Factors Associated with the Occurrence of Medical Errors among Practicing Physicians in Public Health Facilities in Abuja Nigeria

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ABSTRACT

Objective: *To compare the occurrence of medical errors and associated factors among physicians in government secondary and tertiary health facilities in Abuja, Nigeria.*

Methodology: *A cross sectional survey of physicians in seven out of fourteen hospitals was conducted. A cluster sampling technique of the hospitals was used to obtain a total sample size of 402 physicians, 201 for each level. A semi structured questionnaire was used to collect the data. Data was analyzed using SPSS version 19.0 and summarised as proportions. Chi-square test was used to assess associations between variables at a significance level of 5%.*

Results: *Some 485 physicians were studied. Tertiary level versus secondary level errors occurrences were near misses (85.4% vs 85.7%), mistakes (73.3% vs 77.5%), slips or lapses (51.9% vs 65.5%) and technical errors (70.6% vs 68.0%), (p > 0.05). The overall error rates at the tertiary and the secondary levels were (62.2% vs 66.2%; p = > 0.05). At both levels, these error occurrences were largely attributed to poor communication (68.5% vs 64.3%, p = 0.333) and lack of medical equipments (67.4% vs 58.52%, p = 0.042).*

Conclusion: *This study revealed that poor communication and lack of medical equipments are the leading factors associated with the occurrence of medical errors. Therefore, improved communication in the medical team as well as the provision of medical equipments would reduce the burden of medical errors.*

Key words*: Medical errors, Occurrence, Physicians, Factors.*

INTRODUCTION

The Canadian Safety Institute defines an error as a failure of a planned action to be completed as intended (i.e., error of execution) or the use of a wrong plan to achieve an aim (i.e., error of planning).[1] An error often results to an adverse event to the patient. Adverse events are the injuries or harms that result from an error in the course of the management of the patient rather than the underlying condition of the patient; usually as an unintentional and unexpected occurrence. Medical errors are therefore defined as preventable adverse medical events. [1]

A recognized classification of medical errors also developed by the Canadian Safety Institute identifies the following broad categories of errors: [1]

"Near misses" are errors that do not cause harm to patients by chance or because the error was corrected before harm could occur. "**Mistakes**" are errors in the planning of an action.

"**Slips or lapses**" are errors in the execution of an action that often occur as a result of distraction or momentary failure of concentration. **"Technical errors"** occur when there is a failure to carry out an action successfully even if the plan of action and technique are appropriate.

The magnitude of the medical error problem from recent studies suggests that medical errors cause tens of thousands of avoidable impairments, disabilities, handicaps and deaths annually as evidenced by the following studies.[2] In **Utah** and **Colorado**, USA, survey data revealed a medical error rate of 2.9%[3] while a medical practice study in Ontario, Canada showed that 3.7% of patients in hospitals suffered prolonged hospital stay or disability or both as a result of medical errors; 33% of which were considered preventable. [4,5]

In Nigeria, a recent study conducted at the University College Hospital Ibadan revealed an overall medical error rate of 25.2 % and 76% [6,12] Prescription faults and errors are failures in the decision making and prescription writing process respectively.[12]

General objective

The broad objective of this study was to compare the occurrence of medical errors and the factors associated with their occurrences among physicians in government secondary and tertiary health facilities in Abuja, the Federal Capital Territory (FCT).

Specific objectives

1. To assess the perceptions of physicians on medical error occurrence rates at the tertiary and secondary health facilities and the overall medical error occurrence rates at both levels
2. To compare the physicians' perceptions of medical error occurrence rates by cadres and by sub-specialties
3. To identify the factors associated with the occurrence of medical errors among the physicians

MATERIALS AND METHODS

Study area: The study was carried out in the Federal Capital Territory Abuja **(**FCT**).** Abuja officially became Nigeria's capital on 12th December 1991. Based on the 2006 census, the population of the FCT was 1,405,201. [19] Currently, the population of Abuja is estimated to be over 4 million people.[19]

Study design: A comparative cross sectional survey of

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physicians in the tertiary and secondary health facilities was conducted to obtain quantitative data.

Study population: All cadres of medical and dental practitioners regardless of number of years in practice i.e. consultants, resident doctors, medical officers and house officers in the selected government secondary and tertiary health facilities in the Federal Capital Territory Abuja were studied. In addition, consultants, resident doctors, medical officers and house officers at the tertiary level were compared with their corresponding cadres at the secondary level.

Sampling Technique: A cluster sampling technique was used in this study. Each health facility was studied as one cluster.

Step 1: The 12 secondary and two tertiary health facilities were identified using available information from the Federal Capital Territory administration. Each health facility was classified as one cluster; therefore one government tertiary health facility (= 1 cluster) was selected by balloting out of the two tertiary health facilities and six government secondary health facilities (= 6 clusters) were also selected by balloting out of the 12 health facilities.

Step 2: All cadres of consenting medical and dental practitioners (i.e. **consultants, resident doctors, medical officers and house officers**) in all the selected health facilities
(i.e. clusters) were studied. Note that the estimated numbers of physicians of all cadres i.e. **consultants, resident doctors, medical officers and house officers** in the government health facilities were as follows:
One tertiary health facility = 250 to 400 physicians and one secondary heath facility = 25 to 70 physicians

Inclusion criteria: All consenting physicians in the selected facilities were studied. No reported cases of lawsuits or medico-legal actions were reported at that time. If present their experiences may have enriched the study findings.

Exclusions: None, except physicians working in facilities that were not picked by the cluster sampling technique applied or those who refused to participate in the selected facilities.

Sample size determination

The formula for calculating sample size for the comparison of two independent proportions was used [31]

$$n/\text{group} = \frac{2(Z\alpha + Z\beta)^2 \pi (1-\pi)}{d^2}$$

Where,

n = minimum sample size per group

Zα = standard normal deviate corresponding to the probability of α

i.e., the probability of making a type 1 error at 5% = 1.96

Zβ = standard normal deviate at 90% statistical power, corresponding to the probability of making a type 2 error

= 1.28

π = mean of two proportions P_1 and P_2

P_1 = previous estimate of medical errors among physicians [5,13.]

P2 = previous estimate of medical errors among physicians

d = the desired level of difference between the two groups [31.]

Studies conducted in the USA and Canada documented 66% prevalence of non-disclosure of medical errors among physicians [5,13] and this was used in this study to detect a difference of 15 % [31] of medical errors between physicians at the secondary and tertiary levels of the health system in the FCT Abuja.

Therefore,

P_1 = 66% = 0.66

P_2 = 81% = 0.81

π = 66 + 81/2 = 147/2 = 73.5% = 0.735

1-π = 1 − 0.735 = 0.265

$$n = \frac{2(1.96+1.28)^2 \times 0.735 \times 0.265}{0.15^2}$$

$$n = \frac{20.9952 \times 0.735 \times 0.265.}{0.0225}$$

n = 182 = minimum sample size for each group

Some 10% non-response rate was added = 18.2 i.e. 182 + 18.2 = 200.2 = approximately 201 physicians per group. Therefore total sample size = 201 × 2 groups = approximately 402 physicians.

Research instrument: The study used a survey questionnaire which was administered to the physicians. The instrument was a semi-structured, self-administered questionnaire. The questions were a mix of those constructed and developed by the researchers and those culled and modified from a standardized questionnaire survey on medical errors among physicians in the USA; a project funded by the Robert Wood Johnson foundation. [18]

Data management: Data from the questionnaire were entered and analyzed using SPSS version 15 software. The socio-demographic characteristics such as age, gender, nationality, professional ranks etc, and other relevant findings were summarized and displayed in appropriate tables and charts. For the analysis of the occurrence of medical errors, responses were dichotomized as follows: 'Very often', 'sometimes', and 'not too often' were categorized as 'yes' responses and 'never' as 'no' responses. The overall medical error occurrence rates for the tertiary and the secondary levels were estimated as the total of the 'yes' responses to the occurrence of the various error categories surveyed i.e. near misses, mistakes, slips/lapses, technical errors and others. Also for the analysis of factors associated with the occurrence of medical errors, responses were also

dichotomized as follows: 'very weak', 'weak', 'slightly weak' and 'neutral' were categorized as 'weak' responses while 'slightly strong', 'strong' and 'very strong' where categorized as 'strong' responses. The analytic focus was therefore on positive responses. Test statistics such as chi square (χ^2), t-test and Fisher's exact tests were used to test significant differences between the variables as appropriate.

Conflict of interest: None

Duration of study: 1 year, March 2011- February 2012

RESULTS

A total of 485 doctors were interviewed, with 255 (52.5%) from the tertiary level and 230 (47.4%) from the secondary level. Respondents from the secondary level were older than those from the tertiary level with mean age of 36±7.5 years compared to 34±7.3 years. This was statistically significant ($p < 0.05$). The sex distribution of the respondents was also different with a higher proportion of male respondents, 340 (70.1%) than female respondents, 145 (29.9%) as shown in table 1 below. In addition most respondents belong to the surgical sub-specialties 221(45.6%) as compared to the physicians 149(30.7%). This was statistically significant ($p < 0.05$).

Table 1 Socio-demographic characteristics of physicians

Variables	Tertiary Level (N=255) n (%)	Secondary Level (n=230) n (%)	Total (N=485) N(%)	Statistic X^2	p-value
Age (years)					
20-29	89 (34.9)	48 (20.9)	137 (28.2)	8.69	0.034*
30-39	115 (45.1)	116 (50.4)	231 (47.6)		
40-49	42 (16.5)	56 (24.4)	98 (20.2)		
50-59	7 (2.8)	7 (3.0)	14 (0.03)		
≥ 60	2 (0.4)	3 (1.3)	5 (0.01)		
Mean age (± SD) years	34±7.3	36±7.5	35±7.4	5.46†	0.016
Sex Male	178 (69.8)	162 (70.4)	340 (70.1)	0.05	0.822
Female	77 (30.2)	68 (29.8)	145 (29.9)		
Nationality					
Nigerians	252 (98.8%)	229 (99.6)	481 (99.1)	0.80	0.372
Others*	3 (1.2)	1 (0.4)	4 (0.01)		
Marital status					
Married	149 (58.4)	116 (50.4)	265 (54.6)	40.09	0.001*
Single	99 (38.8)	66 (28.7)	165 (34.0)		
Others**	7 (2.8)	48 (20.9)	55 (11.3)		
Mean number of years in practice	7.9± 5.5	8.04±6.1	8±5.8	3.76†	0.654
Professional ranks	28 (11.0)	34 (14.8)	62 (12.9)	73.57	0.001*
Consultants	162 (63.6)	88 (38.3)	250 (51.5)		
Resident doctors	33 (12.9)	11 (4.8)	44 (9.1)		
House officers	32 (12.5)	97 (42.2)	129 (26.6)		
Medical officers					
Sub-specialties of the physicians					
'Surgical'	126 (49.4)	95 (41.3)	221 (45.6)	2.15	0.032*
'Non- surgical'	87 (34.2)	62 (26.9)	149 (30.7)		
Others***	42 (16.4)	73 (31.7)	115 (23.7)		

p-values < 0.05 are significant. Others* = foreigners. Others = Widows/widowers, cohabiting, separated, divorced. Others*** = no specialty of interest.*

† = t test.

Perceptions of physicians on medical error occurrence rates at the tertiary and secondary levels

Figure 1 shows that the medical errors occurrence rates were mostly higher at the secondary level over the previous three months than at the tertiary level. For example, near misses (85.7% vs 85.4%) and mistakes (77.5% vs 73.3%). There was however no statistically significant difference ($p > 0.05$).

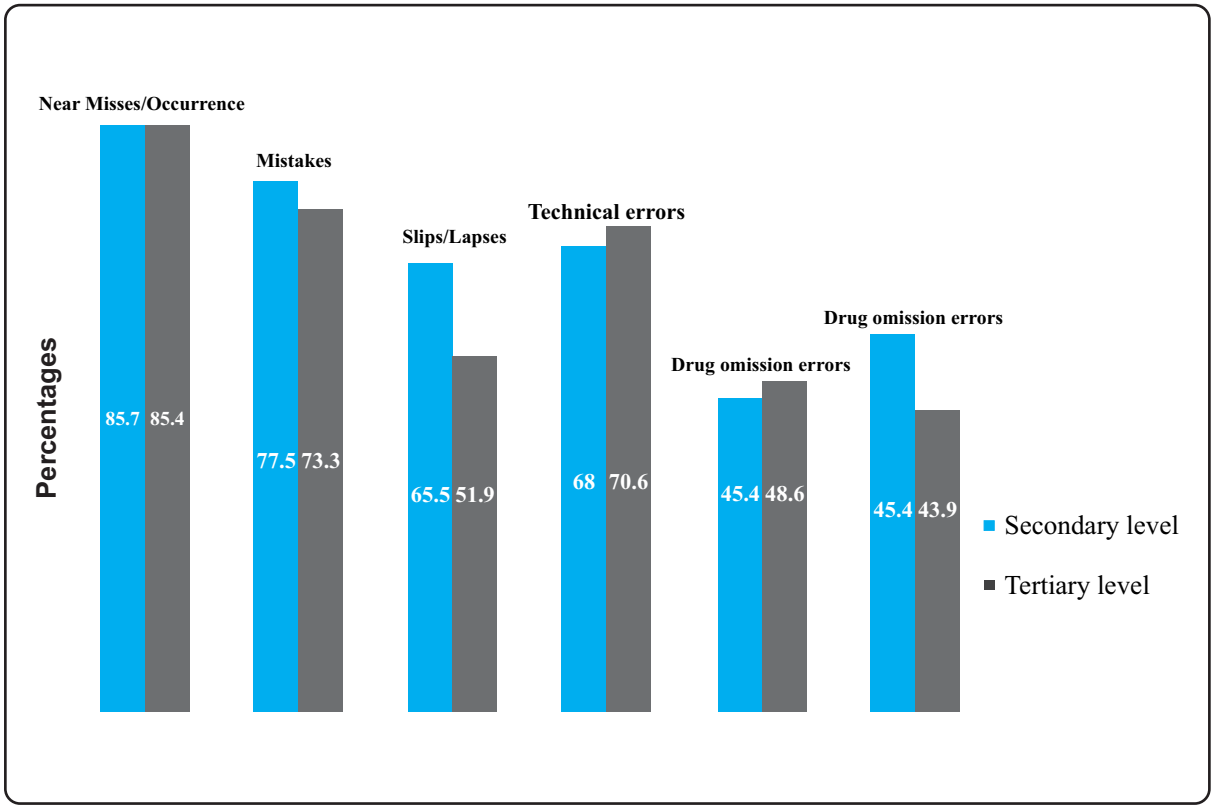


Figure 1 Perceptions of physicians on medical error occurrence rates at the tertiary and secondary levels

The medical error rates among physicians below the rank of consultant were generally higher than among consultants at both tertiary and secondary levels; for example, slips/lapses 56.8% > 14.2% and 74.4% > 14.5%). The differences between the corresponding cadres at both the tertiary and secondary levels were not statistically significant e.g. mistakes (21.4% vs. 23.5%) and (79.9 vs. 87.2); $p > 0.05$ for both comparison groups, as shown in the table 2 below.

Table 2: Comparison of the physicians' perceptions of medical error occurrence rates by cadres

Category of error Physicians' cadre	Medical error rates		Total (N=485)	Statistic X^2	p-value
	Tertiary Level (n=255) n(%)	Secondary level (n=230) n(%)			
1. **Near miss**					
Consultants	7 (23.5)	9 (24.4)	16 (25.8)	0.004	0.945
Non consultants	211 (92.9)	188 (95.9)	399 (94.3)		
2. **Mistakes**					
Consultants	6 (21.4)	8 (23.5)	14 (22.5)	1.139	0.286
Non consultants	181(79.9)	170 (87.2)	351 (82.9)		
3. **Slips/Lapses**					
Consultants	4 (14.2)	5 (14.5)	9 (14.5)	2.073	0.150
Non consultants	129 (56.8)	146 (74.4)	275 (65.0)		

4. **Technical errors**					
Consultants	5 (17.8)	6 (17.6)	11 (17.7)	0.396	0.529
Non consultants	175 (77.0)	150 (76.5)	325 (76.8)		
5. **Drug omission errors**					
Consultants	3 (10.7)	4 (11.7)	7 (11.2)	0.494	0.482
Non consultants	121 (53.3)	101 (51.5)	222 (52.4)		
6. **Wrong drug route errors**					
Consultants	2 (7.1)	3 (8.8)	5 (8.0)	6.173	0.013*
Non consultants	110 (48.4)	123 (62.7)	233 (55.0)		

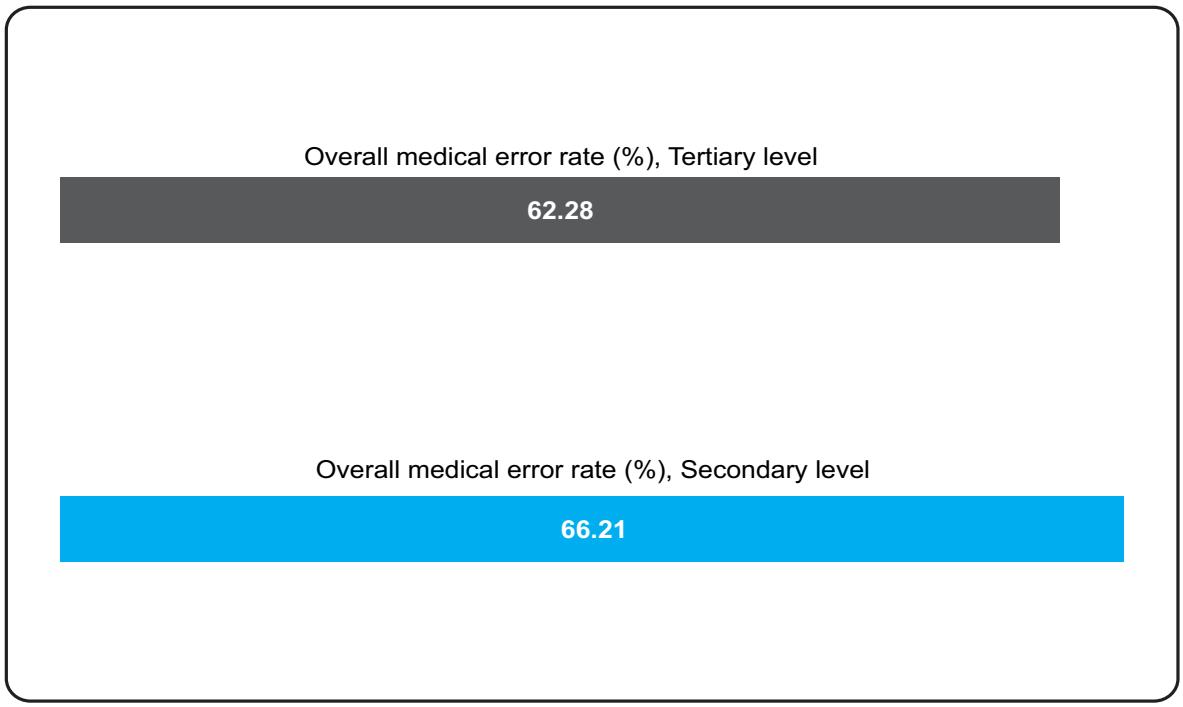
* Statistically significant

The sub-specialty with the highest overall medical error rate was surgery (34.7%). This was followed by radiology (31.1%), obstetrics and gynaecology (30.5%), family medicine (30.3%), paediatrics (30.0%) and ENT (30.0%) as shown in table 3 below. The sub-specialties with the least medical error rates were dentistry (23.4%) community health (24.4%) and ophthalmology (25.6%), p-values > 0.05.

Table 3: Comparison of the physicians' perceptions of medical error occurrence rates by sub-specialties

Sub-specially	Medical error rates			Statistic X^2	p-value
	Tertiary (n=255) n(%)	Secondary (n=230) n(%)	Total (N = 485) N (%)		
Surgery	13 (31.7)	11 (39.2)	24 (34.7)	0.528	0.467
Radiology	8 (28.5)	6 (35.2)	14 (31.1)	0.528	0.467
Obstetrics& Gynaecology	19 (25.3)	18(39.1)	37 (30.5)	2.603	0.154
Family Medicine	8 (33.3)	9 (28.1)	17 (30.3)	0.213	0.645
Paediatrics	7 (24.1)	8 (38.0)	15(30.0)	0.834	0.659
ENT	6 (26.0)	6 (35.2)	12 (30.0)	1.606	0.205
Internal Medicine	10 (26.3)	9 (34.6)	19 (29.6)	0.990	0.320
Anaesthesia	5 (25.0)	5 (33.3)	10 (28.5)	0.714	0.398
Laboratory Medicine	5 (25.0)	5 (29.4)	10 (27.0)	0.106	0.745
Ophthalmology	5 (25.0)	5 (26.3)	10 (25.6)	2.815	0.934
Community Health	6 (24.0)	5 (25.0)	11 (24.4)	0.597	0.440
Dentistry	6 (23.3)	5 (23.8)	11 (23.4)	0.197	0.657
Others	61 (23.9)	60 (26.0)	121(24.9)	0.301	0.583

Taking all the categories of errors surveyed, together (i.e. near misses, mistakes, slips/lapses, technical errors, drug omission errors and wrong drug route errors); the estimated overall medical error rate at the secondary level was higher than at the tertiary level (66.21% > 62.28%) as shown in Figure 2 below.



(X^2 = 1.202, p = 0.273)

Figure 2 Comparison of the physicians' overall perceptions of medical error occurrence rates at the tertiary and secondary levels

Factors associated with the occurrence of medical errors

At both the tertiary and the secondary levels, the error occurrences were mainly attributed to the following factors: poor communication e.g. with colleagues, patients (68.5% vs 63.3%; p = 0.33) and lack of medical equipments or materials (67.4% vs 58.5%; p = 0.04), poor communication in relation to the medical teams (53.1% vs 47.8%; p = 0.24) as shown in table 4 below.

Table 4 Factors associated with the occurrence of medical errors among physicians

Factors	Tertiary level (n = 255) n (%)	Secondary level (n = 230) n (%)	Total (N = 485) N (%)	X^2	p-value
Inadequate communication	174 (68.5)	148 (63.3)	322 (66.5)	0.93	0.33
Lack of materials/equipment	172 (67.4)	134 (58.5)	306(63.22)	4.13	0.04*
Poor communication in relation to the medical team	135 (53.1)	110 (47.8)	245 (50.6)	1.36	0.24
Poor documentation of medical records	125 (49.0)	112 (48.7)	237(48.8)	0.01	0.94
Poor interpersonal relationships in the medical teams	103 (40.3)	105 (46.0)	208 (43.0)	1.57	0.21
Increasing complexity of medical practice	84 (33.0)	98 (42.7)	182 (37.6)	4.84	0. 028*
Other factors e.g., age, gender, marital status, professional rank.	20 (7.8)	11 (4.7)	31 (6.3)	1.89	0.96

*Statistically significant difference

DISCUSSION

This study revealed that the physicians' overall perception on medical error occurrence rates at both the tertiary and secondary levels were very high (62.2% vs 66.2%). Our findings of the high rates of occurrence of errors do not compare favourably with findings in the United States of America where only 20% to 42% of patients reported personal experience with an error in their healthcare or in Germany where only 30% of patients reported errors in their personal health care. [26] However, despite the lower error rates in the USA, annual deaths due to medical errors in the USA was reported to be about 120,000 deaths and this was ranked the fifth leading cause of death ahead of deaths due to all forms of accidents combined.[29] In Australia, a study on the quality of the healthcare system also reported lower rates of medical error occurrences.[5] The Australian study reviewed 14,179 hospital admissions; and found that 16.6% of all admissions were associated with medical errors, 13.7% of them led to permanent disabilities and 4.9 % resulted to deaths. The study further revealed that 51% of these adverse events were preventable.[5] The high rates of the occurrence of medical errors in medical practice suggest that some of our patients may have suffered impairments, disabilities, handicaps or deaths as a result of medical errors.

In Africa, medical errors were said to account for at least 20 million deaths and Nigeria with a population above 160 million people represents the people of Africa most affected by this problem. [22] Many of the victims and sufferers of these errors include children as revealed by a study at the Lagos State University Teaching Hospital among paediatric out-patients.[22] It was reported that up to 38% of the children suffered from drug related errors alone, including omission of child's age and identification number on prescription sheets. [22] This is similar to our findings on drug related errors among the general population of patient where it was found that drug related errors affect nearly half of all patients at both the tertiary and secondary levels of the health system. The study conducted in Lagos was at the tertiary level alone where the overall quality of healthcare service may be expected to be better hence the smaller magnitude of the problem at that level. [22]

Other studies on medical errors from African countries such as South Africa, Ghana, Sudan and Nigeria suggest that overall medical error occurrence rates in Africa were mostly very high. [6,23,30,32,33,34] For example a clinic-pathologic study on missed fatal firearm wounds in 2010, by Bhana and colleagues, in Durban, South Africa; reported error rates ranging from(49.3% to 63.9%) [30.] Another study by Clarke and colleagues in Kwa-Zulu Natal province in South Africa; among surgical patients reported a high overall mortality rate of (27.0%), attributed directly or indirectly to medical errors. [21] These high medical error occurrence rates are very similar to the findings of our study.

A descriptive study to evaluate the level of completion of haematology request forms at a Ghanaian tertiary hospital by Olayemi and colleagues; revealed overall error rates of (22.7% to 100%). [32] Even though this was a wide range, it still does suggest that the error rates in Ghana are also very high. [32] In addition, a cross sectional study by Yousif and colleagues; aimed at analyzing the appropriateness of prescription writing in different health facilities in Wad Medani, Sudan; revealed prescription error rates of (6.9% to 99.9%). [33]

On the occurrence of medical errors by physicians' cadre; this study showed that medical error rates among physicians below the rank of consultant at both the tertiary and the secondary levels were generally higher. In South Africa, Clarke and colleagues also reported that medical error rates were highest among residents in training when compared with consultants. [21]Also in keeping with the findings of this study, Eze and colleagues of the Department of Radiology, University of Benin Teaching Hospital Benin City; found higher medical error rates among trainee radiologists. [24] These findings suggest that medical error occurrences reduce with increasing level of professional training. [21,24]

This study also revealed that the sub-specialties with the highest overall medical error rates in descending order were surgery, radiology, obstetrics and gynaecology, family medicine, paediatrics, then ENT. These high error rates may be attributed to the very intrusive nature of surgical procedures. A Harvard medical practice survey on the rate of medical errors by specialties also revealed that the surgical specialties ranked higher than other specialties on medical error rates. Their findings in descending order were vascular surgery, thoracic and cardiac surgery, neurosurgery, obstetrics, and then neonatology. [26]

This study identified several important factors that were associated with the occurrence of medical errors. They include poor communication with patients, lack of equipment or materials to work with and the increasing complexity of modern medical practice; overwork as well as poor interpersonal relationships and documentation. Similar factors have been reported by Clinton and colleague in the United States of America. [13]

In addition, this study revealed that the level of the health facility is a factor associated with the occurrence of medical errors. This study showed that a health facility at the secondary level has a higher odds of being involved in an error when compared with the tertiary level, in this study setting (OR = 1.57; p = 0.013).

Another study showed that,[15] most deaths associated with medical errors involved central nervous system drugs, cardiovascular system drugs or anti-neoplastic drugs. According to this study,[15] the deaths involved mainly wrong drug dose and wrong drug routes errors. Robertson[14] also reported similar conditions that often predicate errors, for example; error-producing conditions. Error-producing conditions according to Robertson[14] included individual, team and environmental factors in relation to the assigned task that often affect performance such as momentary distractions and interruptions in the process of carrying out the tasks. In slight contrast, Abdoul-Fatouh and colleagues[16] in Cairo Egypt, reported lack of team work as an important factor in the occurrence of medical errors.[16] Note however that lack of team work often emanates from poor communication in the team as reported in our study.

Conclusion

Medical error occurrence rates were found to be very high as revealed by this study. At both the tertiary and the secondary levels, the error occurrences were mainly attributed to poor communication e.g. with colleagues or patients, and lack of medical equipment.

Recommendations

* Institutions should provide and maintain an optimum working environment for the doctor.
* Physicians should ensure good interpersonal relationships within and between the healthcare teams.
* Team work will reduce the work overload on an individual physician. This coupled with adequate documentation will reduce breakdown in communication and minimize errors in patient care.

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