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Research Article

Patterns of Prescribing Practices in Makueni County Referral Hospital, Kenya

Nicholas C. Mulwa [a, b] *, George O. Osanjo [a], Stanley N. Ndwigah [c], Albert N. Kaburi [a,b], and Gichuru Muriuki [a]

[a] *Department of Pharmacology and Pharmacognosy, School of Pharmacy, University of Nairobi, Kenya*
[b] *Ministry of Health, Kenya*
[c] *Department of Pharmaceutical Chemistry, School of Pharmacy, University of Nairobi, Kenya*

* **Corresponding author:** Department of Pharmacology and Pharmacognosy, School of Pharmacy, University of Nairobi, P.O. Box 19676-00200 KNH, Nairobi, Kenya. **Tel**: +254-72-0349153; **Email**: lesmulwa@gmail.com

Background: Prescribing is said to be irrational if it does not conform to good standards of treatment. Irrational prescribing leads to increased cost of drug therapy, increased risk for adverse drug reactions and emergence of drug resistance.

Objective: The study objective was to determine the quality and patterns of prescribing in Makueni County Referral Hospital, Kenya, using World Health Organization prescribing indicators.

Methodology: The design was a descriptive retrospective cross-sectional study. Data was abstracted from 824 patient encounters selected through quasi-random sampling. Data was collected from the sampled prescriptions using a pre-tested data collection form, entered into and analyzed using Stata version 10.0 software.

Results: The mean number of drugs per patient encounter was 2.7. Only 45.5% of the total drugs were prescribed using generic names. Antibiotics and injections were prescribed in 74% and 13.2% of the prescriptions surveyed respectively.

Discussion: On average, inpatients received a higher number of drugs per encounter compared to outpatients, probably because they usually have more severe disease than outpatients which may require management with more drugs.

Conclusion: The results showed a trend towards irrational prescribing, particularly polypharmacy, underuse of generic names and over-prescription of antibiotics. Relevant educational, managerial and regulatory interventions are recommended to remedy the problems.

Keywords: Irrational prescribing, prescribing indicators, polypharmacy

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1. Introduction

Medicines are important weapons in the fight against diseases. However, these medicines are 'double-edged swords' and therefore, they should be used rationally. According to the World Health Organization (WHO), statistics indicate that more than half of all drugs are prescribed, dispensed, or sold improperly across the globe, and 50% of patients fail to take them correctly (WHO, 2002). Irrational drug use is therefore an enormous problem with several undesirable consequences such as increased cost of drug therapy, increased risk for adverse drug reactions, emergence of drug resistance, wastage of resources and reduction in the quality of drug therapy (Bhartiy et al, 2008).

Prescribing is a crucial step in the drug use cycle. Prescribing should be rational in order to benefit the patient. However, various forms of irrational prescribing still exist in many healthcare facilities. The

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problem includes prescribing using proprietary brand names, polypharmacy, over-prescription of antibiotics and overuse of injections among other practices. Irrational prescribing habits lead to higher treatment costs, ineffective therapy, unsafe treatment and exacerbation of illness (Desalegn, 2013).

It is advisable to describe and quantify the current situation before mechanisms are put in place to promote rational drug use. Prescription surveys using WHO prescribing indicators have been employed to describe prescribing patterns in healthcare facilities. These indicators have been accepted globally and have been used in over thirty developing countries (Laing et al, 2001). Prescribing practices should be evaluated periodically so as to provide feedback to prescribers and remedy any problems identified.

Patterns of prescribing practices have not been studied extensively in Kenya hence there is limited data on the extent of irrational prescribing in healthcare facilities in the country. From the literature reviewed, no drug prescribing survey had been conducted before in Makueni County Referral Hospital. The hospital was not included in the national survey on access to essential medicines in Kenya (Ministry of Health, Kenya, 2009), neither was it included in the baseline survey to assess the pharmaceutical situation in Kenya (Ministry of Health, Kenya, 2003). It was therefore an appropriate site for the study. This study was conducted in order to assess the quality and patterns of drug prescribing practices in Makueni County Referral Hospital.

2. Methodology

2.1 Study setting

The study was carried out in Makueni County Referral Hospital, the largest hospital in Makueni County. The hospital is located in Wote town, about 140 kilometers from the country's capital city, Nairobi.

2.2 Study design and study population

The design was a descriptive retrospective hospital-based cross-sectional study. The study population included all patient encounters from outpatient and inpatient departments written between 1st January and 31st December 2013.

2.3 Sampling and eligibility criteria

The sampling unit was a patient encounter/prescription. According to the WHO, at least 600 patient encounters should be included in a cross-sectional study to describe the current prescribing practices in one facility, with a greater number, if possible (WHO, 1993). Based on this WHO criteria and to cater for any excluded prescriptions and also to increase the power of the study, a total of 960 patient encounters were sampled.

Quasi-random sampling was employed to get a sample size of 960 encounters. Patient encounters were included in the study if they were written between 1st January and 31st December 2013 and if they were from Makueni County Referral Hospital.

Out of the 960 encounters sampled, only 824 met the eligibility criteria and were therefore included in the study. Illegible patient encounters, those from comprehensive care clinic and those written before 1st January 2013 or after 31st December 2013 were all excluded. Prescriptions from the from comprehensive care clinic were excluded as they have standard number of drugs prescribed as per the current Anti-Retroviral Treatment (ART) guidelines. Moreover, these drugs are usually prescribed using the approved abbreviations instead of the international non-proprietary names.

2.4 Data collection

A pre-tested data abstraction form was used to collect the relevant data on prescribing indicators, patient demographics, disease and prescriber information. Data was abstracted retrospectively from stored copies of prescriptions, patient files, registers, cards and computerized patient records.

2.5 Outcomes of interest

Irrational prescribing was measured using the WHO prescribing indicators. The primary outcome of interest was prevalence of polypharmacy. Polypharmacy involves prescribing many/multiple drugs for a patient during a specific patient encounter. In this study, polypharmacy was defined as prescription of more than two drugs per encounter. A cut off of two drugs was used because the Kenyan reference value (Ministry of Health, Kenya, 2009) for average number of drugs prescribed per patient encounter is < 2.

Secondary outcomes included prevalence of prescribing using generic names, prevalence of antibiotic prescribing, prevalence of injection prescribing and compliance with essential drug list when prescribing. Predictor variables were patient sex, patient age, patient residence, comorbidities, chronic conditions, prescriber sex and prescriber cadre.

2.6 Statistical analysis

All filled up data collection instruments were stored securely. Data was coded to ensure confidentiality and blind the data analyst. Stata software, version 10.0 (Stata Corp LP, Texas, USA) was used for data analysis.

All variables were subjected to descriptive data analysis. Continuous variables that were normally distributed were expressed as mean and standard deviation (SD) of the mean. For those continuous variables that were not normally distributed, the median and interquartile range (IQR) was reported. Categorical variables were reported as proportions and their corresponding 95% confidence intervals (95% CI).

Bivariable analysis was done to show the distribution of the outcome of interest across the different arms of the predictor variables. Inferential methods such as the Chi Square test and Mann-Whitney test were used in the bivariable analysis.

Logistic regression modelling was conducted to determine the most important risk factors for polypharmacy and to control for confounding. Both bivariable and multivariable analyses were conducted.

Model building was done using a manual stepwise forward approach to achieve the parsimonious model. The results of the logistic regression analysis were reported using odds ratios (OR).

For all analyses, p values less than 0.05% were considered statistically significant.

2.7 Ethical considerations

The study was approved by the Kenyatta National Hospital and University of Nairobi Ethics and Research Committee (KNH/UON ERC, Approval Reference No. **KNH-ERC/A/82 (P9/01/2014)**.

3. Results and Discussion

3.1 Baseline characteristics

A total of 824 participants were included in the study, out of which 720 were from outpatient and 104 from inpatient department. The baseline characteristics of the participants are summarized in **Table 1**. Majority of the study participants were females (53.9%). The median age for the participants was 29 [IQR: 15 – 43] years. The age ranged from 0.1 to 95 years. Most of the patients were rural dwellers (78.5%). This was expected since the hospital is situated in a rural county.

Table 1: Baseline characteristics of study participants

Baseline characteristic	Outpatient (N=720)	Inpatient (N=104)	Total (N=824)	p value*
Patient demographics:				
Sex:				
Male	331 (46%)	49 (47.1%)	380 (46.1%)	0.827**
Female	389 (54%)	55 (52.9%)	444 (53.9%)	
Age in years, Median [IQR]	30 [15 – 43]	24 [6.5 – 45]	29 [15 – 43]	0.155***
Residence:				
Town/Market	160 (22.2%)	17 (16.4%)	177 (21.5%)	0.173**
Village/Rural	560 (77.8%)	87 (83.7%)	647 (78.5%)	
Disease information:				
Comorbidities:				
Yes	149 (20.7%)	22 (21.2%)	171 (20.8%)	0.914**
No	571 (79.3%)	82 (78.9%)	653 (79.3%)	
Chronic conditions:				
Yes	93 (12.9%)	22 (21.2%)	115 (14%)	**0.023****
No	627 (87.1%)	82 (78.9%)	709 (86%)	
Length of hospital admission in days, Mean (SD)	-	5.96 (4.24)	-	-
Prescriber characteristics:				
Sex:				
Male	469 (65.1%)	69 (66.4%)	538 (65.3%)	0.809**
Female	251 (34.9%)	35 (33.7%)	286 (34.7%)	
Cadre:				
Clinical Officers	507 (70.4%)	13 (12.5%)	520 (63.1%)	
Medical Practitioners	167 (23.2%)	83 (79.8%)	250 (30.3%)	**< 0.001****
Others (nurses & dental officers)	46 (6.4%)	8 (7.7%)	54 (6.6%)	**< 0.001****

**Significant p values are bolded, **Pearson Chi-square test, ***Mann-Whitney test*

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Table 2: Prescribing indicators

Indicator,	Outpatient (N=720)	Inpatient (N=104)	Total (N=824)	Reference values (KENYA)[a]	Standard values (WHO)[b]	p value*
Average number of drugs per encounter, (SD)	2.48 (1.34)	4.18 (1.99)	2.70 (1.54)	< 2	1.6 – 1.9	**<0.001*** **
Percentage of drugs prescribed by generic name (95% CI)	45 (40.9-48.3)	47.6 (43.5-51.7)	45.5 (41.2-49.6)	100	100	0.095**
Percentage of encounters with an antibiotic prescribed (95% CI)	72.9 (69.7-76.2)	81.7 (74.2-89.3)	74 (72-77)	< 30	20 – 26.8	0.055**
Percentage of encounters with an injection prescribed (95% CI)	1.5 (0.6-2.4)	94.2 (89.7-98.8)	13.2 (10.9-15.6)	< 20	13.4 – 24.1	**<0.001****
Percentage of drugs prescribed from essential drugs list or formulary (95% CI)	90.6 (84.8-95.4)	82.8 (77.5-87.7)	89.1 (84.4-94.3)	100	100	0.098**

Significant p values are bolded,* ***Pearson Chi-square test,* ****Mann-Whitney test,* **a=*Adapted from "Access to Essential Medicines in Kenya. A Health Facility Survey"* (Ministry of Health, Kenya, 2009), **b=***Adapted from "The development of standard values for the WHO drug use prescribing indicators,"* (Isah et al, 2008).

About a fifth of the study participants had comorbidities (20.8%). Chronic conditions were present in 14% of the participants. These chronic conditions were significantly more prevalent among inpatients (21.2%) compared to outpatients (12.9%), p = 0.023. The median length of hospitalization for inpatients was 5 [IQR: 3 – 8] days.

Clinical officers generated most of the prescriptions (63.1%). However, comparing the two clinical settings, medical practitioners generated a majority of the prescriptions for inpatients (79.8%) whereas clinical officers generated the highest percentage of prescriptions for outpatients (70.4%), p < 0.001. This could be due to the fact that clinical officers are the first line clinicians in most public hospitals in Kenya; hence they form a bigger percentage of prescribers in outpatient. On the other hand, medical practitioners usually deal with more complex medical conditions that require hospital admissions.

3.2 Prescribing indicators

3.2.1 Number of drugs per encounter

The mean number of drugs prescribed per encounter was 2.7 (SD: 1.54) (**Table 2**). This mean was higher compared to the country's reference value of less than 2 and the WHO standard value (1.6 – 1.9). This indicated some degree of polypharmacy. Inpatients (4.18) received significantly a higher average number of drugs per encounter compared to outpatients (2.48), p < 0.001. Two or more drugs were prescribed in 83.7% of all inpatient prescriptions compared to 45.7% of outpatient prescriptions. Only two (0.3%) outpatient prescriptions had 7 to 8 drugs prescribed compared to 23 (22.1%) inpatient prescriptions (**Table 3**). This indicated a higher degree of polypharmacy in inpatient compared to outpatient department. This could be explained by the fact that inpatients usually have severe disease than outpatients which may require more drugs in order to manage successfully. The higher inpatient average compared to outpatient was consistent with results obtained from prescription surveys conducted in Pakistan (Najmi et al, 1998) and Nigeria (Chukwuani et al, 2002).

Table 3: Number of drugs prescribed per patient encounter

No. of drugs prescribed	Outpatient	Inpatient	Total
1	220 (30.6%)	12 (11.5%)	232 (28.2%)
2	171 (23.8%)	5 (4.8%)	176 (21.4%)
3	170 (23.6%)	25 (24%)	195 (23.7%)
4	91 (12.6%)	26 (25%)	117 (14.2%)
5	60 (8.3%)	9 (8.7%)	69 (8.4%)
6	6 (0.8%)	4 (3.9%)	10 (1.2%)
7	1 (0.1%)	19 (18.3%)	20 (2.4%)
8	1 (0.1%)	4 (3.9%)	5 (0.6%)
Total	**720 (100%)**	**104 (100%)**	**824 (100%)**

The mean number of drugs prescribed per encounter for outpatients (2.48) was similar to that reported by surveys done in Saudi Arabia (El Mahalli, 2012) and China (Li et al., 2012). This average was lower compared to that reported by surveys conducted in

Kenya (Ministry of Health, Kenya, 2009) and Bangladesh (Afsan et al., 2013). Compared to the study results, lower averages have been reported by studies done in Lebanon (Hamadeh et al, 2001) and Sudan (Hogerzeil et al., 1993). Inadequate training and financial incentives to prescribers by drug industry have been documented as major contributors to polypharmacy.

3.2.2 Drugs prescribed by generic name

Prescribing using international non-proprietary (generic) names was not widely practiced in the hospital. Less than half (45.5%) of all drugs were prescribed using generic names. Prescribing using generic names was slightly higher in inpatient (47.6%) compared to outpatient (45%) department, though the difference was not statistically significant, p = 0.095 (**Table 2**).

Prescribing using proprietary brand names was very common with combination drugs such as ophthalmological preparations and cardiovascular agents. This may be attributed to the lengthy generic names of such combinations. Other reasons that might have contributed to the low prevalence of prescribing using generic names include prescribers' perception that most generics are of poor quality or less effective compared to branded drugs and drug promotion by medical representatives.

The percentage of drugs prescribed using generic name was very low compared to the country's reference value and the WHO standard value of 100%. These results were similar to those reported by studies done in Kenya (Ministry of Health, Kenya, 2003) and India (Bhartiy et al., 2008). Lower percentages of generic prescribing were reported by studies conducted in Kenya (Ministry of Health, Kenya, 2009) and Bangladesh (Afsan et al., 2013). Compared to our results, higher prevalence of generic prescribing was reported by studies conducted in Ghana (Bosu and Ofori-Adjei, 2000) and Ethiopia (Desalegn, 2013).

3.2.3 Encounters with an antibiotic prescribed

The prevalence of antibiotic prescribing was very high (74%). The prevalence was higher for inpatients (81.7%) compared to outpatients (72.9%), though the difference was not statistically significant, p = 0.055. This may be explained by the fact that inpatients usually have severe disease than outpatients which may require empirical treatment with antibiotics even before confirmatory diagnosis. Overestimation of the disease severity could also have led to over-prescription of antibiotics. The higher inpatient prevalence was consistent with results obtained from a survey done in Nigeria (Chukwuani et al., 2002) which reported a prevalence of 96.7% for inpatients compared to 50.3% for outpatients.

The prevalence of antibiotic prescribing in outpatient department (72.9%) was very high compared to the country's reference value of less than 30% and the standard value derived by WHO to serve as ideal (20 - 26.8%). This indicated over-prescription of antibiotics. The results were similar compared to those of surveys conducted in Kenya (Ministry of Health, Kenya, 2003; Ministry of Health, Kenya, 2009). Over-prescription of antibiotics has also been documented by studies done in Nigeria (Erah et al, 2003) and Iran (Ghadimi et al., 2011).

In encounters where an antibiotic was prescribed, 82% of the prescriptions had one antibiotic, 15.5% had two antibiotics and 2.5% had three or more antibiotics. Prescriptions with three or more antibiotics were almost exclusively prescribed for inpatients (99.5%). The commonly prescribed antibiotics differed between outpatients and inpatients. In the outpatient department, the top four commonly prescribed antibiotics were amoxicillin (47.6%), cotrimoxazole (23.2%), ciprofloxacin (13.1%) and flucloxacillin (10.5%). The top four commonly prescribed antibiotics for inpatients were benzyl penicillin (52.9%), gentamicin (45.9%), ceftriaxone (37.7%) and chloramphenicol (17.7%). Most inpatient prescriptions had injectable antibiotics as opposed to oral formulations, while most outpatient prescriptions had oral antibiotics.

3.2.4 Encounters with an injection prescribed

Injections were prescribed in 13.2% of all prescriptions surveyed. The prevalence of injection prescribing was very low for outpatients (1.5%) and extremely high for inpatients (94.2%), ($p<0.001$). The higher inpatient prevalence was consistent with results from a survey done in Pakistan (Najmi et al., 1998). This could be explained by the severity of illness which is higher for inpatients compared to outpatients. Injections are preferred for severely ill patients since they have a faster onset of action and also severely ill patients may be unable to take drugs orally.

The prevalence of injection prescribing in outpatient department (1.5%) was within the country's reference value of less than 20% and lower than the standard value derived by WHO to serve as ideal (13.4% - 24.1%). These results were comparable to those of a study conducted in India (Karande et al, 2005). Other studies that have reported acceptable percentage of injection prescribing, though higher than our findings include surveys done in Kenya (Ministry of Health, Kenya, 2009) and Bangladesh (Afsan et al., 2013). Over-prescription of injections has been documented by studies conducted in China (Li et al., 2012) and Ethiopia (Desalegn, 2013).

In prescriptions where an injection was prescribed, most (90%) had two or more injections prescribed. Outpatient prescriptions accounted for almost all (98.2%) prescriptions with one injection prescribed. Diclofenac (65.6%) was the most frequently prescribed injection in outpatient department followed by insulin (29.5%) and hydrocortisone (25.2%) injection. In the inpatient department, benzyl penicillin (55.7%) was the most frequently prescribed injection followed by gentamicin (48.2%) and ceftriaxone (40.3%) injection.

3.2.5 Drugs prescribed from the Kenya Essential Medicines List (KEML)

Most (89.1%) of the drugs were prescribed from the Kenya Essential Medicines List (KEML), indicating a high compliance with KEML during prescribing. This

could be attributed to the availability of copies of KEML in the facility. Compliance was higher in outpatient (90.6%) compared to inpatient (82.8%) department, though the difference was not statistically significant, p = 0.098. Drugs that contributed to non-compliance with KEML were mostly cough preparations and various creams and ointments.

The percentage of drugs prescribed from the KEML in outpatient department (90.6%) was encouraging but below the country's and WHO's reference values of 100%. The results were consistent with those reported by studies conducted in Kenya (Ministry of Health, Kenya, 2009) and Uganda (Bell et al, 2010). On the contrary, surveys conducted in Bangladesh (Afsan et al, 2013) and China (Dong et al, 2011) reported low compliance compared to our results.

3.3 Completeness of prescriptions

The overall percentage of complete prescriptions was low (46%). The percentage of complete prescriptions was 41.7 and 100% for outpatient and inpatient prescriptions respectively. Most of the incomplete prescriptions lacked diagnosis. The low percentage of complete prescriptions at outpatient department could be attributed to the frequent stock out of the standard printed prescription books. This led to improvising of prescription books using plain papers which did not have the various sections required to be filled when writing prescriptions.

3.4 Factors associated with polypharmacy

A positive correlation was found between patient age and number of drugs prescribed whereby the number of drugs prescribed seemed to increase with increasing patient age (**Figure 1**). However this correlation was weak with a correlation coefficient of 0.36. A similar correlation was reported in a study done at Kitovu Hospital in Uganda (Bell et al, 2010).

Logistic regression modelling was used to determine the most important factors associated with polypharmacy and to control for confounding (**Table 4**). Bivariable and multivariable analyses were conducted. In the multivariable analysis, polypharmacy was more likely to occur in prescriptions of older patients compared to those of younger patients. For every one year increase in patient age, the odds of polypharmacy occurring increased by 2% (adjusted OR 1.02; 95% CI: 1.01 – 1.03; p < 0.001). This could be explained by the fact that older people usually present with several diseases together, hence requiring a greater number of drugs compared to younger people. Indeed 90% of patients aged 60 years or more in the study received three or more drugs. Polypharmacy was one and half times as likely to be seen in prescriptions for patients living in town settings compared to those living in rural settings (adjusted OR 1.55; 95% CI: 1.04 – 2.31; p = 0.030).

Polypharmacy was 86% less likely to be seen in outpatient prescriptions compared to inpatient prescriptions (adjusted OR 0.14; 95% CI: 0.07 – 0.26); p < 0.001). On the other hand, prescriptions for comorbid conditions were 6.3 times more likely to exhibit polypharmacy compared to the ones with no comorbidities (adjusted OR 6.30; 95% CI: 4.06 – 9.77; p < 0.001). This was expected since comorbidities involve several diseases which may require different drugs to manage hence leading to polypharmacy.

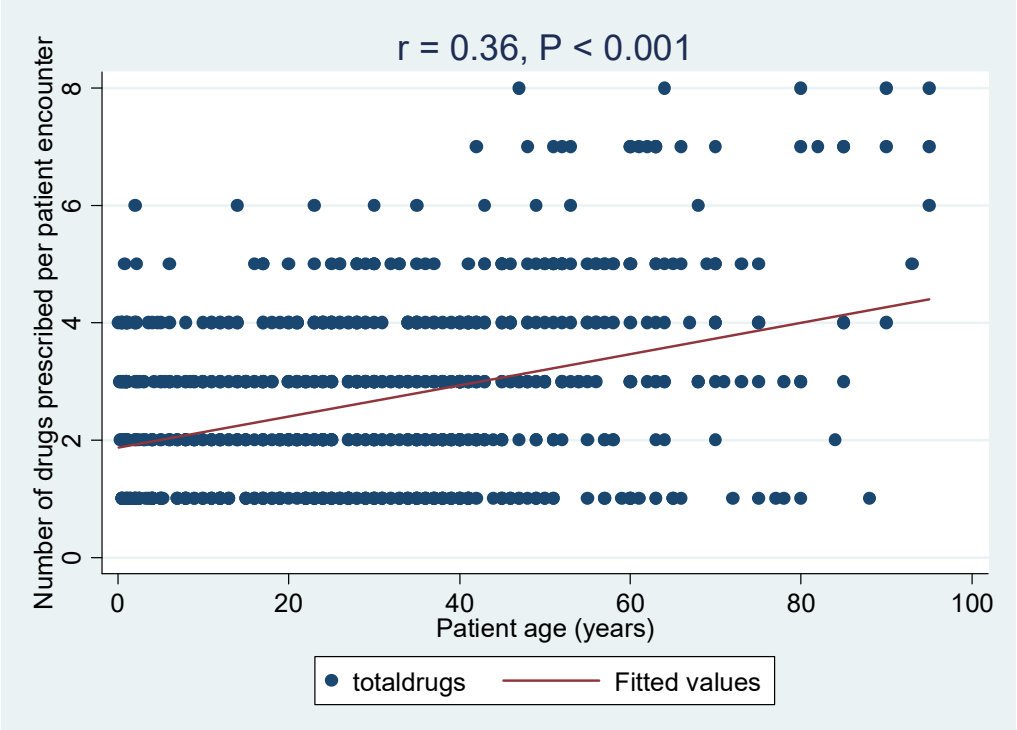

Figure 1: Correlation between patient age and number of drugs prescribed per encounter

Table 4: Logistic regression analysis of factors associated with polypharmacy

Predictor variables	Bivariable analysis		Multivariable analysis	
	Crude OR (95% CI)	p value*	Adjusted OR (95% CI)	p value*
Patient demographics:				
Sex: Male	0.91 (0.69 – 1.20)	0.498	0.96 (0.69 – 1.33)	0.797
Age in years	1.03 (1.02 – 1.03)	**<0.001**	1.02 (1.01 – 1.03)	**<0.001**
Residence: Town/Market	0.93 (0.67 – 1.30)	0.689	1.55 (1.04 – 2.31)	**0.030**
Clinical setting: Outpatient	0.16 (0.10 – 0.28)	**<0.001**	0.14 (0.07 – 0.26)	**<0.001**
Disease information:				
Presence of comorbidities	4.58 (3.09 – 6.77)	**<0.001**	6.30 (4.06 – 9.77)	**<0.001**
Presence of chronic conditions	12.03 (6.35 – 22.78)	**<0.001**	8.08 (3.96 – 16.50)	**<0.001**
Prescriber characteristics:				
Sex: Male	1.77 (0.60 – 1.17)	**<0.001**	1.35 (0.95 – 1.93)	0.098
Cadre:				
Clinical Officers	1.00 (Ref)		1.00 (Ref)	
Medical Practitioners	3.70 (2.67 – 5.11)	**<0.001**	1.46 (0.95 – 2.26)	0.085
Other (nurses & dental officers)	2.40 (13.50 – 4.26)	**0.003**	1.34 (0.66 – 2.70)	0.419

**Significant p values are bolded*

The prevalence of polypharmacy in prescriptions for chronic conditions was eight-fold that of prescriptions for non-chronic conditions (adjusted OR 8.08; 95% CI: 3.96 – 16.50; $p < 0.001$). This could possibly be due to the observation that most chronic conditions require multiple drugs for effective management. In addition, most of these chronic conditions usually present with additional symptoms which may lead to extra drugs being prescribed.

In the parsimonious model, four predictor variables were identified as the most important variables associated with polypharmacy. These were patient age, clinical setting, comorbid conditions and chronic conditions. The odds ratios in the parsimonious model were similar to the adjusted odds ratios in the multivariable logistic regression.

4. Conclusion

The results show a trend towards inappropriate prescribing, particularly polypharmacy, underuse of generic names and over-prescription of antibiotics. Frequent prescription surveys and drug utilization studies are recommended to identify irrational prescribing. This should be followed by relevant educational, managerial and regulatory interventions to remedy any problems identified. This being among the first few studies on prescribing practices using WHO prescribing indicators in Makueni County and Kenya in general, further research is required.

Study limitations

In the retrospective prescription survey, illegible prescriptions were a challenge. All illegible and faded prescriptions were excluded from the study. Incomplete and missing patient records also posed a challenge. These were also excluded.

Conflict of Interest Declaration

The authors declare no conflict of interest.

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