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ANTIMICROBIAL STEWARDSHIP PRACTICES IN KENYAN GOVERNMENT AND FAITH-BASED REFERRAL HOSPITALS BEFORE AND AFTER COVID-19
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ABSTRACT

Background: **Antimicrobial stewardship is essential to mitigate antimicrobial resistance. This study assessed antibiotic use in government and faith-based referral hospitals in Kenya before and after the COVID-19 pandemic. We aimed to understand the impact of the pandemic on antibiotic prescribing practices in these settings.**
Methods: **Data on patient-level antibiotic use were extracted from hospital medical records using a modified WHO point prevalence form. A mobile-friendly online extraction form was made available through Open Data Kit software to facilitate this process.**
Results: **A study of 5,442 medical records found that female adults accounted for 57.41% of antibiotic recipients. The most common reasons for antibiotic use were obstetrics/gynaecological infections (17.3%), pneumonia (15.4%), and soft tissue infections (12.4%). Approximately 55.37% of antibiotic treatments occurred before COVID-19, with an increase afterward. The most commonly prescribed antibiotics were ceftriaxone (34.06%) and Benzylpenicillin (14.7%), both of which were significantly associated with pre- and post-COVID-19 periods (X-squared = 789.95, df = 6, p-value < 2.2e-16). Clinicians underutilized culture and antimicrobial susceptibility tests with approximately 95% of clinician prescriptions lacking laboratory support, and some referral hospitals were incapable of conducting basic microbiology testing.**
Conclusion: **High rates of antibiotic prescribing observed across studied wards suggest potential misuse before and after COVID-19, necessitating strengthened stewardship programmes to ensure responsible prescribing and monitoring. Tailored treatment and equitable access to standardised guidelines are essential to combat antibiotic resistance. Insufficient demand for laboratory**

tests, which contributes to antibiotic resistance, calls for investment, policies, improved communication, and enhanced clinician education.

INTRODUCTION

Antimicrobial resistance (AMR) is an urgent health threat of the 21st century, causing approximately 700,000 deaths annually worldwide (1). By 2050, it is projected to claim 10 million lives, with Africa facing the highest mortality rate from AMR (2).

The primary drivers of AMR are overuse and misuse of antimicrobial drugs, which are more prevalent in low- and middle-income countries. Addressing this issue requires global cooperation, responsible drug usage, robust surveillance, and public awareness campaigns (3).

The 2015 Global Point Prevalence Survey revealed alarming rates of antimicrobial consumption in African hospitals (4). This high usage is due to several factors, including the lack of diagnostic services, ineffective prevention and control committees, and limited access to appropriate antibiotics (5).

Despite challenges, some African countries are implementing antimicrobial stewardship (AMS) programs to promote responsible antibiotic use. A comprehensive approach is needed to address AMR effectively and safeguard public health (6,7).

Kenya has made significant progress in establishing AMS program based on the WHO's global action plan since 2017 (8). However, despite these commendable efforts, Kenya faces challenges in fully addressing AMR due to the lack of a robust AMR surveillance system (9).

To address knowledge gaps and enhance AMS practices in Kenya, a point-prevalence survey was conducted in 11 government and faith-based hospitals across 9 counties. The study aimed to understand antibiotic usage prevalence, common antimicrobial drug types, prescribing patterns, and indications for antibiotic use in patients hospitalised before and during COVID-19. This research, carried out amid the pandemic and the implementation of containment measures, provided insights into the impact of COVID-19 on AMS. Comparisons were made between antibiotic usage, types, prescribing patterns, and indications before and after the pandemic.

The study findings generated essential data on antibiotic usage and resistance patterns in Kenyan healthcare settings. This data should be used to inform targeted interventions to optimize antimicrobial use, enhance AMS practices, and combat antimicrobial resistance. The study also has the potential to make a significant contribution to global AMR initiatives and guide efforts to combat this urgent global health threat.

METHODS

This study employed adapted versions of the WHO Point Prevalence Survey (PPS) tools to gather data at the hospital, ward, and patient levels (10).

Setting:

The point prevalence survey was conducted between April and October 2022 in 11 referral hospitals, including one national referral hospital, five county referral hospitals, and five faith-based referral hospitals. These hospitals are located across Nairobi County (National Spinal Injuries Hospital), Taita Taveta County (Moi County Referral Hospital and Saint Joseph's Shelter of Good Hope Hospital), Embu County (Embu County Referral Hospital and Consolata Mission Hospital Kyieni), Kakamega County (Kakamega General County Referral Hospital), Siaya County (Saint Elizabeth Mission Hospital Lwak), Kiambu County (Kiambu County Referral Hospital), Nyeri County (Consolata Mission Hospital

Mathari), Trans Nzoia County (Trans Nzoia County Referral Hospital Kitale), and Bomet County (Tenwek Mission Hospital).

These teaching tertiary hospitals, offering multi-specialty referral care across their regions, were chosen for their capacity to perform basic microbiology tests and their potential to drive transformative change, as outlined in the six elements of the Transformative Innovation Policy (11). Likewise, the Kenya's Ministry of Health approved the selection of facilities using various criteria. Firstly, to avoid excessive research concentration in specific institutions like Kenyatta National Hospital, the chosen facilities represent a diverse cross-section of healthcare settings. This includes both national and county referral hospitals, ensuring a balanced mix of government and mission institutions.

Secondly, the selection encompasses both urban and rural settings, recognizing the importance of studying healthcare delivery in varied contexts. Counties engaged in the national government's AMS activities are also included, facilitating a comprehensive understanding of antimicrobial practices across the country.

Thirdly, preference was given to facilities equipped with laboratories possessing basic microbiology capabilities. This ensures the selected hospitals possess the necessary infrastructure to support research objectives related to antimicrobial activities.

These referral hospitals offer a comprehensive range of services, including internal medicine, general and orthopaedic surgery, obstetrics, and paediatrics. Their dedicated laboratories, staffed by skilled phlebotomy teams, provide most services, including basic microbiology, on a 24-hour basis.

Data collection

Hospital-level data: A researcher and the hospital focal point conducted interviews with hospital administrators, heads of infection prevention and control committees and/or antimicrobial stewardship committees, and laboratory department heads to collect data on existing AMS programs, activities, capacities, and innovations. The data collection tool is provided in Supplementary 1(PPS -Hospital data collection form, PPS -Patient level data collection form, and PPS-ward level data collection form).

Ward-level data: The following data was collected at the ward level: patient numbers, department type, ward name, speciality of the ward, number of patients, and ward code. The wards were grouped into neonatal, paediatric, and adult departments. Paediatric Departments included the Paediatric Medical Ward (PMW), Haematology-Oncology Paediatric Medical Ward (HO-PMW), Transplant BMT/Solid Paediatric Medical Ward (T-PMW), and Paediatric Surgical Ward (PSW). The Neonatal Departments consisted of the Neonatal Medical Ward / Special Care Baby Unit (NMW) and the Neonatal Intensive Care Unit (NICU). Adult Medical Ward (Male, Female & General, Private, TB, Isolation) (AMW), Haematology-Oncology - Adult Medical Ward (HO-AMW), Transplant BMT/solid Adult Medical Ward (T-AMW), Pneumology Adult Medical Ward (P-AMW), Adult Surgical Ward (Male, Female) (ASW), Adult Intensive Care Unit (AICU), Obstetrics and Gynaecology Ward (ante-natal/post-natal, gynaecology, labour) (OBGYN). The results of the survey were pooled at the group level in hospitals with more than one ward in these groupings. Supplementary 2 provides the data collection tool.

Patient-level data: A three-member team collected patient-level data from medical records in participating hospitals from 2 years before to 2 years after the COVID-19 pandemic. The data included patient demographics, healthcare exposures, antibiotics used, diagnoses, and culture and susceptibility tests. Records from the paediatric, adult, and neonatal wards were included. Antibiotic use for prophylaxis was inferred for patients who had undergone surgery or were HIV-infected. Indications for antibiotic prescription were recorded using prespecified PPS indication codes. The data collection tool is provided in Supplementary 3.

Electronic data entry: Data were extracted from paper medical records and entered into electronic format using ODK software (Rajput et al., 2012; ODK-X, 2023). The data were collected on ODK Central and made available to all researchers and focal points in each participating hospital. The datasets were downloaded from ODK Central and stored as Excel files.

Data analysis

Antibiotics were grouped into 10 major groups by ATC codes (12). Data cleaning was conducted to remove errors, outliers, and anomalies. Analysis employed R 4.3.1 software, encompassing descriptive statistics and advanced analytical techniques. Results were presented in clear, disaggregated tables, segmented by gender, hospital, and pre-/post-COVID-19 periods. Comparisons utilised Chi-square tests, with $p < 0.05$ considered statistically significant.

The term "treatment appropriateness" was defined as any prescription in line with treatment guidelines, consensus of resident expert opinions, or tests for bacterial species or antibiotic susceptibility. To assess appropriateness and compliance with treatment, the study questionnaires recorded the availability of guidelines recommended by the Ministry of Health and adopted by the resident experts of the hospital Medicines and Therapeutic Committees. Resident experts comprised members from 8 hospital Medicines and Therapeutic Committees, including the hospital medical superintendent, one senior physician, the hospital pharmacist, a senior clinical officer, a senior nursing officer, an administrator, the laboratory head, and medical records. The questionnaires also featured a checklist of indicators for treatment guideline adherence. A checklist to determine adherence was integrated into the study questionnaire. This checklist for determining adherence was integrated into the study questionnaire.

Ethical considerations

The study protocol was approved by 11 hospital research and ethics committees, 9 County Government research and ethics boards, the Ministry of Health, University of Nairobi-Kenyatta National Hospital Ethics and Research Committee # P675/08/2021 and the National Commission for Science, Technology and Innovation # NACOSTI/P/21/9953 and NACOSTI P/22/19130; applicable to all study hospitals.

RESULTS

Demographic Overview

A total of 5,442 medical records were extracted from 11 referral hospitals across 9 counties in Kenya (Table 1). The targeted medical records dated 2018 and 2019 (before COVID-19) and those dated 2020 and 2021 (After COVID-19). Of the patients, 3,124 (57.4%) were female and 3,685(67.7%) were adults. A total of 1,757 (32.3%) patients were aged between 28 days and 17 years.

Table 1

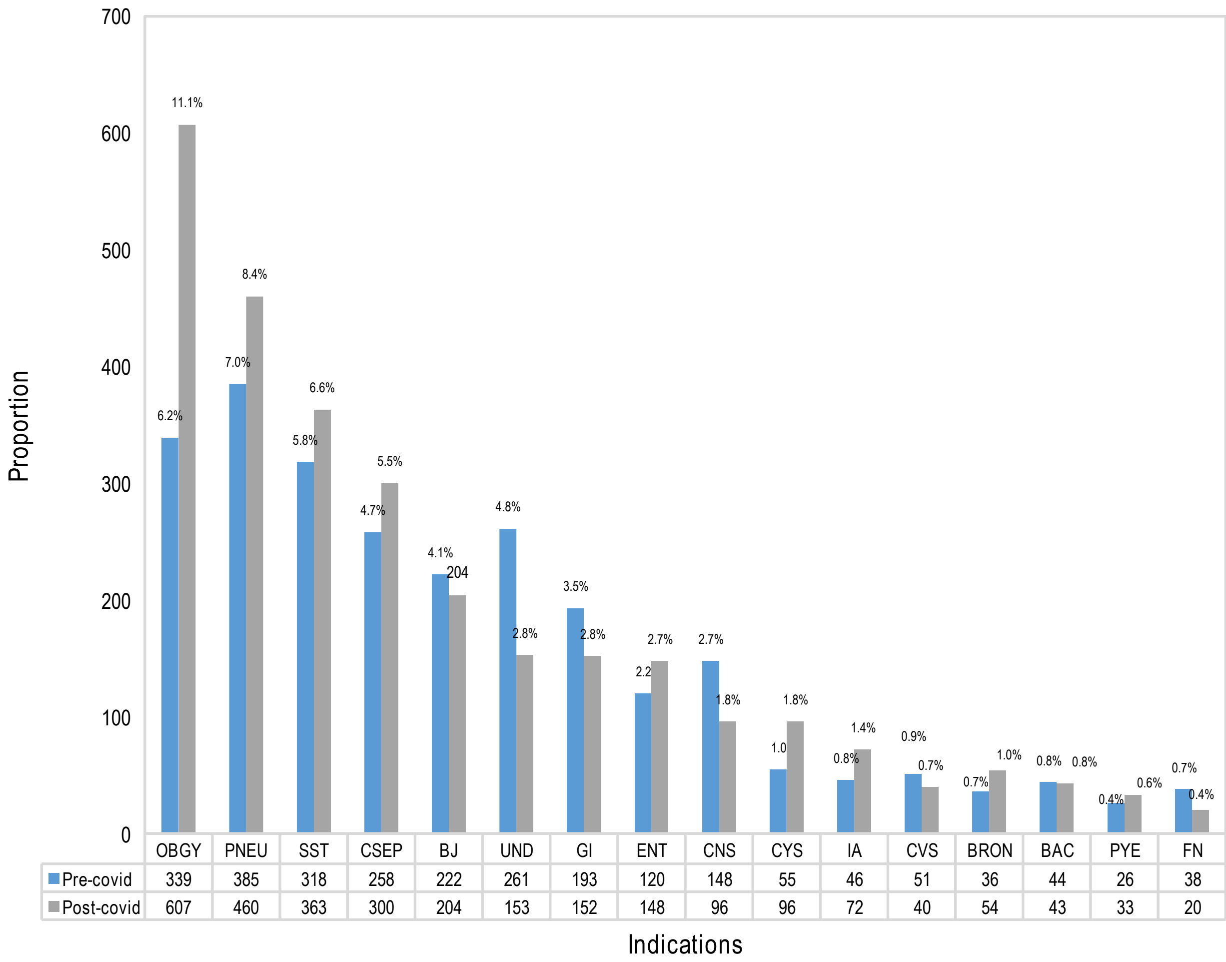
Patient characteristics from medical records in 11 referral hospitals

Hospitals	Bed Capacity	Medical Records	Age Group				Gender	
			Adult (>18 years)	Child (1-17 years)	Infant (1-11 months)	Neonate (<28 days)	Male	Female
H-1	35	240	228	12	0	0	132	108
H-2	750	654	405	92	33	124	281	373
H-3	112	282	150	55	14	63	144	138
H-4	468	586	402	128	33	23	287	299
H-5	316	650	428	111	46	65	356	294
H-6	85	250	168	52	30	0	142	108
H-7	34	565	441	90	28	6	142	423
H-8	280	436	346	80	10	0	126	310
H-9	50	774	410	294	70	0	286	488
H-10	200	590	454	83	18	35	260	330
H-11	361	415	253	41	17	104	162	253
Total	**2,691**	**5,442**	**3,685**	**1,038**	**299**	**420**	**2,318**	**3,124**
Key: H-1- H-6: Government hospitals; H-7- H-11: Mission hospitals								

Distribution of indications for antibiotic use

Sixteen types of infections that infected 5,381 patients were treated with antibiotics in 11 hospitals over a four-year period (2018-2021). Prior to COVID-19, 2,540 patients were taking antibiotics and 2,841 during COVID-19. The most common infections were obstetric/gynaecological (17.6%; n=946), pneumonia (15.7%; n=845), soft tissue infections (12.7%; n=681), clinical sepsis (10.4%; n=558), and bone and joint infections (7.9%; n=426). The data on antibiotic usage according to infection is shown in Figure 1.

Out of 3,648 cases of antibiotic treatment of patient groups admitted in 11 hospitals including neonatal, paediatric, and adult patients showed that most common indications were sepsis (91%; n=3,320), pneumonia (62.3%; n=2,273), and obstetric or gynaecological infections (52.4%; n=1,912). Other common indications included undefined infections, soft tissue infections, bone and joint infections, and gastrointestinal infections as shown in Figure 2. Eye infections were rare, with fewer than ten cases (Figure 2). The frequency of antibiotic treatment differed among wards and time periods. In the pre-COVID-19 period, antibiotic treatment rates were 6% (n=223) in neonatal wards, 12.6% (n=459) in paediatric wards, and 36.7% (n= 1,338) in adult wards. In the post-COVID-19 period, these rates increased in paediatric patients (14.3%; n=523) but dropped in neonatal (5%; n=183) and adult patients (25.2%; n=919) respectively.



OBGY-Obstetric /gynaecological, PNEU-Pneumonia, SST-Soft Tissue, CSEP-Clinial sepsis, BJ- Bone and Joint, UND-Udefined, GI- Gastrointestinal Infections, ENT-Ear, Nose, Throat, CNS- Central Nervous System, CVS- Cardiovascular System, CYS- Symptomatic upper urinary trafct infections, IA- Intra-abdominal sepsis, BRON-Bronchitis, BAC-Bacteraemia, PYE- Symptomatic upper urinary tact infection, FN- Febrile neutropenia.

Figure 1: Most common indications for antibiotic prescription

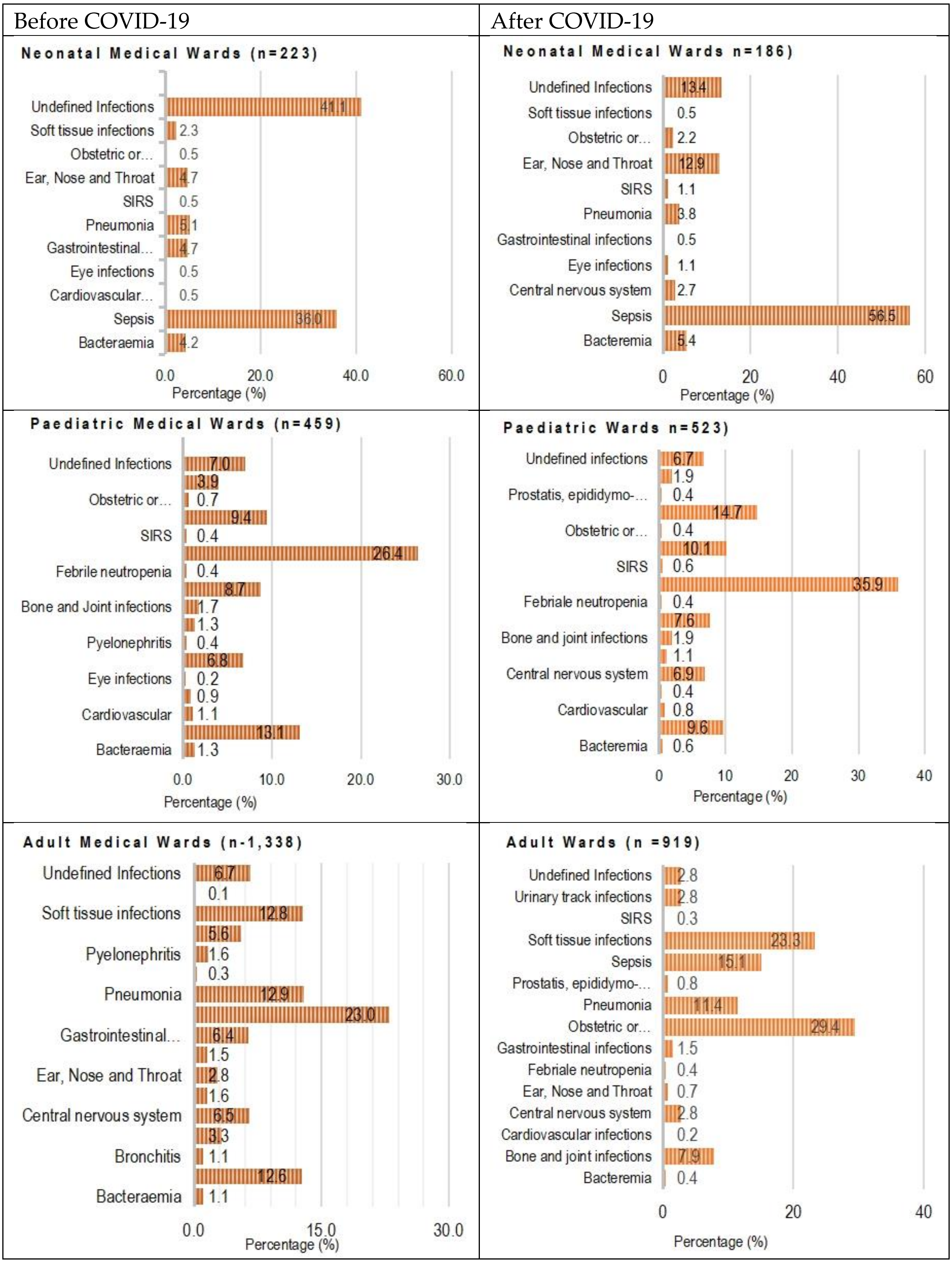


Figure 2: Ward Distribution of Indications in 11 Kenyan Referral Hospitals Before and After COVID-19

Laboratory diagnosis
During the study period, clinicians ordered a total of 189 culture tests and 87 antimicrobial susceptibility tests (Table 2).

The frequency of culture tests and antimicrobial sensitivity tests ordered was significantly different between the periods before and after the COVID-19 pandemic.

Table 2
Culture and Antimicrobial Susceptibility Testing in 11 Kenyan Referral Hospitals

	Test	Hospitals											
		H-1	**H-2**	**H-3**	**H-4**	**H-5**	**H-6**	**H-7**	**H-8**	**H-9**	**H-10**	**H-11**	**Total**
Pre-COVID-19	**Culture tests**												
	Not ordered	132	319	264	267	304	12	22	11	350	102	49	1832
	Undocumented	1	5	1	1	0	0	32	3	0	92	37	172
	Ordered	**1**	**1**	**7**	**6**	**4**	**0**	**4**	**0**	**0**	**3**	**32**	**58**
	AST												
	Not ordered	3	319	269	265	306	7	21	12	350	102	70	1724
	Undocumented	1	5	1	1	0	2	33	2	0	93	37	175
	Ordered	**0**	**1**	**3**	**6**	**1**	**0**	**0**	**0**	**0**	**2**	**11**	**24**
Post-COVID-19	**Culture tests**												
	Not ordered	83	290	0	288	335	10	16	170	384	193	134	1903
	Undocumented	0	3	0	3	0	3	18	4	0	190	74	295
	Ordered	**6**	**13**	**0**	**6**	**0**	**0**	**9**	**3**	**0**	**6**	**86**	**129**
	AST												
	Not ordered	0	290	0	288	298	10	5	169	383	185	184	1812
	Undocumented	0	5	0	3	0	1	25	4	0	198	76	312
	Ordered	**2**	**11**	**0**	**6**	**0**	**0**	**1**	**3**	**0**	**6**	**34**	**63**

Culture tests: X-squared = 44.866, df = 2, *p*-value = 1.809e-10;
Antimicrobial Susceptibility tests: X-squared = 41.426, df = 2, *p*-value = 1.01e-09

Antibiotic use before and after COVID-19
A total of 5,579 antibiotics were prescribed to surveyed patients (Table 3), with 2,401 prescribed before COVID-19 (2018-2019) and 3,178 prescribed after COVID-19 (2020-2022). The most commonly prescribed antibiotics were Ceftriaxone (27.4%), Benzylpenicillin (18.4%), and Gentamicin (17.4%). Ceftriaxone accounted for 33% of the antibiotics used and stopped, whereas Benzylpenicillin accounted for 14.2%.

Gender did not exhibit a statistically significant association with the time periods before and after COVID-19. However, young child-bearing females had notably high antibiotic prescription rates, with 97.7% of patients consuming antibiotics for an average duration of 5 to 7 days.
Statistical analysis confirmed the association between the periods before and during the COVID-19 era and specific antibiotic categories used and ceased upon patient admission.

Table 3

Antibiotic Use and Discontinuation at Admission in 11 Kenyan Referral Hospitals

Indicator		Hospitals											
		H-1	H-2	H-3	H-4	H-5	H-6	H-7	H-8	H-9	H-10	H-11	Total
PRE-COVID	**Gender**												
	Male	9.0% (201)	6.7% (151)	2.5 % (56)	6.0% (135)	3.6% (81)	0.3% (7)	3.7% (83)	0.2% (4)	7.7% (173)	1.9% (43)	1.6 % (35)	43.2% (969)
	Female	7.3% (164)	9.0% (201)	2.7% (61)	6.0% (135)	3.6% (80)	0.7% (16)	11.3% (253)	0.1% (2)	12.2% (274)	2.0% (46)	2.0% (44)	56.8% (1,276)
	Antibiotics												
	Ceftriaxone	6.0% (111)	1.8% (34)	3.3% (61)	7.8% (145)	2.9% (54)	0.8% (14)	8.4% (157)	0.4% (8)	2.7% (51)	2.0% (38)	1.8% (33)	37.9% (706)
	Gentamicin	4.8% (89)	5.6% (104)	0.0% (0)	1.8% (33)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	9.9% (184)	0.0% (0)	0.0% (0)	22.0% (410)
	Ampicillin	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.3% (5)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.3% (5)
	Benzylpenicillin	0.0% (0)	5.6% (109)	1.5% (28)	1.9% (35)	1.5% (27)	0.0% (0)	1.2% (23)	0.3% (6)	10.6% (198)	0.4% (7)	1.6% (29)	24.8% (462)
	A&E	4.8% (90)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	4.8% (90)
	Flucloxacillin	3.2% (59)	0.0% (0)	0.0% (0)	1.2% (22)	1.8% (34)	0.3% (4)	0.0% (0)	0.0% (0)	0.0% (0)	0.6% (11)	1.6% (29)	8.5% (159)
	Others	0.4% (7)	0.0% (0)	0.2% (3)	0.0% (0)	0.2% (3)	0.0% (0)	0.3% (6)	0.3% (6)	0.0% (0)	0.0% (0)	0.2% (4)	1.6% (29)
	Cumulative Mean Days	5	5	6	5	5		4	6	5	5	5	5
POST-COVID	**Gender**												
	Male	2.6% (73)	5.0% (142)	0.2% (6)	4.4% (125)	2.4% (68)	0.6% (17)	3.6% (101)	6.7% (189)	1.6% (46)	8.1% (228)	4.2% (119)	39.6.% (1,114)
	Female	3.0% (83)	3.6% (101)	0.2% (5)	5.4% (153)	8.3% (233)	1.1% (32)	6.5% (183)	15.2% (428)	8.2% (232)	4.6% (128)	4.3% (121)	60.4% (1,699)
	Antibiotics												
	Ceftriaxone	3.1% (72)	5.4% (125)	7.5% (173)	7.5% (173)	1.7% (40)	1.1% (26)	3.4% (79)	7.5% (173)	4.7% (108)	4.3% (98)	5.5% (127)	51.8% (1,194)
	Gentamicin	1.3% (31)	0.0% (0)	1.1% (26)	0.0% (0)	3.1% (71)	0.4% (10)	1.0% (24)	2.9% (66)	2.7% (63)	0.0% (0)	0.0% (0)	12.6% (291)
	Benzylpenicillin	0.0% (0)	1.5% (34)	1.0% (23)	0.0% (0)	0.2% (4)	0.2% (4)	1.0% (23)	6.1% (140)	3.6% (82)	2.1% (48)	0.0% (0)	15.5% (358)
	Ampicillin	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	3.4% (79)	3.4% (79)
	A&E	2.0% (45)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	2.5% (45)
	Flucloxacillin	0.0% (0)	0.0% (0)	1.8% (42)	0.0% (0)	3.5% (81)	0.4% (10)	1.4% (31)	5.3% (123)	0.0% (0)	1.3% (29)	0.0% (0)	13.7% (316)
	Others	0.3% (7)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.3% (6)	0.3% (6)	0.0% (0)	0.0% (0)	0.1% (2)	0.9% (21)
	Cumulative Mean Days	5	7	5	5	5	5	5	5	7	5	5	5

Key: Government hospitals: H-1 to H-6; Mission Hospitals: H-7 to H-11; A&E- Amoxicillin & enzyme inhibitor
Gender: X-squared = 6.3892, df = 1, *p*-value = 0.01148; **Antibiotics:** X-squared = 789.95, df = 6, *p*-value < 2.2e-16

DISCUSSION

This study observed that antibiotic use was high across 11 referral hospitals before and after COVID-19, with adult females on adult medical wards being the most likely to utilise antibiotics. Additionally, admission rates were greater before COVID-19, most likely due to containment and control efforts. This finding corroborates other studies (13)

The most common reason for antibiotic usage was obstetric or gynaecological illnesses, implying that the majority of patients were females of reproductive age. These diseases became more common during COVID-19, presumably as a result of increased sexual behaviour while under lockdown (13). Paediatric pneumonia was the second most prevalent illness that resulted in antibiotic usage, with a higher incidence rate among paediatric patients. This might be due to lockdown contamination (14)

During the pandemic, mission hospitals used more antibiotics, reversing a tendency that existed before COVID-19. This might be related to a lack of defined COVID-19 treatment guidelines in the early phases, an increase in demand for healthcare services, and the belief that mission hospitals were better prepared and had more easily accessible antibiotics (15,16).

Ceftriaxone was the primary antibiotic for numerous purposes in both male and female wards, raising worries about antibiotic resistance. Ceftriaxone is a broad-spectrum antibiotic that is widely used, which may result in the emergence of resistant bacterial strains (17).

More women than men sought healthcare services, which is consistent with earlier research demonstrating that COVID-19 affects women disproportionately. This might be related to their professions and caregiving duties, as well as a shortage of transportation, childcare, and financial resources (18).

The diversity in antibiotic treatment indications emphasises the need to adapt antibiotic therapy to the specific patient group and clinical state. Antibiotics should be administered only when absolutely required, and the antibiotic should be chosen based on the best available data. Antibiotic overuse can lead to antibiotic resistance, making it more difficult to treat illnesses in the future (19).

The study revealed a low demand for culture and antimicrobial susceptibility tests among clinicians, despite their critical role in clinical diagnoses and antibiotic use. Around 95% of clinician prescriptions lacked laboratory support, and some referral hospitals lacked the capacity for basic microbiology testing.

Before the COVID-19 pandemic, clinicians typically ordered 58 culture tests and 24 antimicrobial susceptibility tests monthly, significantly fewer than the 129 culture and 63 antimicrobial susceptibility tests conducted during the pandemic. However, challenges like undocumented medical records and incomplete data persisted even during this period, highlighting systemic issues in recordkeeping.

The surge in tests during the pandemic reflected the adoption of laboratory measures aligned with government COVID-19 containment efforts. Yet, factors such as the lack of laboratory reagents, inadequate personnel, insufficient training, equipment shortages, inadequate space, and a lack of basic infrastructure contributed to the insufficient adoption of laboratory tests. Additionally, the absence of a clear policy framework for prioritizing laboratory tests and facilitating testing for patients unable to cover the costs exacerbated the problem (20).

Another significant factor contributing to the low demand for laboratory tests was the tension between clinicians and laboratory staff, leading to clinicians assessing a patient's ability to afford tests and, if unaffordable, resorting to empirical therapy without relying on laboratory tests. This conflict underscored the ongoing issue of low demand for laboratory tests across all hospitals (21).

Limited laboratory support in low-resource settings leads to varied prescription patterns and treatment choices among doctors. Experienced doctors may prescribe second-line broad-spectrum antibiotics with caution, while less experienced doctors may prescribe them more frequently, promoting polypharmacy and antimicrobial resistance (22,23).

Challenges associated with empirical therapy in low-resource settings include inappropriate hardcopy documentation, lack of automated electronic medical records, incorrect handling of laboratory data, and a lack of consensus between clinicians and laboratory staff. When patients cannot afford laboratory testing, clinicians may prescribe empirical therapy, but laboratory personnel believe that clinicians do not adequately create demand for laboratory testing, undermining its value in the fight against antimicrobial resistance (24).

CONCLUSION AND RECOMMENDATION

The study observed an increase in the inappropriate use of antibiotics in referral hospitals, which can be mitigated through strengthened antibiotic stewardship programmes. These programmes should focus on educating healthcare professionals about responsible prescribing practices and monitoring antibiotic consumption to address overuse. Additionally, tailoring antibiotic treatment to individual patient populations and clinical conditions can minimise the emergence of antibiotic-resistant bacterial strains. It is crucial to ensure that all healthcare facilities, including mission hospitals, have access to and adhere to standardised treatment guidelines, especially during health crises like pandemics, to distribute the antibiotic usage burden more equitably.

The study also noted low demand for laboratory tests, which contributes to antibiotic resistance. This can be addressed by investing in laboratory resources and personnel to improve capacity for basic microbiology testing. This is essential for providing clinicians with the information they need to make informed decisions about antibiotic use. Additionally, clear policies should be developed and implemented to prioritise laboratory testing and facilitate testing for patients who cannot afford it. This will help ensure that all patients have access to the testing they need, regardless of their financial situation. Furthermore, communication and collaboration between clinicians and laboratory staff should be improved to ensure that laboratory results are interpreted and used appropriately to guide antibiotic treatment. Finally, education and training for clinicians on the importance of laboratory testing and the judicious use of antibiotics should be enhanced to ensure that antibiotics are used only when necessary and in the most effective way possible.

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