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Statistical Analysis of Medication Errors in Delhi, India

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ABSTRACT: This study was aimed at finding out the occurrence of medication errors and the occurrence of risk factors for medication errors in the inpatient setting of the general hospitals in Delhi. 20 doctors, 30 nurses, 45 pharmacists, 500 patients charts were the population involved in the study. It was recorded that 88 out of the 1063 prescriptions resulted in ADEs, representing 8.2%. This implies that out of every 1000 prescriptions, approximately 82are likely to result in ADEs in the inpatients of OPD setting of general hospitals and Clinics in Delhi. These results put the records of occurrence of medication errors in this study very high. The results show that the young age group category (18-30) was at high risk but both males and females were at equal risk. Ceftriaxin and Diclofenac Tablets were among the least prescribed drugs but recorded the highest ADEs. They, thus appear to be the most frequently responsible drugs for ADEs in the hospitals.

KEYWORDS: Medication Error; Health; Medication Misadventure; Medical Errors.

INTRODUCTION

Medication misadventure can occur anywhere in the health care system from prescriber to dispenser to administration and finally to patient use, the simple truth is that many errors are preventable. According to studies cited in the institute of Medicine report, “to Err is Human; Building a Safer Health System” 44,000 to 98,000 Americans die each year as a result of medical errors.

The subject of medication errors has received more national attention recently than any other time, thanks to attention drawn to the subject by physicians. Pharmacists have a long history of conducting research on medication errors, starting 40 years ago with a study that demonstrated errors are a much bigger problem than anyone realized. Barker and McConnell compared the effectiveness of incident reports and voluntary reports to direct observation of nurses as error detection methods. Thirty-six errors were documented by incident reports during the year studied. By comparison, two weeks worth of data collected by direct observation when extrapolated over the same one year period indicated that 51,200 errors may have occurred (including 600 wrong time errors). This figure is 1,422 times the number identified by incident reports. Other studies have confirmed the difference between the two methods[1].

Communication Barriers

Communication barriers can result in medication errors during every step within the medication administration process. In many cases, the physicians orally give medication orders, which can create errors due to the fact that many drug names sound alike and can be mispronounced [2]. Doctors often write medication orders, and the nurses transcribe, by hand, the information. Messy and illegible handwriting, by both the physicians and nurses, can result in errors, such as wrong patient, incorrect medication, incorrect dose, and/or incorrect route. In addition, some hospitals use medication order forms that produce duplicate copies, and handwriting can become very illegible through several carbon copies.

In the future, it may be possible to adapt the computer assisted adverse drug reaction program described by Dalton-Bunnow and Halvachs to medication errors[3]. This program uses a list of tracer antidote drugs to help identify when an adverse drug reaction may have occurred and stimulates a pharmacist review of the patient chart. The tracer drugs may also be ordered in response to an unintentional overdose (wrong dose error), or in response to the wrong drug being given – for example, naloxone ordered stat as a result of a narcotic overdose. Drugs may be ordered stat if a previous dose was omitted, as well. Other tracer or target drugs include diphenhydramine, flumazenil for benzodiazepine overdoses, and phytonadione injection ordered stat. Target orders that may be evidence that an error has occurred include transfer to ICU, orders to discontinue or hold a drug, and stat orders for drugs or labs. The pharmacist investigated suspect situations on a list of target drug orders by reviewing the patient's chart and collecting additional evidence that a wrong dose was given, or an unauthorized drug was administered, or that a drug was omitted. The hospital using this system for ADR's detected two per week, requiring an average of 2 hours of pharmacist time per week. If this system is applied to medication errors, it could complement an existing incident report system, or observation-based error detection system (the target drug program could cover the entire hospital instead of sampling as observation typically involves). Error rates of over 40% have been measured for floor stock drug distribution systems (including wrong time errors) and over 20% when wrong time errors are subtracted. Error rates measured by observational studies of the medication administration process in hospitals range from 9-12% in 14 studies of unit dose systems (including wrong time errors). Error rates of less than 2% have been achieved in 7 observation-based studies (excluding wrong time errors). Studies of partially automated medication distribution systems measured error rates between 7-17%.6, Barker and colleagues[4] estimated that errors (excluding wrong time errors) occur at a rate of about one error per patient per day, based on data from a number of studies.

The provision of quality, safe and accessible healthcare has become the primary objective of most countries in the world, especially of developing countries. The demand for safe reliable and evidence-based care is a trend in discussions at the local, regional and national levels. This implies that governments in developing countries including India have become more aware of and are becoming more committed to the provision of effective and reliable healthcare for their citizens.

So the aim of the current study was to check the status of medication errors in the National Capital of India and to produce appropriate recommendations on the prevention of medication errors as applicable in the Indian context as one of the means of improving patients' safety in the inpatient settings of the Indian health system.

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RESEARCH METHODOLOGY

Research Design

The research design is a prospective research design. The descriptive survey design was used because the purpose of the study was to provide Delhi hospitals and clinics with information on the extent to which medication errors occur and the presence of factors that generally increase the chance of medication errors.

Population Target

The study was performed in the Delhi. The targeted populations for this research are patients both in patients and OPD, doctors, nurses and pharmacists from the five main locations in Delhi covering East, West, North, South and Central Delhi. The researcher, is a citizen of India and native of Delhi. This way, the review of the patients' charts could be performed as confidential as possible.

Sample and Sampling Procedure

Research question: inpatients and out patients in June 2009- September 2010, 18-45 years, admission >= 1week or on medication more than 2 weeks in case OPD patient

For research question (the occurrence of medication errors) the inclusion and exlusion criteria for the patients were:

Inclusion Criteria

- Admission for more than one week for in patient
- On treatment for more than two weeks for OPD
- Age between 18- 45 years
- Admission or on treatment between June 2009- September 2010

Table 1: Number of patients included in the study for research question (occurrence of medication errors) by randomly picking patient charts

Zone	Male (n)	Female (n)	Total (n)
East	60	50	110
West	50	50	100
North	70	60	130
South	30	30	60
Central	44	56	100
Total	254	246	500

Research Instruments

For research question (occurrence of medication errors), the instrument used is the review of inpatients charts by means of the Trigger Tool.

Table 2 Concepts and indicators of risk factors for the occurrence of medication errors

	INDICATORS	Indicators are translated into questions (appendix) for:
Overload of work	Hours of work, days of work, number of patients cared for, Complexity of work.	Doctors, nurses, pharmacists
Lack of expertise and training	Qualification, Experience, Upgrading of knowledge, opportunities for further training.	Doctors, nurses, pharmacists
Appropriate Technologies	Computer aided diagnosis, prescription and ordering.	Doctors, nurses, pharmacists
Labelling	Legibility of inscription, Content colour, shape, size etc.	Doctors, nurses, pharmacists

Prescription	Legibility of hand writing, typographical errors, duration of prescription, etc.	Doctors, nurses, pharmacists
Communication among health professionals	Healthy working relationship, emotional condition of colleagues, conflict resolution, staff/patient relation.	Doctors, nurses, pharmacists
Handing over	Number of shifts, Briefing on handover, hand-over notes, hand-over gaps	Doctors, nurses, pharmacists
Victimization	Free reporting, queries, fear of intimidation	Doctors, nurses, pharmacists
Patient,/relative Participation	Knowledge on diagnosis, dosage and dosage regimen of drugs etc.	Patients

Data Collection Procedure

The randomly selected number of inpatients charts and out patients prescriptions form three hospitals were put together in a located office at the regional hospital where the researcher used officially. The review process was carried out by the researcher with the aid of a general practitioner at the regional hospital with clarifications sought from the specialist Hospital who was the resource person for the researcher.

The questionnaires were self administered and collected within a ten days interval. This was to avoid forgetfulness and lost of instruments. The data collection period in Delhi lasted for twenty weeks.

Data Analysis Plan

Since the information retrieved from the patients charts and prescriptions were all open-ended and of varied characteristics, a statistical data processing package known as the "Epi-info" version 3.3.5 was used to captured the data and then transported to the Statistical Package for Social Sciences (SPSS version 12.0) for analysis. All the other data on doctors, nurses, pharmacists and patients were coded and put together as combination data for analysis. The combination data was created to give a general analysis of the items since the recommendation is to be used for a general policy strategy for the hospitals (and others which were not captured in the study).

RESULTS & DISCUSSION

Demographic characteristics of the study populations

The table below captures the general information about the characteristics of the population sampled for this study.

1. Samples and sampling

The in patients were selected on the bases of their charts on the shelves with years of admission labelled on them and OPD patients were selected on basis of their prescriptions.

This process was carried out separately for males and females and was repeated in all the five zones until 500 (250 males and 250 females), from each zone totalling 2500 charts or prescriptions were obtained from all of the zones i.e. covering the whole of the Delhi.

From this larger group of 2500 patients, a smaller and final group of 500 patients was randomly selected: every fifth chart or prescription was picked after every five charts or prescription and this procedure was repeated for both males and females until the required number of charts was obtained. Table 8 contains a summary of the 500 patients whose charts were selected for the study. The age range was also pegged at between 18 and 45 for consistency.

2. Socio-demographic characteristics

2.1. Age and gender

Upon categorization of patients 18-24, 28- 38, 38- 45 years, age category showed that 26.4% are between 18-28 years of age and 48.4% are between 28-38 years of age and rest 25.2% are 38-45 years of age. The mean age was 31.5 ± 8.1 years. The proportion of the interviewee as regards sex was a 49.2% female and 50.8% male. The results are presented in Table 3.

Table 3 Socio-demographic characteristic of Patients - Age

Age	**Patients (n=500)**	
	Frequency	**Percentage (%)**
18-28	132	26.4
28 to 38	242	48.4
38 to 45	126	25.2
Mean Age	31.5 (8.1)	
Total	500	100

Table 4 Socio-demographic characteristic of Doctors – Age

Age	**Doctors (n=20)**	
	Frequency	**Percentage (%)**
20-30	2	10
30-40	3	15
40-50	10	50
50-60	3	15
More than 60	2	10
Total	20	100
Mean	47.9(9.9)	

Table 5 Socio-demographic characteristic of Nurses – Age

Age	**Nurses (n=30)**	
	Frequency	**Percentage (%)**
20-30	3	10
30-40	15	50
40-50	9	30

50-60	3	10
More than 60	0	0
Total	30	100
Mean	35.4 (8.2	

Table 6 Socio-demographic characteristic of Pharmacist - Age

Age	**Pharmacist (n=45)**	
	Frequency	**Percentage (%)**
20-30	10	22.2
30-40	9	30.0
40-50	19	63.3
50-60	7	23.3
More than 60	0	0.0
Total	45	150.0
Mean	47.9(9.1)	

Table 7 Socio-demographic characteristic of Patients – Gender

Gender	**Patients (n=500)**	
	Frequency	**Percentage (%)**
Female	246	49.2
Male	254	50.8
Total	500	100

Table 8 Socio-demographic characteristic of Doctors, Nurses & Pharmacist– Gender

Gender	**Doctors (n=20)**		**Nurses (n=30)**		**Pharmacist (n=45)**	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Female	12	60	0	0	35	77.8
Male	8	40	30	100	10	22.2
Total	20	100	30	100	45	100

Table 9 Socio-demographic characteristic of Doctors, Nurses and Pharmacist - Education of Professionals

Higher Education	**Doctors (n=20)**		**Nurses (n=30)**		**Pharmacist (n=45)**	
	Frequency	**(%)**	**Frequency**	**(%)**	**Frequency**	**(%)**
Diploma	0	0.0	12	40.0	30	66.7
Degree	4	20.0	12	40.0	15	33.3
Post Graducation	16	80.0	6	20.0	0	0.0
Ph D	0	0.0	0	0.0	0	0.0
Total	20	100	30	100	45	100

Table 10 Socio-demographic characteristic of Doctors, Nurses and Pharmacist - Experience of practices

Work exp. In years	Doctors (n=20)		Nurses (n=30)		Pharmacist (n=45)	
	Frequency	(%)	Frequency	(%)	Frequency	(%)
1-3 years	4	20.0	3	10.0	2	4.4
4-6 years	1	5.0	0	0.0	7	15.6
7-9 years	3	15.0	12	40.0	7	15.6
10-12 years	4	20.0	9	30.0	9	20.0
More than 13 years	8	40.0	6	30.0	20	44.4
Total	20	100	30	100	45	100.0

Table 11 Socio-demographic characteristic of Patients - Educational Level

Characteristics	Patients (n=500)	
	Frequency	Percentage (%)
Illiterate	48	9.6
Read and Write	92	18.4
Primery Schools	84	16.8
Secondry Schools	182	36.4
College and Above	94	18.8
Total	500	100

Table 12 Socio-demographic characteristic of Patients - Occupation

Characteristics	Patients (n=500)	
	Frequency	Percentage (%)
Student	101	20.2
Government employee	211	42.2
Self employee	98	19.6
Employed by private business	35	7.0
Unemployed	55	11.0
Total	500	100

Table 13 Socio-demographic characteristic of Patients - Average Monthly Family Income

Characteristics	Patients (n=500)	
	Frequency	Percentage (%)
Less than 4500 Rs.	196	39.2
4500 to 10000 Rs.	204	40.8
10000 to 25000 Rs.	75	15.0
More than 25000 Rs.	25	5.0
Total	500	100

Table 14 Socio-demographic characteristic of Patients – Religion

Characteristics	Patients (n=500)	
	Frequency	Percentage (%)
Hindu	412	82.4
Muslim	40	8.0
Sikh	18	3.6
Christian	10	2.0
Others	20	4.0
Total	500	100

2.2 Educational level and occupation -patients

Further analysis of the patients based on the their educational level showed that 9.6 % of the patients were illiterate, and 35.2 % of patients either read and write, or had primary level education and 55.2 were found to have secondary level, and college and above level of education. Analysis also showed that 20.2% of patients were students and 68.8% of the patients were either government employees, employees of private business or self-employed. But the rest, 11.0 % were unemployed.

2.3 Educational level –Professionals (Doctors, Nurses and Pharmacists)

Of the total doctors 80% were post graduate and rest were graduates. 80% of the nurses were having either diploma or degree and rest 20% were having post graduation. In case of pharmacists 66.6% were diploma and 33.3% were graduates.

A total of 500 questionnaires were administered to almost equal proportion of male and female on admission at the time of study. The mean age was found to be 35.4, ±9.1.

Out of the 160 diseases recorded the highest, 70% were Infection/ Parasitic whiles the lowest 5% were Trauma. twenty doctors were involved in the study with their mean age found to be 47.9, ±9.9. The number of male doctors were 60% and 40% out of doctors having work experience of more than 13 years 20% of them found to have a working experience of 1-3 years.

The total number of nurses involved in the study was thirty. None of them were found to be Male. The mean age of the nurses was 35.4, ±8.2. 45 pharmacists, males 66.7 % and females 33.3% with mean age of 47.9, ±9.1.

3. The Occurrence of Medication Errors in Delhi Hospitals

In this section, appendices provide the summary for the occurrence of medication errors posed in the research question one (the occurrence of medication errors in state general hospitals in Delhi) of this study.

Table 15 Displays the number of patients on each prescription, drugs, the number of times prescribed, number of signals and confirmed cases, the percentages of the confirmed cases to the total prescriptions, and the percentages of ADEs from the signals

No	Drug	No. of patients on individual prescript-tion	Total Number of prescript-tions	Number of signals	Confirmed (n)	% ADEs of total prescri-ptions	% ADEs of the individual prescriptions
1	Quinine	38	41	9	7	17.1	18.4
2	Flucloxacillin	5	5	0	0	0	0
3	Ceftriaxin	6	7	2	2 28.	6	33.3
4	Diclofenac	30	32	9	8	25	26.7

5	Magnesium Sulphate	15	15	1	1	6.7	6.7
6	Atesunate Amodiaquine (tablets)	22	22	4	3	13.6	13.6
7	Laxis	4	4	0	0	0	0
8	Amoxycillin	15	15	0	0	0	0
9	Injection Analgin	6	10	0	0	0	0
10	Macain	12	12	1	0	0	0
11	Diclofenac Tablets	7	9	2	2	22.2	28.6
12	Analgin	6	7	1	0	0	0
13	Amodiaquine Cloxaxcilline Tablets	20	22	2	1	4.6	5
14	Chloroquine Injection	9	11	1	1	9.1	11.1
15	IV Aminophillin	11	13	1	1	7.7	9.1
16	Niphedipine	19	19	2	2	10.5	10.5
17	Diazepam	7	9	0	0	0	0
18	Aspirin	14	14	1	0	0	0
19	Ibuprofen	12	12	0	0	0	0
20	Paracetamol	23	35	0	0	0	0
21	Morphine	15	15	1	0	0	0
22	Amitriptyline	11	11	0	0	0	0
23	Nifedipine	8	8	0	0	0	0
24	Ferric Amonium Citrate	10		0	0	0	0
	Total		340	37	28		

A total of 340 prescriptions were recorded in the charts reviewed with 37(10.9%) signals and 28(8.2%) confirmed Adverse Drug Events.The drugs with the highest risk for DAEs were Ceftriaxin (33.3%), Diclofenac Tablets (28.5%). Diclofenac (26.7%), Atesunate Amodiaquine (13.6%), Chloroquine Injection (11.1%) and Niphedipine (10.5%), Fluxacillin, Laxis, Amoxicillin, and Diazepam, just to mention a few, were the drugs with the least risk for ADEs. They recorded zero ADEs. Evnthough Ceftriaxin, Diclofenac, iphedipinerecorded the hiest ADEs, they pose extra risk situations since all the signals identified in them resulted in ADEs.

Quinine was the highest prescribed drug (38), out of which seven resulted in ADEs. It is one of the main malaria drugs prescribed within the period resulting in 18.4% ADEs puts it at higher risk since malaria is the highest cause of OPD attendance. Paracetamol was prescribed 35 times but recorded neither a signal nor an ADE, implying that it has no risk in the medication process.

CONCLUSION

This study was aimed at finding out the occurrence of medication errors and the occurrence of risk factors for medication errors in the inpatient setting of the general hospitals in Delhi. 20 doctors, 30 nurses, 45 pharmacists, 500 patients charts were the population involved in the study.

Most of the patients were not aware of their medication status. This is because most of them were not told the diagnosis made on them and the drugs they were taking at the hospital. They neither asked nor were they informed. Because patients are highly variable in their preferences, clinicians cannot assume that they alone can make the best decision for their patients. Patients have a role to play in the diagnosis of their illness. Without the patients' knowledge in the process of care in the ward, it poses the risk of the patient continuing the medication appropriately after discharge. The patient cannot even make any informed judgement about improvement in his health status.

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