Original Research Article

Medication Errors among Healthcare Workers in a Major HIV treatment Centre in Nigeria.

ABSTRACT

Background: Medication errors are major challenging clinical incidents in health care settings that could jeopardize a patient's life and well being. These errors could occur at any step of the medication use process from prescribing, prescription verification, dispensing, drug administration to monitoring. This study aims to assess and classify medication errors among doctors and pharmacists.

Method: A prospective observational study from July to September 2018. Randomly selected prescriptions were screened for errors before and after dispensing of drugs. Errors were assessed and classified according to the National Coordination Council for Medication Error Reporting and Prevention (NCCMERP) index to determine the level of harm it posed to the patient.

Results: Out of 1529 prescriptions analyzed, 182(11.9%) medication errors were observed; 104(57.1%) and 78 (42.9%) among doctors and pharmacists respectively. Majority of the errors were for female patients, those on first line antiretroviral drug regimen, in the age group 41-50years and according to the NCCMERP index of the error type D. The most common medication errors among the doctors were omission errors (36.5%) and errors in patient data (21.1%) while unsigned prescriptions (33.3%) and omitting prescribed drugs from dispensed drugs (28.2%) ranked highest among pharmacists' errors. Doctors and pharmacists (53.3% and 75% respectively) with < 5years HIV care experience had higher error rates.

Conclusion: Medication errors associated with cotrimoxazole therapy were most common for both categories of health workers and this has a potential for poor treatment outcome. There is need for continuous training of health workers in HIV management.

Keywords: Medication Errors, Antiretroviral therapy in Nigeria, HIV, Doctor's Errors, Pharmacists errors.

1. INTRODUCTION

Medication errors in health care settings are challenging and could lead to poor treatment outcomes, high mortality and adverse drug events especially among patients on lifelong therapy. They are a leading cause of adverse drug reactions in hospital settings [1, 2]. Approximately 1.5million patients are reported to have suffered harm from medication errors with about 7000 deaths annually in the United States of America alone [3].

Available evidence shows that medication errors are a significant problem in Australia, North America, Canada and the United Kingdom [4].

Medication errors are defined as “unintended failure in the treatment process that leads to or has the potential to harm the patient” [5].They are classified by different schools of thought using different criteria. Some have classified errors based on the psychological process, level of severity of potential harm, degree of harm or the stage of the medication use process at which the error occurred [1, 6]. While others have classified errors using criteria that inform preventive strategies such as knowledge- based mistakes, action-based mistakes, rule-based mistakes and lapses or slips [7].

According to the National Coordination Council for Medication Error Reporting and Prevention (NCCMERP) a United States based council with a mission to maximize safe use of drugs and increase medication error awareness and reporting, a medication error is “any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, the patient or the consumer”. The Council has classified these errors into 9 categories (A to I) on the basis of harm it poses to the patient [8].

Medication errors could occur at any step of the medication use process from drug storage, preparing, prescribing, transcribing, prescription verification, dispensing, administering to monitoring. These steps could vary in various healthcare settings such as the outpatient or inpatient units [2, 3, 9, and 10].However studies have shown that the most common reported errors occur during prescribing and administration [2, 11, 12, 13].

A prescription is information written by a medical practitioner (the prescriber) to the pharmacist with instructions on drugs administration to the patient [14].

It is the pharmacists’ responsibility to review a prescription and also dispense accurately according to the instructions on a prescription ensuring that the patient understands how to administer the drugs [15, 16].

Health workers’ medication errors could result from personal, health system and organizational factors. Organizational policies, heavy work load, poor working conditions and the environment are some factors related to the health system.

Personal factors such as level of experience, inadequate training, forgetfulness, carelessness, negligence, poor motivation, inability to focus under pressure, wrong calculations, inadequate knowledge, defective communication style and distractions have been identified to contribute to medication errors among others [11, 17].

Medication errors could result in devastating consequences to the patient, families, health care provider, health facility and society. Although not all medications errors cause harm some could be life threatening, lead to prolonged hospital stay or death [18]. The cost implication and trauma to the provider can also not be ignored. The reputation of the health facility could be destroyed with very frequent occurrence of these incidents and confidence in the system is negatively affected [19, 20]. People living with HIV/AIDS are on lifelong therapy with highly active antiretroviral therapy and may also be on

other drugs for the treatment of co-morbidity. Long term safety thus becomes a major concern as they receive regular prescription to ensure regular intake of their medication(s).The continuous monitoring and follow up on the therapeutic outcome of treatment given to these individuals is of utmost importance [21].

The recent call especially in the developed world to reduce errors in the use of prescribed drugs by about 40-50% is based on the fact that the base on which to make the comparison exists [7, 8, 12-14]. In most developing countries including Nigeria these figures do not exist and needs to be established. This study was conducted to establish a baseline as part of a quality improvement process in HIV/AIDS patient care. Our objectives were to estimate the incidence, identify types of medication error and the medication use process in which they occur to evaluate their clinical significance.

2. METHODOLOGY

2.1 Study Setting and Design

The study was a cross-sectional survey conducted at a large HIV treatment Centre in Lagos, South western Nigeria. The Centre is located in a medical research institution charged with the responsibility to conduct research into disease of public health importance in the country. The Institute was among the 25 centres selected in 2002 to implement the Federal Government of Nigeria antiretroviral drug access programme. It was selected principally to provide research backup for the programme. Cumulatively over 24,000 HIV positive adults and children including pregnant women have been enrolled into the programme since inception. Sixty five percent of the patients come from Lagos state while others are from either the southwestern, North-central, South-south and South-eastern part of Nigeria. A little over 0.025% comes from the neigbouring western African countries.

All patients' information is stored in the programme electronic database including details of patient's medication. All antiretroviral drugs prescriptions were according to a unified patient's national HIV treatment guideline. In addition to the antiretroviral drugs, other medications are prescribed to prevent or treat other co-morbidities. Prophylactic treatments are also given to prevent emergence of opportunistic infections which might arise as a result of a deficient immune system such as cotrimoxazole therapy.

On typical clinic visits which are either based on scheduled appointment or event triggered, medications are prescribed by the medical practitioners using a structured prescription sheet. The prescription sheet has four sections which should be completely filled. The first section captures the patient information such as the patient's name, identification number, date of birth, weight, sex, visit date and allergy information. The second section captures all the names of the various antiretroviral drugs available in the Centre with their corresponding codes which the prescriber selects as appropriate. The third section is assigned to drugs prescribed for co-morbid conditions, while the last section is for the names and signatures of the prescriber and pharmacist. The patients takes the prescription sheet to the pharmacists, who after a one

on one medication adherence counseling session and verification of medication by comparing the current prescription with previous information on database dispenses the medication. The current prescription is thereafter used to update the database. However, for the purpose of this study a second pharmacist screens the drugs handed over to the patient for correctness and also checks data entry done by the first pharmacist.

2.2 Study population

HIV positive adults aged 18 years and older seen at the center for monthly antiretroviral drug refill and 6 monthly physician consults over a 3months period from July 1st to September 2018 were invited to participate in the study. Prescribers were unaware of the study, and pharmacists were not aware of the second pharmacist's review in order to avoid changes in behavior

2.3 Study sample size determination and sampling procedure

Raosoft online sample size calculator was used to calculate the sample size for the study. (http://www.raosoft.com/samplesize.html)[RaosoftIncorporated:RaosoftSamplesize calculator. 2004, Available from URL: http://www.raosoft.com/samplesize.html].

Given that there were approximately 24,000 adults on the programme, on the basis of the most conservative error distribution of 50%, since no previous data in our environment and allowing 2.5% margin of error at 95% confidence interval, the required minimum sample size was calculated to be 1448.

2.4 Study Sample selection

A systematic random sampling technique was used to select the patients whose prescriptions were used for the study. On the average 350-400 patients requiring drug prescription are seen in each of the three clinic days in a week. For every ten patients one was selected from the daily clinic attendance list during the study period for the study. Effort was made to ensure patients were not sampled for more than once in the study

2.5 Ethical Issues

Ethical approval for the study was obtained from the Ethics committee of the Institution. Information about the study was given to the patients who were selected from the sample frame by the lead researcher as part of the informed consent process before signing the consent form. The prescriptions were reviewed by trained research assistants who were all pharmacists. Thereafter the lead researcher and a different team of research assistants re-reviewed the prescription after it was dispensed.

2.6 Data Collection

The prescriptions of selected patients were screened for prescribing errors and information was collected in three stages. The initial information collected were errors observed on the prescription sheet, then entry errors obtained by checking the electronic record entered for each patient by the pharmacist in comparison to the information on the prescription sheet and finally dispensing errors obtained by physical assessment of drugs handed over to the patients and the assessment of directions given on drug administration.

Patient parameters such as age, gender and drug information were also obtained from the prescription sheet. All collected data were entered into an excel spread sheet. Two pharmacists independently classified the observed errors and in cases of discrepant classifications the lead researcher's classification was the tie breaker.

2.7 Definition of terms and classification of medication error

The National Coordination Council for Medication Error Reporting and Prevention, USA definition and classification of medication error was adopted for this study.

2.7.1 Category / Description Event

A Circumstances or events occur that have the capacity to cause error.

B An error occurred but the error did not reach the patient**.**

C An error occurred that reached the patient, but did not cause patient harm.

D An error occurred that reached the patient and required monitoring to confirm that it resulted in no harm, and /or required intervention to preclude harm.

Cases in which harm reaches patient

E An error occurred that may have contributed to or resulted in temporary harm to the patient and required intervention.

F An error occurred that may have contributed to or resulted in temporary harm to the patient and required an initial or prolonged hospital stay.

G An error occurred that may have contributed to or resulted in permanent harm.

H An error occurred that required intervention necessary to sustain life.

I An occurred that may have contributed to or resulted in patient death.

2.8 Data Management

The obtained information were coded, entered into the computer and analyzed using the SPSS version 22.0 (SPSS Inc. Chicago, IL) statistical packages. The main outcome variable was presence of medication error. Results were presented using descriptive statistics.

3. RESULTS AND DISCUSSION

3.1 RESULTS

A total of 1529 prescription were selected and analyzed during the study period of which 182(11.9%) had errors consisting of doctor's (104; 57.1%) and pharmacists errors (78; 42.9%). Table 1 shows the characteristics of patients whose prescriptions had errors and these were segregated into doctors' and pharmacists' errors.

Majority of the patients with doctors' and pharmacists' errors were females (58.6% and 56.4% respectively), aged 41-50years (40.3% and 39.7% respectively), were on the first line antiretroviral drug regimen (60.6% and 66.7% respectively) had errors of category D.

Table 2 describes the doctors and pharmacists who attended to the prescriptions with errors of which majority were females (66.7% and 75% respectively) and in the 21-30years age group (40% and 75% respectively). Over 50% of the doctors and the pharmacists in this cohort have less than 5 years of HIV management experience and no post graduate qualification while a greater percentage of the pharmacist (75%) have had less than three antiretroviral therapy training.

A description and pattern of the doctors prescribing errors is displayed in table 3.Omission error (36.5%) was the most prevalent error with omission of cotrimoxazole from an eligible patient's prescription ranking highest. Errors in patient's data accounted for a total of 21.1% of the errors while prescription of wrong drug regimen and unsigned prescription occurred in close ranges of 14.4%, and 12.5% respectively.

Other observed errors of note were allergy status errors (5.8%), wrong dosage (3.9%) and blank prescriptions (5.8%).

Among the pharmacists' errors displayed in table 4, unsigned prescription (33.3%) and omission of drugs from dispensed drugs to patients for whom it was prescribed (28.2%) were of the highest occurrence. Other observed errors were data entry errors (15.3%), verification error (15.3%) and labeling errors (7.7%).

Table 1: Characteristics of patients whose prescriptions had errors

S/N	*Variables*	*Doctor's Errors* *n=104 (57.1)*	*Pharmacist's Errors* *n=78 (42.9)*
1	**Sex**		
	Male	43(41.4)	34(43.6)
	Female	61(58.6)	44(56.4)
2	**Age**		
	21-30	5(4.8)	4(5.1)
	31-40	34(32.7)	19(24.4)

	41-50	42(40.3)	31(39.7)
	51-60	16(15.4)	19(24.4)
	61-70	6(5.8)	5(6.4)
	>70	1(1.0)	0(0)
3	**Antiretroviral Regimen**		
	First Line	63(60.6)	52(66.7)
	Second Line	41(39.4)	26(33.3)
4			
	Error Category		
	Type B	23(22.1)	12(15.4)
	Type C	13(12.5)	26(33.3)
	Type D	68(65.4)	40(51.3)

Table 2: Characteristics of Doctors and Pharmacists who attended to the Prescriptions

Variable	*Doctors n=15(%)*	*Pharmacists n=8(%)*
Sex		
Male	5(33.3)	2(25)
Female	10(66.7)	6(75)
Age		
21-30	6(40)	6(75)
>30	9(60)	2(25)
Years of HIV Mgt Experience		
1-5	8(53.3)	6(75)
>5	7(46.7)	2(25)
Post Graduate Qualification		
Yes	7(46.7)	1(12.5)
No	8(53.3)	7(87.5)
No of ARV Training		
<3	7(46.7)	6(75)
>3	8(53.3)	2(25)

Table 3: Doctors Prescription Errors

Types of Prescribing Errors	**NCCMERP Classification**	**Frequency (%) , n =104**
Omission Error	**D**	**38(36.5)**
Omission of cotrimoxazole		33
Omission of Isoniazid		2
Omission of one antiretroviral drug		3
Wrong drug regimen	**D**	**15(14.4)**
1st line regimen prescribed instead of 2nd line		5
Prescription of previous drug regimen		6
Wrong drug combination		4
Unsigned Prescriptions	**C**	**13(12.5)**

Failure to indicate name Failure to sign Prescription Failure to indicate name and signature		3 1 9
Allergy Issues Prescription of Cotrimoxazole to a patient with sulpha allergy	**D**	**6(5.8)** 6
Blank Prescriptions No ARV drugs prescribed	**B**	**6(5.8)** 6
Wrong dosage Full dose of ARV prescribed instead of reduced dose in patients with renal impairment	**D**	**4(3.9)** 4
Error in Patient Data Wrong patient identification number Error in weight Error in visit date Wrong date of birth Gender Errors	 **B** **D** **B** **B** **B**	**22(21.1)** 10 5 3 2 2

Table 4: Pharmacists' Dispensing, Verification and Entry Errors.

Types of Error	NCCMERP Classification	Frequency (%) n=78
Unsigned Prescription Failure to indicate name Failure to sign prescription Failure to indicate name & signature	**C**	**26 (33.3)** 7 8 11
Omission Errors among dispensed drugs Omission of Cotrimoxazole Omission of Isoniazid	**D**	**22 (28.2)** 20 2
Data Entry Errors Entry totally not made for drug pick up Entry not done for months of drug supplied Wrong months of drug supply entry Entry not done for cotrimoxazole dispensed Entry not done for isoniazid dispensed Wrong ARV Drug entry	**B**	**12 (15.3)** 4 1 3 2 1 1
Verification Error Failure to detect wrong ARV was prescribed Failure to detect omission of cotrimoxazole Failure to detect patient data not filled Failure to detect omission of Isoniazid Failure to detect wrong patient data filled	**D**	**12 (15.3)** 3 4 2 1 2

Labelling Error No dosage direction given Wrong dosage direction	**D**	**6 (7.7)** 4 2

3.2 DISCUSSION

The overall frequency of medication error observed in this study was 11.9% which is similar to that reported by Al-khani and his colleagues [3] in Saudi Arabia (10%) whose research work was also carried out in the specialist clinic of a research Institute. However these findings are much lower than reports from several other studies and this could be attributed to the fact that our study and that of Al Khani *et al* [3] were conducted among a cohort of patients in a specialized clinic while other studies were conducted in hospital settings where patients are treated for varying diseases thus probably a contributing factor to the observed higher error rates recorded by Sapkota *et al* (53%) [9], Sheikh *et al* (20%) [10], Seden *et al* (43.8%) [11] and Agalu *et al* (51.8%) [19].

The most common error among the doctors in this study was medication omission error (36.5%) which occurred at the prescribing stage. The pharmacists were also observed to have omitted prescribed medications from drugs dispensed to the patients (28%).This pattern is in tandem with other studies conducted in England by Harkenen *et al* [22] and Sheikh *et al* [10] in India who both reported omission errors as the most common error category (31.4%) and (77.5%) respectively observed from their work. Seden *et al* [11] and Agalu *et al* [19] have similarly reported omission error rates of 29.6% and 29.0 % respectively.

Majority of the patients whose prescription had errors in our study were of the age group 41-50 years. This is in contrast to several studies that have observed high level of medication errors among geriatrics or critically ill patients in general hospital settings [9, 20]. This high prevalence of medication error among this group of patients is attributed to poly pharmacy which is quite common in their care. The observed prevalent age group in our study could be a reflection of the age group with the highest burden of HIV/AIDS infection and the fact that the study is in an outpatient facility.

Pharmacists have a major role to play in preventing prescribing errors which could be averted at the stage of prescription verification. The observed verification error rate of 15.3% in our study is worrisome because the prescription errors ought to be detected by the pharmacist and should not slip by as much as possible.

In this study a second pharmacist was engaged to screen the pharmacists' error and this helped identify some slips in the verification process as well dispensing errors. The process of reviewing the pharmacy verification and dispensing procedure by another pharmacist could be tedious and will ultimately prolong patient's waiting time especially in a large treatment centre with limited number of pharmacist. However, its effectiveness cannot be undermined. Nwasor *et al* [23]

have equally stressed the importance of checking mechanisms especially in the administration stage as they have also found this process deficient among anesthetists.

The errors observed in the current study were mainly of the NCCMERP category D classification which represents errors that reached the patient but requires monitoring to ensure no harm has been done to the patient. Contrary to our findings Chalsani *et al* [24] and Sheik *et al* [10] reported errors of NCCMERP category A and C respectively as their most prevalent error category. Though these studies have reported varying prevalent NCCMERP error categories, intensified patient monitoring of treatment outcome should be generally enforced to enable early detection of the aftermath medication errors.

Medication errors were most observed in doctors and pharmacists with less than 5 years of HIV care experience or less than three antiretroviral therapy trainings. This emphasizes the need for training and retraining of healthcare workers, in this case doctors and pharmacist to ensure accurate knowledge and skill in the conduct of their professional duties. There is also need for occasional review or audit of the prescription and dispensing processes to ensure that errors are nipped in the bud and that preventive strategies are instituted or maintained.

Organizational and personal factors contribute to medication errors in health care settings. Identifying these factors which are specific to individual health care settings and developing strategies to ameliorate their occurrence and impact should be the goal of every organization.

4. CONCLUSION

Omission error was common among doctors and pharmacists in this study and it was principally associated with the drug cotrimoxazole which is a very important part of therapy for people living with HIV/AIDS. Continuous training of health care workers in HIV/AIDS management is recommended. Factors that contribute to medication error in this setting should be investigated and strategies devised to address them.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

CONSENT

All authors declare that written informed consent was obtained from patients for use of their data for study and those who declined to give consent were excluded from research.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the ethics committee of the Nigerian Institute of Medical Research.

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