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Antibiotic use by clinical presentation across all healthcare providers in rural Burkina Faso: a healthcare visit exit survey

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Background: To guide antibiotic stewardship interventions, understanding for what indications antibiotics are used is essential.

Methods: In rural Burkina Faso, we measured antibiotic dispensing across all healthcare providers. From October 2021 to February 2022, we surveyed patients in Nanoro district, Burkina Faso, following visits to health centres (3), pharmacies (2), informal medicine vendors (5) and inpatients in health centres. We estimated prevalence of antibiotic use and the proportion of Watch group antibiotics by provider type and by clinical presentation, assessing compliance with WHO's AWaRe Antibiotic Book. We estimated per capita antibiotic use by multiplying prevalence of antibiotic use, mean DDD per adult treatment course, and the rate of healthcare visits per 1000 inhabitants per day, estimated from a prior household survey.

Results: Outpatient antibiotic use was more frequent after health centre visits (54.8%, of which 16.5% Watch, $n=1249$) than after visits to pharmacies (26.2%, 16.3% Watch, $n=328$) and informal medicine vendors (26.9%, 50.0% Watch, $n=349$). The frequency of antibiotic use was highest for bronchitis (79.9% antibiotic use, of which 12.6% Watch), malaria (31.9%, 23.1% Watch), gastroenteritis (76.0%, 31.7% Watch), rhinopharyngitis (40.4%, 8.3% Watch) and undifferentiated fever (77.0%, 44.8% Watch). Compliance with WHO AWaRe guidance could have averted at least 68.4% of all Watch antibiotic use in outpatients at health centres. Community-wide, 2.9 DDD (95% CI 1.9–3.9) were used per 1000 adult inhabitants per day.

Conclusions: Most Watch antibiotic use at community level or primary care deviated from WHO guidance. Antibiotic stewardship should focus on key clinical presentations and include primary care and self-medication.

Introduction

In sub-Saharan Africa, increasing antimicrobial resistance (AMR) threatens effective treatment with accessible antibiotics. Over the last 10 years, Enterobacterales isolates from patients have had high and increasing resistance to fluoroquinolones and third-generation cephalosporins.[1–3] To combat AMR, optimizing antibiotic use is one of the five objectives in the Global Action Plan on Antimicrobial Resistance.[4] In many low- and middle-income countries (LMICs), the presence of informal medicine stores (non-licensed), as well as over-the-counter dispensing, i.e. without prescription, in private community pharmacies, are facilitating self-medication with antibiotics.[5–8] To effectively guide and target interventions to optimize antibiotic use, it is essential to know where, to whom and for what antibiotics are used at community level.[9]

In Burkina Faso, primary health centres should be patients' first contact when seeking healthcare. Nevertheless, in a prior

study, 27% of patients admitted to hospital had used antibiotics without a prior health centre visit.[10] In health centres, malaria rapid diagnostic tests (mRDTs) are the only available tool to guide febrile illness diagnoses, resulting in frequent unnecessary antibiotic use when the test is negative.[11] Interventions to improve antibiotic use should target all community-level healthcare or medicine providers substantially contributing to community-wide antibiotic use. Knowledge of indications that trigger antibiotic use, antibiotic dose or treatment duration could guide antibiotic stewardship intervention options.

The objective of this study was to quantify antibiotic use by type of healthcare or medicine provider, including prevalence and quantity of antibiotic use, dose, duration, clinical presentations instigating antibiotic use, and providers' compliance with the WHO Access, Watch, Reserve (AWaRe) Antibiotic Book,[12] in a rural district of Burkina Faso.

Methods

Study area

In Burkina Faso, primary health centres (PHCs) are supposedly patients' first point of contact with the healthcare system. Generally, nurses diagnose and prescribe treatment, yet in a so-called medical centre, a medical doctor is also present but most consultations are done by nurses. In PHCs (including medical centres), patients with severe cases can be observed for maximum of 2 days; more complicated cases should be referred to the district hospital, which has hospitalization wards, medical doctors and a laboratory. Each PHC and district hospital has a medicine store, where medicines should only be dispensed following prescription. Healthcare costs are paid out of patients' pocket, without any reimbursement plan, except for under 5 year olds and pregnant women, for whom healthcare is free.[13] Of private community pharmacies (private pharmacies outside PHCs and district hospitals), the health district and the national pharmaceutical regulatory agency are responsible for inspecting the origin and quality of medicines and whether dispensing of certain medicines follows medical prescription.[14]

This study was conducted in two health areas of the Nanoro health district, which include 30 PHCs (of which only 4 have medical doctors) and the district hospital. The two health areas, Nanoro and Nazoanga, are located in central-west Burkina Faso, about 90 km from Ouagadougou. Nanoro health area includes five villages with 17 300 inhabitants. Nazoanga health area includes three villages with 8800 inhabitants. Nanoro has the district hospital, a PHC (with a medical doctor), two private community pharmacies (one run by a pharmacist, although actual medicine dispensing is ensured in both pharmacies mainly by non-pharmacists), three informal medicine vendors (non-licensed vendors) and two traditional healers. Nazoanga has a PHC (without a medical doctor), two informal medicine vendors and one traditional healer.

In Nanoro health district, the most frequently reported diagnosis is malaria,[15] which in children is sometimes associated with community-acquired invasive bacterial coinfection, caused by non-Typhi *Salmonella* spp. in particular.[1,16] Malaria is endemic, with a high malaria transmission season from July to November. This period overlaps with the rainy season, which extends from June to October. The low malaria transmission season is from December to June.

Study design

We conducted a healthcare visit exit survey from October 2021 to February 2022. In a preceding qualitative study, all healthcare providers in both health areas were identified. The district hospital and PHCs with integrated medicine stores, private community pharmacies (integrated medicine stores and private community pharmacies are further referred to as formal pharmacies) and informal medicine vendors were included. Traditional healers were not included because a pilot study found they did not dispense antibiotics.[5] A consecutive sample of patients presenting with acute illness was taken by selecting the next patient exiting when the interview with the previous patient was completed. We planned to interview at least 50 patients who had received an antibiotic per type of healthcare provider to obtain 95% CI limits with a margin of error of 5%, assuming 15% of Watch antibiotic use.[17] In addition, all inpatients admitted to the paediatric and medicine wards of the Nanoro district hospital and patients under observation in Nazoanga and Nanoro PHCs were interviewed once. Using an electronic questionnaire, field workers approached patients or caretakers after buying medication to collect data on symptoms that had triggered healthcare seeking, type of healthcare provider visited, diagnoses if any received, type of medicines dispensed/bought (antibiotic or not), dose, route of administration, uptake frequency, treatment duration and whether dispensing followed a prescription during a healthcare consultation or not.

Data analysis

We analysed antibiotic use by type of healthcare provider, by clinical presentation, and by age group (0–4, 5–17, 18–49 and ≥50 years). If medicine dispensing from any medicine outlet—i.e. medicine stores of the Nanoro district hospital, the Nanoro or Nazoanga PHC or the two private pharmacies located in Nanoro—followed a formal healthcare consultation, we assigned it as health centre medication, or if otherwise, as self-medication in formal pharmacies. In health centre, all patients surveyed in observation (PHCs) and hospitalized (district hospital) were defined as inpatients. We assigned clinical presentations to presumed diagnoses reported by the healthcare provider, or—if none reported—to a combination of reported symptoms (Table S1, available as Supplementary data at *JAC* Online) following the symptoms reported for each disease in the WHO AWaRe antibiotic book.[12] In the case of a patient reporting only one symptom, the latter was reported as the clinical presentation. At health-centre level, a malaria infection was generally diagnosed based on positive mRDT, systematically used for any fever. For self-medicated patients, malaria was reported as a clinical presentation when assumed by the healthcare provider visited or the patient themself. In the case of a patient presenting with more than one clinical presentation, we prioritized reporting the one that would have led to an antibiotic prescription. Patients with chronic diseases such as high blood pressure, diabetes, asthma, epilepsy, mental illness and HIV, without any additional acute illness, were excluded from this analysis.

We analysed antibiotic use frequency, class, mode of administration, and AWaRe distribution,[18] and median treatment duration with 95% CI, by provider type, by age group and by clinical presentation. In outpatients, frequency of antibiotic use, as well as the percentage of Watch antibiotic use, was compared between types of provider using chi-squared tests; *P* values were reported and significance was set at 5%. Mean DDDs were calculated for adults only. Combining the DDD with the number of adult outpatient visits per 1000 inhabitants per day in a preceding household healthcare utilization survey conducted in the same study area[5] with the frequency of antibiotic use per adult visit and per type of provider, we generated the DDD used per 1000 adult inhabitants per day (DID). Reported prevalence, means and proportions were corrected for clustering by healthcare provider, in two strata (Nanoro, Nazoanga), except for informal medicine stores, for which neither store nor health area were recorded to ensure confidentiality. We classified antibiotic use as 'necessary' if used for a clinical presentation for which an antibiotic should be administered according to guidance in the WHO AWaRe antibiotic book.[12] For adult outpatients, we also classified antibiotic uptake regimens as optimal versus suboptimal. An uptake regimen was considered optimal if daily dosage and treatment duration for a clinical

presentation for which this antibiotic was used were in line with the treatment guide in the WHO AWaRe antibiotic book. In the case of unnecessary use, we nevertheless classified uptake regimen as optimal regardless of the clinical presentation for which it was used, if daily dosage was between the lower and the higher dose recommended for such an antibiotic and duration was within the recommended duration range for mild to moderate cases in which it should be used as recommended in the WHO AWaRe antibiotic book. For all antibiotics for which treatment duration recommended for mild to moderate cases was limited to a maximum of 5 days for adults, we added a margin of 2 days, thus considering a duration up to 7 days as correct.

Ethics

The study protocol was approved by the Ethics Committee for Health Research of Burkina Faso (ref no. 2020-8-171). Written informed consent was obtained from all patients aged at least 18 years. For patients aged between 14 and less than 18 years, oral assent was obtained in addition to parents or caretakers' written informed consent. For patients under 14 years, written informed consent was obtained from parents or caretakers.

Results

Characteristics of the study population

Out of 2196 patients interviewed, 2108 (96.0%) had an acute illness, 86 (3.9%) a chronic illness, and 2 (0.1%) attended for antenatal care or a delivery. Out of the 2108 acute illness cases in this study, 1431 (67.9%) attended health centres [182 (12.7%) inpatients, 1249 (87.3%) outpatients]; 328 (15.6%) self-medicated at formal pharmacies; and 349 (16.6%) self-medicated at informal medicine vendors (Table 1). Children aged 0–4 years were most frequently seen in health centres (94.5%, 622/658) rather than self-medicating (either in formal pharmacies or informal medicine vendors) (5.5%, 36/658). Adults aged 18–49 years most often self-medicated (56.4%, 473/839) rather than consulting in health centres (43.6%, 366/839). Patients who presented with fever most often consulted health centres (84.5%, 1027/1215) rather than self-medicated (15.5%, 188/1215).

Inpatient antibiotic use

Among 182 inpatients, 90.7% (95% CI 77.9%–96.4%, $n=165$) used antibiotics, of which 59.4% (95% CI 16.1%–91.8%, $n=98$) used more than one antibiotic. Among inpatients who used antibiotics, 64.2% (95% CI 8.13%–97.3%, $n=106$) used Watch antibiotics (Table 2). Malaria, bronchitis and gastroenteritis were the most frequent clinical presentations, together accounting for 62.6% (114/182) of inpatients, 61.2% (111/165) of antibiotic use, and 54.7% (58/106) of Watch antibiotic use.

Outpatient antibiotic use

Antibiotic use was more frequent after consultation in health centres (54.8%, 95% CI 32.3%–75.5%, $n=685$) than at formal pharmacies (26.2%, 95% CI 10.3%–52.4%, $n=86$, $P<0.001$) and informal medicine vendors (26.9%, $n=94$, $P<0.001$). Among these patients who used antibiotics, the percentage of those with Watch antibiotic use was higher at informal medicine vendors (50.0%, $n=47$) than in health centres (16.5%, 95% CI 10.6%–24.8%, $n=113$, $P<0.001$) or at formal pharmacies (16.3%, 95% CI 15.0%–17.8%, $n=14$, $P<0.001$) (Table 3).

AWaRe distribution of all antibiotics used

Among all antibiotics used in inpatients, 60.3% (95% CI 32.2%–82.9%, $n=176$) were Access, 39.7% (95% CI 17.1%–67.8%, $n=116$) were Watch; and none Reserve (Figure 1). By clinical presentations, malaria, bronchitis, undifferentiated fever, gastroenteritis and wounds accounted together for 70.7% ($n=82$) of all inpatient Watch antibiotics used. Ceftriaxone was the most used Watch antibiotic among inpatients.

Among all antibiotics prescribed for outpatients at health centres, 85.2% (95% CI 80.9%–88.7%, $n=675$) were Access and 14.8% (95% CI 11.3%–19.1%, $n=117$) were Watch. Clinical presentations such as malaria, rhinopharyngitis, bronchitis, undifferentiated fever, gastroenteritis, pain, dermatosis and wounds for which antibiotics were not recommended (apart from dermatosis where Access group antibiotics were adequate) accounted together for 68.4% ($n=80$) of all Watch antibiotics used, which could have been avoided. Ciprofloxacin was the most frequently dispensed Watch antibiotic in health centres (35.0%, $n=41$), followed by erythromycin (32.5%, $n=38$) and ceftriaxone (22.2%, $n=26$).

Among all antibiotics received after formal pharmacy visits, 84.6% ($n=77$) were Access and 15.4% ($n=14$) were Watch. Clinical presentations such as rhinopharyngitis, bronchitis, gastroenteritis, dermatosis and pain accounted for 64.3% ($n=9$) of all Watch antibiotics used, which could have been avoided. Ciprofloxacin was the most frequently used Watch antibiotic by self-medication in formal pharmacies (71.4%, $n=10$) followed by erythromycin (28.6%, $n=4$).

Among all antibiotics used after informal medicine vendors' visits, 52.5% ($n=53$) were Access and 47.5% ($n=48$) were Watch. Clinical presentations such as rhinopharyngitis, bronchitis, gastroenteritis, pain and wounds for which antibiotics were avoidable, accounted for 50.0% ($n=24$) of all Watch antibiotics used. Oxytetracycline was the most used Watch antibiotic following informal medicine vendors' visits (45.8%, $n=22$), followed by norfloxacin (27.1%, $n=13$), ciprofloxacin (25.0%, $n=12$) and erythromycin (2.1%, $n=1$).

Class of antibiotics

Third-generation cephalosporins were the most frequently used antibiotic class in inpatients (35.6% 95% CI 10.3%–72.8%, $n=104$) while penicillins were the most frequently used class by outpatients who consulted health centres (40.3% 95% CI 27.7%–53.3%, $n=319$) or self-medicated in formal pharmacies (49.5% 95% CI 16.6%–82.8%, $n=45$) or at informal medicine vendors (31.7%, $n=32$) (Figure 2).

Antibiotic route of administration, duration and dosage

Injectable antibiotics accounted for 68.2% (95% CI 8.2%–98.1%, $n=199$) of antibiotics used by inpatients and 6.9% (95% CI 2.7%–16.5%, $n=54$) of antibiotics used by outpatients who visited health centres. None of the antibiotics used by self-medicated was injectable.

Table 1. Characteristics of patients who visited health centres, formal pharmacies and informal medicine vendors

	Health centre ($n=1431$)		Self-medicated at formal pharmacies ($n=328$)		Self-medicated at informal medicine vendors ($n=349$)	
Characteristic	*n*	%	*n*	%	*n*	%
Gender						
Female	737	51.5	175	53.4	148	42.4
Male	694	48.5	153	46.7	201	57.6
Age group, years						
0–4	622	43.5	21	6.4	15	4.3
5–17	253	17.7	43	13.1	21	6.0
18–49	366	25.6	206	62.8	267	76.5
≥50	190	13.3	58	17.7	46	13.2
Education level						
No education	951	66.5	200	61.0	275	78.8
Primary school	270	18.9	49	14.9	54	15.5
Secondary school	194	13.6	70	21.3	19	5.4
University	16	1.1	9	2.7	1	0.3
Care status						
Inpatients	182	12.7	0	0.0	0	0.0
Outpatients	1249	87.3	328	100.0	349	100.0
Fever						
Present	1027	71.8	105	32.0	83	23.8
Absent	404	28.2	223	68.0	266	76.2
Clinical presentation						
Malaria	555	38.8	88	26.8	21	6.0
Rhinopharyngitis	116	8.1	63	19.2	61	17.5
Bronchitis	211	14.7	36	11.0	51	14.6
Pneumonia	45	3.1	0	0.0	0	0.0
Enteric fever	9	0.6	4	1.2	20	5.7
Undifferentiated fever	87	6.1	0	0.0	0	0.0
Gastroenteritis	128	8.9	7	2.1	48	13.8
Stomach ache	70	4.9	32	9.8	28	8.0
Pain	65	4.5	62	18.9	75	21.5
Dermatosis	17	1.2	3	0.9	2	0.6
Wound	37	2.6	12	3.7	18	5.2
Sexually transmitted/vaginal infection	13	0.9	2	0.6	0	0.0
Urinary tract infection	6	0.4	1	0.3	4	1.2
Sepsis	5	0.4	0	0.0	0	0.0
Anorexia/asthenia	20	1.4	2	0.6	3	0.9
Other	47	3.3	16	4.9	18	5.2

The median duration of treatment was 5 days (IQR 4–7) among health centre outpatients, 5 days (IQR 5–7) in formal pharmacies and 3 days (IQR 2–3) at informal medicine vendors.

In adult outpatients, 60.7% (95% CI 28.7%–85.5%, *n*/*N*=74/122) of antibiotics prescribed in health centres and 69.1% (*n*/*N*=67/97) of antibiotics used by self-medicators, including 59.1% (95% CI 0.2%–99.9%) in formal pharmacies and 90.3% (*n*/*N*=28/31) in informal medicine vendors were taken suboptimally.

The mean DDD per antibiotic treatment course among adult outpatients was higher in health centres (5.9 DDD, 95% CI 3.9–8.0) and formal pharmacies (4.7 DDD, 95% CI 2.6–6.8) than at informal medicine vendors (1.8 DDD).

Community-wide antibiotic use

The rate of healthcare utilization was 1.46 visits per 1000 inhabitants per day (655 healthcare visits among 4984 adult household members in the past 3 months/90 days): 0.97 to health centres ($n=434$), 0.36 to informal medicine vendors ($n=162$) and 0.13 to private community pharmacies ($n=59$).

The community-wide rate of antibiotic use was 2.9 DID (95% CI 1.9–3.9 DID), consisting of 2.6 DID (95% CI 1.7–3.5 DID) from health centres, 0.14 (95% CI 0.08–0.2 DID) from community pharmacies and 0.15 DID from informal medicine vendors. This gap is explained by differences in healthcare utilization, as well as the prevalence of antibiotic use per type of provider visited.

Table 2. Number of inpatients who used antibiotics and Watch antibiotics according to clinical presentation

Clinical presentation		Patients who received antibiotics		Patients who received Watch antibiotics	
	N	*n*	% (95% CI)	*n*	% (95% CI)
Malaria	52	40	76.9 (50.5–91.6)	22	55.0 (44.7–97.0)
Bronchitis	36	35	97.2 (70.8–99.8)	20	57.1 (0.4–99.8)
Pneumonia	11	11	100.0	10	90.9 (0.03–100)
Enteric fever	5	5	100.0	1	20.0 (0.04–99.3)
Undifferentiated fever	19	18	94.7 (20.7–99.9)	15	83.3 (3.0–99.9)
Gastroenteritis	26	26	100.0	16	61.5 (10.4–95.7)
Stomach ache	9	8	88.9 (25.0–99.5)	6	75.0 (4.16–99.5)
Pain	2	1	50.0	0	0.0
Wound	3	3	100.0	1	33.3 (0.0–100.0)
Urinary tract infection	3	3	100.0	3	100.0
Sepsis	5	5	100.0	5	100.0
Anorexia/asthenia	1	0	0.0	—	—
Other	10	10	100.0	7	70.0 (1.8–99.7)
Total	182	165	90.7 (77.9–96.4)	106	64.2 (8.1–97.3)

Discussion

Main findings and comparison with other LMICs

Community-wide antibiotic use in rural Burkina Faso in 2021–22 (2.9 DID) was lower than the median estimate of lower middle-income countries in 2015 (10.8 DID), yet comparable to estimates from Democratic Republic of Congo in 2019–20 (1.75 to 10.2 DID in rural and periurban populations, respectively).[6,19] The 54.8% prevalence of antibiotic use during health-centre visits was within the prediction interval of 44%–60% antibiotic use during primary care-centre visits in a systematic review in 27 LMICs.[17] The percentage of outpatients with Watch antibiotic use after health-centre visits (16.5%) was lower than that observed in most studies globally (range 7.5%–90.3%) yet comparable to that in other west or central African settings (range 10.0%–23.6%).[6,17] Nevertheless, nearly 70% of Watch antibiotic use in PHCs could have been avoided treatment guidance in the 2022 WHO AWaRe Antibiotic Book had been adhered to.

Antibiotic-dispensing mechanisms and informed antimicrobial stewardship in health centres

The high proportion of inpatients dispensed (Watch) antibiotics may be related to prescription being guided by perceived disease severity, as in other LMICs.[20] Likewise, the high proportion of outpatients diagnosed with conditions very unlikely to be of bacterial origin such as rhinopharyngitis, bronchitis, gastroenteritis (watery diarrhoea), who were nevertheless prescribed (Watch) antibiotics when attending health centres, confirms that there also, antibiotics are not only prescribed when recommended, as observed in other LMICs.[21–23] Similarly, inadequate use of antibiotic classes, such as imidazoles and sulphonamide/trimethoprim combinations for pneumonia were observed. In the same way, the single-dose administration of injectable ceftriaxone in some outpatients with mild to moderate clinical presentations without an antibiotic indication, as well as a high proportion of antibiotics dispensed suboptimally, are worrisome. These practices by healthcare workers could be related to limited diagnostic resources in health centres, inducing concerns of missing a potential bacterial coinfection, which resulted in an (over)prescription of wide-spectrum antibiotics. Lack of knowledge on the rational choice and use of antibiotics according to patients' clinical presentations and the implications of incorrect use could have further perpetuated or exacerbated such practices. Interventions to improve quality of care and reduce AMR in health centres should be multifaceted, combining different strategies including dedicated education and awareness on AMR for healthcare workers, improved diagnostic tools to differentiate bacterial from non-bacterial infections, patient management algorithms that take into account age, based on the latest WHO recommendations for antibiotic prescription.[12,24–28]

Informed antimicrobial stewardship targeting over-the-counter dispensing

Although most antibiotics used in the community came from health centres and a large quantity were inappropriate, implying a need for more intensified interventions there, a significant amount were also dispensed over-the-counter, suggesting more involvement of the national pharmaceutical regulatory agency is needed in combating AMR. At district level, this involvement could be more responsibilities allocated to the district management team (well trained on AMR), allowing them to include all private pharmacies in the district areas into their regular monitoring programme with PHCs, instead of spot inspections, as currently allowed.[14] Watch antibiotics should be included in the list of medicines to be dispensed following medical prescription only and should be one of the key components of this monitoring. This could also be an opportunity for ongoing AMR awareness activities for pharmacy workers.[29] At national level, more commitment could

Table 3. Number of outpatients prescribed antibiotics and Watch antibiotics by type of healthcare provider according to clinical presentation

Clinical presentation	Patients who visited health centre ($n=1249$)					Self-medicated at formal pharmacies ($n=328$)					Self-medicated at informal medicine vendors ($n=349$)				
	Number of patients per clinical presentation	Patients who received antibiotics		Patients who received Watch antibiotics		Number of patients per clinical presentation	Patients who received antibiotics		Patients who received Watch antibiotics		Number of patients per clinical presentation	Patients who received antibiotics		Patients who received Watch antibiotics	
	N	*n*	% (95% CI)	*n*	% (95% CI)	*N*	*n*	% (95% CI)	*n*	% (95% CI)	*N*	*n*	*n/N* (%)	*n*	*n/N* (%)
Malaria	503	170	33.8 (15.5–58.8)	27	15.9 (6.9–32.6)	88	2	2.3 (0.0–82.6)	0	0.0	21	0	0.0	—	—
Rhinopharyngitis	116	74	63.8 (34.2–85.6)	6	8.1 (5.3–12.1)	63	13	20.6 (3.6–64.7)	1	7.7 (1.0–40.9)	61	10	16.4	1	10.0
Bronchitis	175	161	92.0 (64.9–98.6)	6	3.7 (1.3–10.4)	36	31	86.1 (0.0–100.0)	1	3.2 (0.0–92.6)	51	11	21.6	3	27.3
Pneumonia	34	31	91.2 (7.65–99.9)	1	3.2 (0.1–56.4)	0	—	—	—	—	0	—	—	—	—
Enteric fever	4	3	75.0 (0.0–100.0)	3	100.0	4	4	100.0	1	25.0 (0.0–99.9)	20	6	30.0	3	50.0
Undifferentiated fever	68	49	72.1 (42.5–90.0)	15	30.6 (10.4–62.7)	0	—	—	—	—	0	—	—	—	—
Gastroenteritis	102	87	85.3(42.8–97.8)	12	13.8(1.9–56.5)	7	6	85.7	3	50.0	48	20	41.7	13	65.0
Stomach ache	61	29	47.5 (24.7–71.5)	9	31.0 (15.7–52.2)	32	12	37.5 (20.5–58.3)	4	33.3 (0.1–99.7)	28	19	67.9	14	73.7
Pain	63	7	11.1 (3.7–29.0)	2	28.6 (0.8–95.4)	62	3	4.8	2	66.7	75	2	2.7	2	100.0
Dermatosis	17	15	88.2 (6.0–99.9)	12	80.0 (57.7–92.1)	3	2	66.7	2	100.0	2	2	100.0	2	100.0
Wound	34	29	85.3 (14.9–99.5)	6	20.7 (6.0–51.6)	12	11	91.7	0	0.0	18	18	100.0	4	22.2
Sexually transmitted/ vaginal infection	13	9	69.2 (12.7–97.2)	7	77.8 (17.3–98.3)	2	0	0.0	—	—	0	—	—	—	—
Urinary tract infection	3	2	66.7 (0.0–100.0)	1	50.0 (0.0–100.0)	1	1	100.0	0	0.0	4	4	100.0	4	100.0
Anorexia/ asthenia	19	0	0.0	—	—	2	0	0.0	—	—	3	0	0.0	—	—
Other	37	19	51.4 (36.4–66.1)	6	31.6 (16.5–51.9)	16	1	6.3	0	0.0	18	2	11.1	1	50.0
Total	1249	685	54.8 (32.3–75.5)	113	16.5 (10.6–24.8)	328	86	26.2 (10.3–52.4)	14	16.3 (15.0–17.7)	349	94	26.9	47	50.0

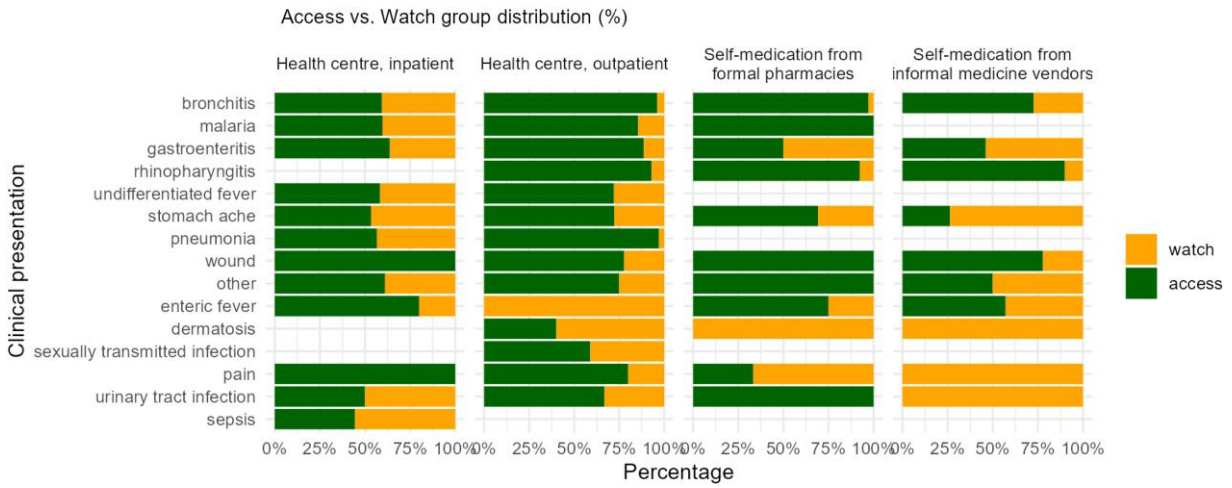

Figure 1. Distribution of AWaRe groups among all antibiotics used per type of visit. This figure appears in colour in the online version of *JAC* and in black and white in the print version of *JAC*.

Figure 2. Distribution of antibiotic classes among all antibiotics used, by clinical presentation and by type of visit. This figure appears in colour in the online version of *JAC* and in black and white in the print version of *JAC*.

help limit uncontrolled access to medicines of potentially poor quality, hence reducing the availability of over-the-counter antibiotics at informal medicine vendors. For this group, AMR awareness programmes should stress the harm of the misuse of Watch antibiotics (wrong indications and suboptimal regimen) for their entire community and urge them not to sell these medicines.

Informed community-targeted antimicrobial stewardship

At community level, health literacy, including awareness of risk behaviours leading to emergence and spread of resistant microorganisms in the community, could significantly reduce self-medication with antibiotics.[30] Such activities should be combined with interventions facilitating and promoting access to healthcare facilities, e.g. through universal health insurance and patient-centred care including reducing patients' waiting time.[31–34]

Conclusions

Interventions to optimize antibiotic dispensing should be provider-type tailored: at formal pharmacies, strengthening regulation on antibiotic sales, associated with regular AMR awareness activities and monitoring, should mitigate over-the-counter dispensing of Watch antibiotics; at informal medicine vendors, AMR awareness programmes should help self-restriction of Watch antibiotic sales; and in health centres, while access should be promoted and facilitated, interventions should include healthcare professionals' education and awareness on AMR, which is a key component for the success of a multiplex intervention including improving diagnostic tools and using appropriate algorithms to reduce (over)prescription.

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Transparency declarations

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. All authors have no conflicts of interest to declare.

Supplementary data

Table S1 is available as Supplementary data at *JAC* Online.

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