with at least one injectable product (yes/no), prescription in INN, prescription according to NEML.

Data were extracted from the consultation register. The 2018 edition of the NEML was used to check whether the drugs prescribed were included or not.

2.6. Data Analysis

Quantitative variables are described as mean ± standard deviation, while qualitative variables are expressed as absolute frequency and relative frequency (%).

Prescription indicators were calculated as follows:

1. Average number of drugs per prescription = total number of drugs prescribed divided by the number of prescriptions included (600).
2. Proportion of drugs prescribed in INN = number of drugs prescribed in INN divided by the total number of drugs prescribed and multiplied by 100.
3. Proportion of drugs prescribed and listed in the NEML = number of drugs pre-scribed and listed in the NML divided by the total number of drugs prescribed and multiplied by 100.
4. Proportion of prescriptions including at least one antibiotic = number of prescriptions including at least one antibiotic divided by the total number of prescriptions included and multiplied by 100.
5. Proportion of prescriptions including at least one injectable product = number of prescriptions including at least one injectable product divided by the total number of prescriptions included and multiplied by 100.

2.7. Ethical Considerations

The study was authorized by the District Chief Medical Officer. Data were collected anonymously and confidentially. Given the observational nature of the study, the absence of minimal risk (no blood sampling, no use of preserved samples, respect for confidentiality) and the impossibility of contacting patients, consent was not sought [13].

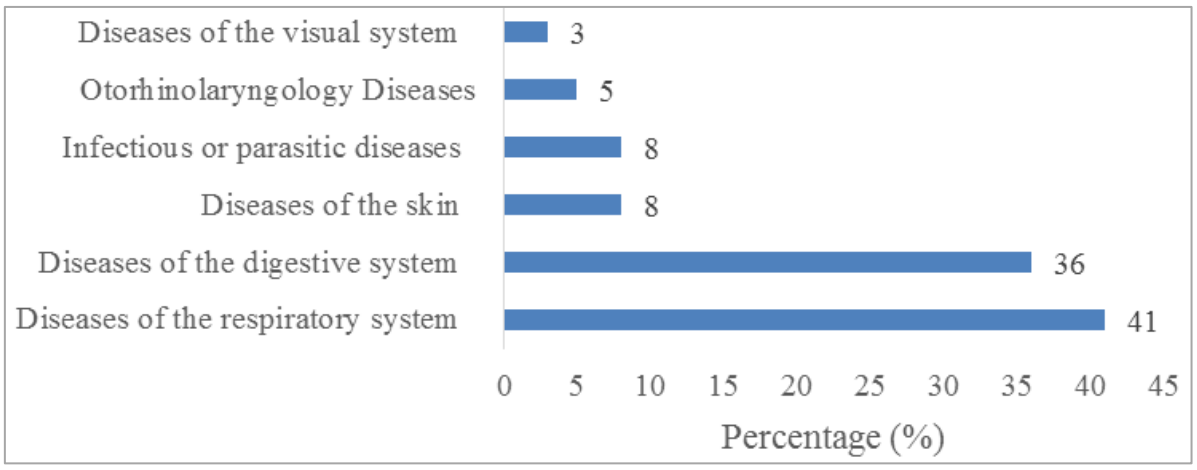

Figure 1. *Distribution of patients by diagnosed pathologies, Bambey Health Center, Senegal, 2021, (N=600).*

3. Results

3.1. Socio-Demographic and Anthropometric Characteristics

The mean age of the children was 24±19 months. Male children accounted for 56.66%. Average weight was estimated at 10.36±4.2 kg. Mean height was 82.4±18.2 cm.

3.2. Clinical Characteristics

The study revealed that pathologies related to the respiratory and digestive systems were the most frequent, accounting for 41% and 36% of cases respectively (Figure 1).

3.3. Distribution of Prescriptions by Number of Drugs

A total of 1,284 drugs were prescribed. The minimum and maximum numbers were estimated at 1 and 5 drugs respectively. Approximately one in two prescriptions (51%) involved two drugs (Table 1).

Table 1. *Distribution of prescriptions by number of drugs, Bambey Health Center, Senegal, 2021 (N=600).*

Number of drugs	Number of encounters	n	%
1	131	22	22
2	305	51	73
3	114	19	92
4	49	8	100
5	1	0	100

3.4. Prescribing Indicators

The average number of drugs per prescription was 2.14±0.8. In addition, the percentages of drugs prescribed in INN and according to the NEML were 32.32% and 66.82% respectively. Prescriptions containing at least one antibiotic and one injectable product accounted for 63.2% (379/600) and 1.5% (9/600) respectively (Table 2).

Table 2. *Prescribing indicators, Bambey Health Center, Senegal, 2021.*

Prescribing indicators	Value	WHO standards
Average number of drugs per prescription	2.14	<2
Percentage of drugs prescribed in INN[1]	32.32%	100%
Percentage of drugs prescribed and listed on the NEML[2]	66.82%	100%
Percentage of prescriptions containing at least one antibiotic	63.2%	<30%
Percentage of prescriptions containing at least one injectable	1.5%	<10%

1 International Nonproprietary Names; 2 National essential medicines list

3.5. Classification of Antibiotics by Family

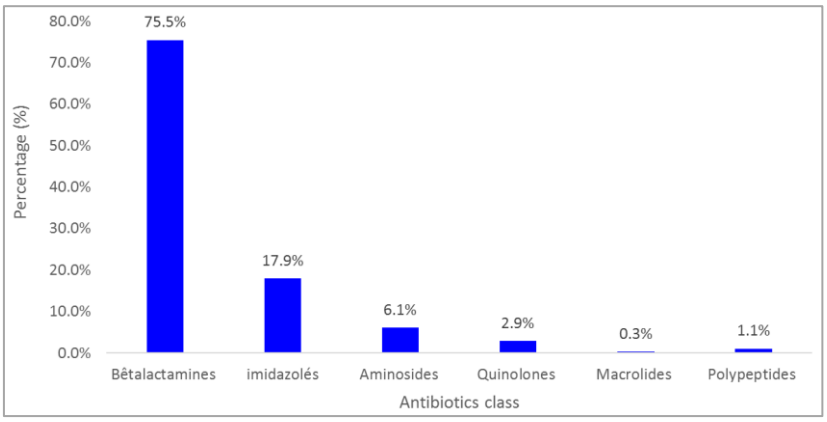

Figure 2. *Distribution of prescriptions according to antibiotic families prescribed, Bambey Health Center, Senegal, 2021.*

Among the antibiotic families prescribed, beta-lactams and imidazoles accounted for 74.9% and 17.9% respectively (Figure 2).

3.6. Who AWaRe Classification

Stratification according to AWaRe showed that 70.2% of antibiotics belonged to the Access class. Amoxicillin or the combination amoxicillin/clavulanic acid is prescribed in 41.1% of cases. A further 28.8% of antibiotics are classified as Watch, with cefixime appearing in 25.4% of cases (Table 3).

Table 3. *Classification of antibiotics prescribed according to AWaRe classification, Bambey Health Center, Senegal, 2021, (N=389).*

AWaRe classification	n	%
Access (n=273)		70,2
Amoxicillin or Amoxicillin/clavulanic acid	162	41,6
Ampicillin	1	0,3
Flucloxacillin	23	5,9
Gentamicin	19	4,9
Metronidazole	68	17,5
Watch (n=112)		28,8
Cefixime	99	25,4
Ceftriaxone	1	0,3
Ciprofloxacin	1	0,3
Norfloxacin	10	2,6
Azithromycin	1	0,3
Unclassified (n=4)		1
Neomycin/ Bacitracin	4	1

4. Discussion

Four strengths of the study should be highlighted. Firstly, this study is the first of its kind at the Bambey health center. The second strength is the estimation of sample size according to WHO guidelines, which consider that the analysis of 600 prescriptions results in reliable and accurate estimates. In addition, stratified sampling by month enabled us to obtain a representative sample, given that prescribing practices can vary from month to month. Finally, the retrospective nature of the study made it possible to avoid the Hawthorne effect, which is an observation bias consisting in the adoption of desirable behavior by participants aware of being observed in a prospective study.

However, this study has its limitations. The first is that health facility indicators and patient care indicators are not evaluated. These indicators would have made it possible to determine, among other things, the rate of availability of drugs and clinical guidelines, and the average consultation time. The second limitation is that the study period covers the first six months of 2021. A 12-month period would have been ideal. However, given concerns about the availability of records, six months was chosen.

The study also showed that the average number of drugs per prescription is 2.14. This indicator exceeds the WHO threshold of two drugs per prescription on average. Although the difference seems minimal, the fact remains that 27% of prescriptions contain three or more drugs. This result highlights a trend towards polypharmacy, but the indicator is below the African average of 3.1 [9]. This may be explained by the fact that Africa suffers from the double burden of communicable and non-communicable diseases [14]. In Senegal, for example, infant and child mortality is mainly linked to malaria, diarrhea and acute respiratory infections [15]. Furthermore, in the central zone to which Bambey belongs, almost one child in ten presents symptoms compatible with asthma [16].

Polypharmacy exposes children to adverse drug reactions, drug interactions, hospitalization, poor compliance and mortality. Added to this clinical burden are the waste of resources, the burden of medical care and the high cost of healthcare [17].

In addition, this study showed that adherence to the NEML and INN prescribing are low. The WHO recommends that all medicines (100%) be prescribed by INN and according to the NEML. Low adherence to INNs and the NEML may force patients to turn to community pharmacies, where medicines are sold at high prices [7]. These results may be explained by the influence of medical representatives, who are often the only source of information for prescribers with little awareness of essential drugs and INNs during their initial training. Given the biased nature of the information provided by medical representatives, two strategies seem necessary. One would be to distribute a periodic pharmaceutical bulletin to prescribers. The ARP could be the publisher. The other strategy would be to set up a pharmaceutical information center. The university could house this center.

This study showed that the proportion of prescriptions containing at least one antibiotic was 63.2%, whereas the WHO recommends that this should be less than 30%. In comparison, studies carried out in Jordan, Nigeria and South Africa respectively revealed proportions of 19.5% [18], 81.3% [19] and 76% [20]. The high use of antibiotics could be explained by the burden of infectious diseases, particularly lower respiratory infections, ranked as the third cause of mortality in sub-Saharan Africa [21]. More specifically, in Senegal, the profession of medical representatives is expanding and could thus influence prescribing practices. At the same time, it has been shown that the absence or inadequacy of diagnostic tools and trained personnel are obstacles to rational antibiotic prescribing [22]. In sub-Saharan Africa,

between 32.7% and 84.4% of consultations in primary health care facilities result in antibiotic prescriptions, of which 13% to 36.4% are inappropriate [23]. The literature has established a close relationship between antibiotic overuse and resistance. As a result, antimicrobial stewardship programs should be implemented in primary care settings. To this end, the WHO has developed a toolbox [24].

In addition, the WHO has classified antibiotics into three categories: "Access" (antibiotics whose accessibility is essential), "Watch" (antibiotics with a higher potential for resistance) and "Reserve" (antibiotics of last resort), with a view to promoting responsible antibiotic use and slowing the spread of antibiotic resistance. In this study, 70.2% of antibiotics prescribed belonged to the Access group. This is encouraging, since the WHO estimates that at least 60% of antibiotics prescribed in a country should be in this group [25]. However, given that primary care services are expected to manage the most common illnesses, it would be desirable for the Access group to be used in 100% of cases; this would limit the use of antibiotics in the "Watch" and "Reserve" groups. In the recently updated NEML of Senegal, antibiotics are not classified according to AWaRe [26]. Generally, in the WHO African Region, few countries (34.5%) have national clinical guidelines incorporating AWaRe classification [27]. This could be an obstacle to responsible use of antibiotics. The solution would be to formulate an AWaRe list within health facilities.

Finally, this study found that the proportion of prescriptions containing at least one injectable product was estimated at 1.5%, thus not exceeding the WHO threshold (<10%). Compared with other studies targeting children under five, the indicator is higher in Nigeria (13.5%) [28] and Sierra Leone (21.1%) [29]. The results of this study are encouraging and could contribute to reducing the incidence of bloodborne infections such as hepatitis B and C and HIV, especially in a context marked by inadequate biomedical waste management. However, there is a need to encourage prescribers to persevere with this good practice, as in other contexts it has been shown that patients mistakenly believe that injections are more effective than other galenic forms. This misconception leads them to request injections during consultations [28].

5. Conclusions

The aim of this study was to assess the five main prescribing indicators in the Bambey health district reference center. Generally, it revealed that practices were not in line with WHO recommendations. In fact, a slight polypharmacy, low prescribing according to the NEML and INN, and increased use of antibiotics were highlighted. Consequently, interventions such as training, information and therapeutic guidelines should be reinforced to encourage responsible drug use at the peripheral level.

Furthermore, given the limitations of this study, it would seem necessary to look in the future at patient care indicators and health service indicators, including the availability of antibiotics in the "Access" group.

Abbreviations

ARP	Senegalese Pharmaceutical Regulatory Agency
AWaRe	Acces, Watch, Reserve
HIV	Human Immunodeficiency Virus
INN	International Non-proprietary Name
NEML	National Essential Medicines List
WHO	World Health Organization

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Conflicts of Interest

The authors declare no conflicts of interest.

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