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Point Prevalence Survey and Patterns of Antibiotic Use at Kirinyaga County Hospitals, Kenya

Perpetua Wanjiku Karanja*[a], Anthony Kiunga[a], George Karoki[a]

[a]Department of Health, Kirinyaga County, Kenya
Correspondence to Perpetua Wanjiku Karanja (perpetuaw@gmail.com)

ABSTRACT

Background: Antibiotics are useful in treating and managing infections in outpatient and inpatient care settings. However, irrational antibiotic use can lead to improper patient care, antimicrobial resistance, wastage of resources and sometimes even death. The pattern of antibiotic use varies from one medical practitioner to another, infection, patient, wards, country and region. The study was a conducted as a baseline to describe the prevalence and patterns of antibiotic use in Kirinyaga County hospitals.

Methodology: The study was a point prevalence survey of antibiotics use among patients admitted to four hospitals in Kirinyaga county and the study utilised the World Health Organization methodology for point prevalence survey of antibiotics in hospitals. Data were abstracted from patients' files of patients who consented using a pretested tool. The data was exported to MS Excel for cleaning and analysed descriptively

Results: The prevalence of antibiotic use in the four hospitals in Kirinyaga county was 44.0% (95%CI 38.6-49.5%). Penicillins were the most prescribed antibiotic class at 29.1%, followed by cephalosporins at 23.0%. Ceftriaxone and metronidazole were the highest prescribed at 22.0% and 19.8%, respectively. Antibiotics were mainly prescribed for community-acquired infections at 58.2%, followed by surgical prophylaxis at 26.0%. Most patients (52.5%) received two antibiotics, predominantly benzylpenicillin and gentamicin, at 40.3%. The majority, 63.0%, of all antibiotics were administered parenterally. There was poor documentation of administration of medicines on the treatment sheet.

Conclusion: There was a relatively high prevalence of antibiotic use, all prescribed empirically. Community acquired infections were the most common indication for antibiotics. There was extensive use World Health Organization "watch" category of antibiotics without microbiological tests. There is a need for antibiotic stewardship program to ensure judicial use of antibiotics.

BACKGROUND

Antibiotics are essential in treating and managing most infections in routine patient care. They are used in treating and preventing microbial infections in both inpatient and outpatient settings. Their use varies across continents, countries, hospitals and even wards in the same hospital.[1,2] A global point prevalence survey showed that 1 out of 2 and 1 out of 3 hospitalised patients received antibiotics in Africa, Asia and Europe respectively.[3]

Medical wards had the least consumption at 27.4%, while transplant surgical wards had the highest at 77.0%.[1] The most prescribed class of antibiotics in the world is a combination of penicillins with B lactamase inhibitors followed by third-generation cephalosporins and fluoroquinolones.[1] A 2018 study by the World Health Organization (WHO) reports penicillins as the most commonly used group of antibiotics in 65 countries.[2] Lower respiratory infections, especially pneumonia, accounted for the highest antibiotic prescriptions.[1]

Numerous studies conducted in Kenya have documented the prevalence of antibiotics use in hospitals found in Nakuru County (54.7%), Nyanza region (67.7%), Kiambu County (62%) and at 3 tertiary hospitals (46%).[4-7] There is need to document more antibiotics prevalence studies in other hospitals in Kenya.

Antibiotic resistance is a mounting danger to humankind as discovering new molecules, especially those against gram-negative bacteria is slow and scarce.[8] This is projected to be severe in low and middle-income countries, which are burdened by a high number of infectious diseases and low access to alternative antibiotics due to high costs.[9] Some factors contributing to antibiotic resistance are; inappropriate and irrational antibiotic use in hospitals, self-medications, failure to complete therapy and substandard antibiotics.[9-11] Irrational use of antibiotics is wasteful and harmful due to the increased risk of adverse effects.[12] Antimicrobial stewardship is crucial in curbing antimicrobial resistance.[13-15] The prevalence and patterns of antibiotic use in Kirinyaga County hospitals have not been documented before

The study was conducted as a baseline to describe the prevalence and patterns of antibiotic use prior to the establishment of the antimicrobial stewardship program.The study was essential to identify areas where antimicrobial stewardship strategies can be applied and to minimise inappropriate antibiotic use.

MATERIALS AND METHODS

Study Setting and Design

The study was conducted at 4 Kirinyaga County public hospitals' inpatient departments in October 2021. The hospitals have a total bed capacity of 359, located in peri-urban centres, and offer varying clinical services for outpatient and inpatients.

The largest hospital was the county referral hospital (typical district hospital) with general medical wards, maternity, orthopaedic, surgical, psychiatry, paediatrics and obstetric wards. The other 3 Sub-county hospitals refer their patients to the referral hospital for further/ specialised management. The sub-county hospitals have maternity and medical wards only. All the hospitals were classified as primary hospitalsi n terms of the scope of services offered.[16]

The study design was a multicentre point prevalence survey of antibiotic use and utilised the World Health Organization (WHO) methodology for point prevalence survey of antibiotic use in Hospitals.[16] The study population consisted of inpatients in the study hospitals.

Inclusion and Exclusion Criteria

Patients admitted at or before 8AM on the day of the survey were included. Neonates born before 8AM and admitted to the maternity ward were also included. Patients admitted in the day surgery and renal dialysis ward were excluded. Patients admitted after 8 AM on the day of the survey and discharged patients awaiting transportation or relatives of admitted patients were also excluded. Antibiotics administered orally or parentally were included. Topical ophthalmic antibiotics and antibiotics initiated after 8 AM or discontinued before 8AM were excluded.

Sample Size

All patients who met the inclusion criteria were included in the study. The study employed universal sampling method because the bed capacity at all the 4 hospitals was less than 500. The WHO methodology for point prevalence survey for hospitals recommends the inclusion of all eligible patients for hospitals with less than 500 inpatient beds.[16]

Data Collection

Trained pharmacists collected the data from the 4 hospitals for a period of 2 weeks in October 2021. Data was collected at both ward and patient level. At the ward level, the type of ward, number of patients in the ward, number of eligible and included patients were collected from the ward admission register. At the patient level, informed consent was sought first before inclusion. For patients more than 10 and less than 18 years of age, informed assent from them and informed consent from their parents/guardians was sought. For the patients who consented, data such as age, sex, date of admission, diagnoses, history of antibiotic use and antibiotics used was abstracted from patient files. Data on antimicrobial type, dose, duration of treatment, route of administration, indication for antibiotic use, culture and sensitivity tests was also collected. Data was collected using pretested standardised forms. To ensure confidentiality, all consent forms were stored in a lockable cabinet while data collected was stored in a password protected computer only accessible to the investigators.

Data Analysis

The data collected was exported to Excel for data cleaning and analysis. The data was analysed descriptively. Descriptive statistics such as proportions and frequencies was done and results expressed with a 95% Confidence Intervals.

Ethical Considerations

Ethical approval for this study was sought from Kenyatta National Hospital /University of Nairobi Ethics Review Committee (reference number KNH-ERC/A/110). Approval to collect data in the 4 hospitals was sought from the County Director of Health, Kirinyaga County

RESULTS

Patient Characteristics

A total of 341 patients were approached for consent, of which 332(97.4%) patients gave their consent to be part of the study, only 2.6% (9/341) did not provide consent. A total of 332 records were reviewed from the 4 hospitals during the study. The majority 58.4% (194) were from the county referral hospital (Hospital A). (Table 1) Females represented 66.4% (217) of the patients. Adults represented the majority of those admitted in the wards accounting for 63%, followed by neonates at 14.8%, children aged 1 to 5 years at 12.6%, 6 to 17 years at 6.0 %, and lastly, infants at 3.9%. Most of the admissions occurred in the maternity wards at 41.5% (138/332), followed by the medical wards at 38.3%.

Majority (87.7%, 291/332) of the patients did not have a history of admission in the last 90 days before the study, 8.4% had a prior admission history, with 3.9% whose history had not been recorded. Only 11.8% (39/332) were transferred in from other hospitals. The patients had spent an average of 7 days in the ward before the survey date, ranging from <1 to 62 days (IQR 1-7). Only 15.7% (52/332) of the patients had undergone surgery while admitted, with 73%(38/52) being invasive. Of those surveyed, 1.8%(6/332) were on anti-tuberculosis treatment while 5.4% (18/332) were HIV positive. More than half of the patients had catheters inserted at the time of the survey (51.5%, 171/332), with the peripheral cannula leading at 96.5% (165/171). Only 1.8%(3/171) of those with catheters had urinary and peripheral catheters simultaneously.

Previous Use of Antibiotics

Patients were considered to have previously used an antibiotic if they had used an antibiotic which had been stopped during the current admission. Almost a quarter (23.2%, 77/332) of patients had used antibiotics which had already been stopped at the time of the survey. Most (48.1%, 37/77) had used at least 2 antibiotics during admission, followed by one antibiotic at 39%. Only 1.3%

had used more than 5 antibiotics that had already been stopped during admission.

Antibiotic Use

The prevalence of antibiotic use among the admitted patients was 44.0%, 146/332(95%CI, 38.6-49.5) Hospital B had the highest prevalence of antibiotic use at 54.8%, followed by hospital A at 42.3%. (Table 1) A total of 227 antibiotics were prescribed for 146 patients representing an antibiotic prescribing ratio of 1.55. Hospital A and B had the highest antibiotic prescribing ratio at 1.57, followed by Hospital C at 1.5 and hospital D at 1.

The Anatomical Therapeutic Chemical (ATC) classification of antibiotics and frequency of use were as shown in Table 2. The most commonly prescribed antibiotics class was penicillins at 29.1%, followed by cephalosporins at 23.0%, nitroimidazole antimicrobials at 19.8% and aminoglycosides at 15.4%. Among the penicillins, benzylpenicillin was the most prescribed at 53.3% followed by flucloxacillin at 30.3%. Ceftriaxone was the most prescribed cephalosporin at 96.2%, while gentamycin was the most prescribed aminoglycoside. The 5 most commonly prescribed antibiotics were ceftriaxone at 22%, metronidazole at 19.8%, benzylpenicillin and gentamycin at 15.4% and flucloxacillin at 8.8%. The majority of the patients, 52.7%(77/146) were on 2 antibiotics followed by one antibiotic at 45.9 %. The most common combinations were benzylpenicillin and gentamycin at 40.3%, followed by ceftriaxone and metronidazole combination at 18.2 %.

The Majority of the antibiotics prescribed were in the WHO access group. However, ceftriaxone, the most prescribed antibiotic, is in the watch group. Most of the antibiotics (63.4 %, 144/227) prescribed were administered parenterally, followed by oral at 35.7%. All the antibiotic prescriptions had their frequency of use indicated but 16.3%(37/227) were missing a stop or review date. It was not possible to assess missed doses due to poor documentation.

Common Diagnoses

The most common diagnosis for an antibiotic prescription were obstetrics and gynaecology issues at 22.6% (33/146) followed by pneumonia at 20.7%. The obstetrics and gynaecology issues included caesarean sections, incomplete abortions and postpartum haemorrhage. Other common diagnoses were septic wounds at 4.8%, fractures, upper respiratory infections and convulsive disorders at 4.4%.

Indications, Presence of Catheter and Microbiological Tests

Community-acquired infections were the most common indication at 58.2% (85/146) followed by surgical prophylaxis at 26% (38/146) and medical prophylaxis at 11% (16/146). Almost all (98.1%53/54) of those on antibiotic prophylaxis were on the antibiotics for more than a day. All the hospitals surveyed did not have the capacity to do culture and sensitivity tests prior to use of antibiotics. None of the patients had culture and sensitivity tests ordered or documented at all hospitals under review.

DISCUSSION

The prevalence of antibiotic use across the 4 hospitals was at 44% (95% CI, 38.6-49.5).These results are close to results of a study conducted at 3 tertiary hospitals in Kenya (46%) and Uganda 45% (95% CI, 30-57%).[7,17] The prevalence of antibiotic use reported in this study is slightly lower to that reported in other studies conducted in a referral hospital in Kenya (54.7%), Ghana (51%), 4 African countries (59%) and a referral hospital in Kiambu county (62%).[4,5,7,17] The prevalence of antibiotic use in this study was higher than what was recorded in hospitals in South Africa (31% and 38.5%)and lower than what was recorded in hospitals in Botswana (70.6%) and Pakistan (77.6%).[18-21]

In all hospitals, nearly half of the inpatients (41.6%) were admitted in the maternity.[14] This is due to the fact that Hospital B, C & D offered mainly maternity services and minimal specialised care. Similar results were observed in a survey conducted in a tertiary hospital in Ghana, where most patients were from the obstetrics unit.[22] The high number of patients in the obstetrics unit also explains why most of those on antibiotics (54%) had diagnoses related to obstetrics and gynaecology and mostly as prophylaxis for surgery. This is similar to studies conducted in African hospitals where surgical prophylaxis for obstetrics and gynaecology was a common indication across all countries at between 12 to 18%.[17] Community-acquired infections accounted for the highest indication for antibiotic use at 58.2%, followed by surgical prophylaxis at 26%. This was comparable to results from several studies, such as the global Point Prevalence Survey (PPS) study in 4 African countries, a hospital in Ghana (40.1%), hospitals in Botswana (61.7%) and at a referral hospital in Kenya 54.2%.[4,17,18,22]

Penicillins were the most prescribed class of antibiotics at 29.1%, followed by cephalosporins at 23%. In Ghana, a study conducted in a tertiary hospital reported similar results at 24.9% and 23.7% for penicillins and cephalosporins, respectively.[22] Penicillins were also reported as the most prescribed class in other studies conducted in hospitals in Botswana, in African hospitals in the global PPS, and in a tertiary hospital in Kenya.[4,5,17,18] Ceftriaxone was the most used antibiotic at 22%, followed by metronidazole at 19.8%. This finding is similar to the findings in the global PPS in 3 countries; Uganda (24%), Zambia (21%) and Tanzania (32%).[22] Ceftriaxone was the most prescribed antibiotic at 2 referral hospitals in Kenya at 29% and 31%.[7] Metronidazole was more popular at Ghanaian hospitals at 12% as reported in the global PPS, at a tertiary hospital and in surgical units in hospitals in Ghana.[17,22,23]

The most prescribed class of antibiotics (penicillins) belonged to the WHO "access" category of antibiotics, similar to the global PPS study in 4 African countries.[17] However, there was a concern since the most prescribed antibiotic (ceftriaxone) is in the Watch group of antibiotics with high susceptibility to the development of antimicrobial resistance.[24] The risk of antimicrobial resistance with overuse of ceftriaxone is further compounded by lack of microbiological tests such as culture and sensitivity tests to monitor it at the 4 study hospitals. The WHO recommends that the use of "watch" category of antibiotics should be monitored and prioritised

TABLE 1: Demographic, Patient Characteristics and Antibiotic Prevalence

	Admissions N=332 n (%)	Number on antibiotics	Prevalence of antibiotic use (95%CI)
Hospital			
Hospital A	194 (58.4)	82	42.3(35.2-49.6)
Hospital B	93 (28.1)	51	54.8(44.2-65.2)
Hospital C	26 (7.8)	9	34.6(17.2-55.7)
Hospital D	19 (5.7)	5	26.3(9.1-51.2)
Gender			
Female	217(65.4)	85	39.2(32.6-46)
Male	115(34.6)	61	53(43.5-62.4)
Age group			
Adult > 18 years	209 (63.0)	89	42.6(35.8-49.6)
Child (6-17 years)	20 (6.0)	11	55(31.5-76.9)
Child (1-5 years)	41(2.3)	35	85.4(70.8-94.4)
Infant (1-11 months)	13 (3.9)	6	46.2(19.2-74.9)
Neonate <28 days	49(14.8)	5	10.2(3.4-22.2)
Wards			
Adult medical ward	41(12.4)	18	41.9(24.5-60.9)
Adult surgical ward	31 (9.3)	13	43.9(28.4-60.3)
Adult mixed (surgical/medical) ward	15 (4.5)	9	60(32.3-83.7)
Gynaecological ward	10(3.0)	3	30(6.7-65.2)
Maternity ward	138 (41.6)	41	29.7(22.2-38.1)
Neonatal medical ward	18(5.4)	4	22.2(6.4-47.6)
Paediatric medical ward	28(8.4)	24	85.7(67.3-96)
Paediatric surgical ward	10 (3.0)	6	60(26.2-87.8)
Mixed ward(adult/paediatric) medical ward	40(12.1)	27	67.5(50.9-81.4)
Mixed ward(adult/paediatric) surgical ward	1(0.3)	1	100

TABLE 2: Anatomical, Therapeutic and Chemical (ATC) and WHO Access, Watch, and Reserve (AWaRe) classification of antibiotics and their frequency

Antibiotic	ATC CODE	Frequency of use (%)	WHO AWaRe Classification
Penicillins		**66(29.1)**	
Amoxicillin	J01CA04	7(3.1)	Access
Amoxicillin /Clavulanic acid	J01CR02	2(0.9)	Access
Ampicillin/Cloxacillin	J01CA51	1(0.4)	Access
Benzathine penicillin	J01CE08	1(0.4)	Access
BenzylPenicillin	J01CE01	35(15.4)	Access
Flucloxacillin	J01CF05	20(8.8)	Access
Cephalosporins		**52(23)**	
Ceftriaxone	J01DD04	50(22)	Watch
Ceftazidime	J01DD02	2(0.9)	Watch
Nitroimidazoles		**45(19.8)**	
Metronidazole(IV)	J01XD01	45(19.8)	Access
Aminoglycosides		**35(15.4)**	
Gentamycin	J01GB03	35(15.4)	Access
Fluoroquinolones		**11(4.8)**	
Ciprofloxacin	J01MA02	10(4.4)	Watch
Levofloxacin	J01MA12	1(0.4)	Watch

Continue

TABLE 2: Continued

Antibiotic	ATC CODE	Frequency of use (%)	WHO AWaRe Classification
Tetracyclines		**7.(3.1)**	
Doxycycline	J01AA02	7.(3.1)	Access
Macrolides		**2(0.8)**	
Azithromycin	J01FA10	1(0.4)	Watch
Erythromycin	J01FA01	1(0.4)	Watch
Others		**9(3.9)**	
Clindamycin	J01FF01	6(2.6)	Access
Cotrimoxazole	J01EE01	2(0.9)	Access
Rifaximin	A07AA11	1(0.4)	Watch
Total		**227**	

in antimicrobial stewardship programs.[24] Empiric therapy was the usual practice, and thus there is a need to improve laboratory support to guide targeted antibiotic use through culture and sensitivity tests. None of the antibiotics prescribed belonged to the "reserve" group of antibiotics. This finding is similar to a study in 4 African countries.[17] This is also in line with the Kenya Essential Medicine List which restricts their use to tertiary hospitals in Kenya.[25]

The prescribing ratio in the 4 hospitals was 1.55, lower than what was reported by a study conducted in hospitals in Ghana (2.0) and higher than what was reported in a study conducted in Botswana hospitals (1.38).[18,22] Most patients (52.7%) had a combination of 2 antibiotics, similar to studies conducted in hospitals in African countries and surgical units in hospitals in Ghana.[17,23] The use of 2 antibiotics expands the spectrum of activity, perhaps compensating for the lack of microbiological tests to check the sensitivity of antibiotics. There was high use of parenteral antibiotics at 63%, similar to studies conducted in Ghana and Botswana respectively.[22,23]

On quality prescribing, all antibiotic prescriptions had the frequency indicated. Surprisingly, about 1 in every 5 antibiotics did not have a review date or stop date, contrary to studies conducted in Uganda and Tanzania, where 99 % of the prescriptions had a stop or review date and could fuel antimicrobial resistance.[17]

CONCLUSION

There was a relatively high prevalence of antibiotics use at Kirinyaga hospitals at 44% (95% CI 38.6-49.5). The use of antibiotics in the hospital was wholly empirical. There was extensive use of antibiotics in the WHO watch group category without microbiological tests support. There is a need for laboratory support to improve targeted prescription of antibiotics and establish an antimicrobial stewardship program. An in-depth study is required to establish the appropriateness of antibiotic use and compliance to clinical guidelines in the 4 study hospitals.

Study Limitations

The study had several limitations. There were low admission rates in Hospital C & D at the time of the study. Therefore, the prevalence of antibiotic use may have been under estimated and thus, the results of this study may not be generalisable to facilities at the same level. Poor documentation of medication use was noted in all hospitals, some updated the treatment sheets, while others documented drug administration in the nurse's flow sheet (Kardex). Even with cross checking different documents (Treatment sheet and Kardex), it was not possible to assess if there were missed doses which was part of the study questions. However, the choice of antibiotics across the 4 hospitals was relatively similar. With a non-existent antimicrobial stewardship program in the hospitals, the study forms a baseline to improve antibiotic use in the hospitals.

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