



## RESEARCH ARTICLE

### AN OBSERVATIONAL STUDY ON INCIDENCE AND SEVERITY OF INTRAVENOUS MEDICATION ERRORS IN SOUTH INDIAN HOSPITAL

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#### ARTICLE INFO

##### Article History:

Received 12<sup>th</sup> September, 2017

Received in revised form

16<sup>th</sup> October, 2017

Accepted 14<sup>th</sup> November, 2017

Published online 27<sup>th</sup> December, 2017

##### Key words:

IV, Medication errors,  
Observational study,  
Preparation errors,  
Administration errors.

#### ABSTRACT

**Aim:** Intravenous medication errors are frequent events. They are associated with considerable harm, but little is known about their causes. The objective of the study was to find out the IV medication errors in medical, surgery, pediatric and ICU department of tertiary care teaching hospital.

**Materials and Methods:** An observational study using disguised observation was carried out for six months. Nurses were accompanied daily during IV drug rounds for 6 months. Details of each IV drug preparation and administration errors identified were recorded on a standard data entry form. Information came from observation and talking informally to the nursing staff. The details obtained were checked and completed for each IV drug within 24 hours of leaving the ward.

**Results:** Each case of IV medication error was analyzed to identify the main active failure, and was recorded in the form. IV drugs prepared and administered for patients were observed during study period. One or more errors were occurred in the preparation of 421 out of 827 drug doses (50.90%). Preparation errors occurred in 110 IV doses (26.44%).

**Conclusion:** The study found a high incidence of medication errors of IV drugs. It is also evident from the study that pharmacist intervention is effective in reducing in the number of IV medication errors.

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**Citation:** Binu, K. M., Nimmy.N.John, Jilu Varghese, Akshay Kumar, N., Sarfaraz, M. D., Doddayya, H. and Antin, S. 2017. "An observational study on incidence and severity of intravenous medication errors in south Indian Hospital", *International Journal of Current Research*, 9, (12), 62480-62483.

## INTRODUCTION

IV administration is the most important and most common parenteral administration route. Intravenous therapy is a complex process usually requiring the preparation of the medicine in the clinical areas before administration to the patient. There have been reports of deaths and harm following medication errors such as wrong drug, dose, diluents, and cross contamination errors with intravenous therapy. The design of procedures and implementation of the system for preparing and administering intravenous medicines was thought likely to be influenced by national factors such as legislation, healthcare system requirements, professional standards, university course curricula, and delivery of education and training for healthcare staff [www.pharmacy.gov.my.]. An intravenous drug error is defined as a deviation in preparation and administration or both of a drug from a doctor's prescription, the hospitals intravenous policy, or the manufactures instructions.

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Most of the literature on MAE's to date has focused on oral medications administered during regular drug rounds. A few examples of MAE's arising from IV bolus doses or intermittent infusions have been reported. But we have not been able to find any information describing the prevalence of MAE's associated with continuous IV infusions which are usually replaced by nursing staff, Once the contents of previous bags have been infused. This is dissimilar to oral/ IV bolus drugs and requires an observer to be present at the point of preparation [Cousins, 2005]. In most of the European countries nurses generally prepare and administer IV drugs prescribed by doctors. Administration of IV therapy is associated with considerable risk and UK department of health has targeted this to increase patient safety. Similar initiatives have been proposed in US. Little prospective research has been done into the incidence, causes and severity of intravenous drug error. Single site studies carried out on one or two wards have reported errors in preparing and administering intravenous drugs of 13- 84%, but the studies used different definitions and did not assess the severity of errors.

Epidemiological studies using retrospective records review have shown that adverse drug events are common but have not provided details of the type of errors (Taxis, 2003). Interview and document review are commonly used to analyse, the causes of adverse events, but these methods rely on adverse events being documented or reported. Previous research and pilot work has shown that nurses are often unaware of the occurrence of medication errors. An ethnography approach combining several methods, including observation of actual practice and interviews, provides an insight into the behaviour of which participant themselves may be unaware. It over comes the discrepancy between what people say and what they actually do [Taxis, 2003]. Even though the literature reports a number of studies on identifying IV medication errors in various hospitals abroad, the data available on such situation in India is limited. Therefore to investigate the causes of intravenous preparations and administration errors department of Pharmacy Practice has undertaken a study entitled "An Observational Study on Intravenous Medication Errors in South Indian Hospital" for six months.

## MATERIALS AND METHODS

The study was carried out for a period of 6 months January 2013- June 2013 in Navodaya Medical College, Hospital and Research Centre, Raichur. It was an observational study using disguised observations. For obtaining the clearance certificate, an application along with study protocol was submitted to the chairman of the institutional ethical committee of Navodaya Medical College Hospital and Research Centre. The study was approved by committee by issuing ethical clearance certificate.

### Definition of intravenous medication errors

We defined an IV drug error as a deviation in preparation or administration of medicine from a doctor's prescription, hospital intravenous procedures or manufacturer's instructions. The administration errors and clinical appropriateness of prescription and potential clinical outcomes resulting from the observed medical errors were not recorded. The leaf let produced by the manufacturer, which were especially designed for health care professionals, were used as the definition of correct practice. Errors in appropriateness of prescribing were beyond the scope of this study.

### PARTICIPANT SELECTION

**Inclusion criteria:** Nurses were eligible for the study if:

- They were registered nurses.
- They were fully qualified for preparation and administration of IV drugs.

**Exclusion criteria:** Student and trainee nurses were excluded.  
**Observations**

Nurses were observed by a single observer for a maximum number of four times in order to include as many as different nurses as possible. During the process of preparing and administering IV drugs nurses were observed by using the observation list. The nurses are aware of the observation but unaware about true purpose. The name of nurses, the number of observation by individual nurse and phase of study were registered. Observation took place on different days of week and different times of day and night in all hospital wards. The observer was present during a preset series of shift, to represent the variation of nursing hours in nursing practice.

## Data analysis

Definition of the types of errors were based on the classification by (Allan and Barker) and adapted to the data. Preparation errors included preparation of the wrong drug, the wrong dose, the wrong dosage form, the wrong preparation technique, omission errors and preparation of an unordered drug dose. Preparation error rates were calculated as percentage by dividing the sum of all recorded preparation errors by the sum of the prepared drug doses observed. Datas were expressed as percentages and kept as 95% confidence interval.

### Items Monitored In the Study

- Was the vehicle compatible with the drug?
- Was the preparation and administration properly?
- Was the dose prepared properly?
- Was the drug administered properly?
- Was aseptic technique complied with (were hands disinfected, vial tops swabbed with alcohol etc.)?
- Was the drug properly stored, was the expiration date checked?

### Preparation Errors ([www.pharmacy.gov.my](http://www.pharmacy.gov.my))

Preparation Errors	Descriptions
Wrong drug	Preparation of a drug, which was not the prescribed one.
Wrong dose preparation	The amount of drug prepared differed from that prescribed.
Wrong preparation technique	Procedure of preparation did not comply with the recommendation of the manufacturer or hospital drug policy.
Omission error	An I.V. Dose prescribed but not administered until the next dose was prescribed. An intended omission where a drug could harm the patient was excluded (for example a dehydrated patient who was prescribed for a diuretic)
Unordered drug	Administration of a drug dose which was not prescribed
Other preparation error	All other preparation errors, which were not included in the categories, used above.

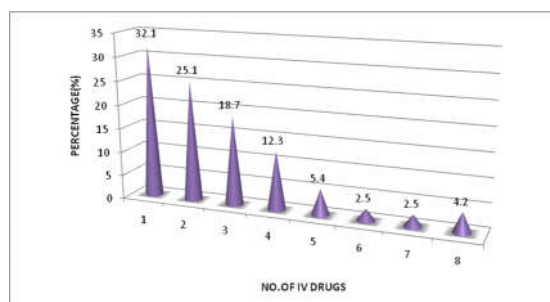
## RESULTS

438 patients were observed during study period, of which 231 (52.83%) were females and 207 (47.27%) were male patients.

**Table 1. Gender distribution (n=438)**

Gender	No. of Patients	Percentage (%)
Male	207	47.2
Female	231	52.8

Most of the prescriptions containing 1 (32.14%) or 2 (25.16%) IV drugs.



**Figure 1. Number of IV drugs per prescription**

The commonly prescribed class of drugs are illustrated in fig-4 in which antibiotics are most commonly prescribed followed by nutrients.

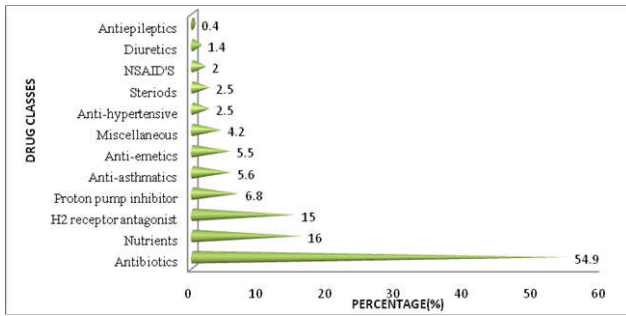


Figure 2. Categories of drugs prescribed (n=1201)

In our study 63 nurses were observed. The characteristics of observations are ICU No. of preparation observations 79 (18.9%), Medical 126 (30.2), Surgery 134 (32.2), Pediatrics 77 (18.5) and No. of administration observations ICU 81 (19.7), Medical 143 (34.7), Surgery 118 (28.7), Pediatrics 69 (16.7).

Table 2. Demographic details of nurses (n=63)

Gender	Male	22	34.9%
	Female	41	65.1%
Experience	< 5 years	42	66.6%
	5-10 years	12	19.2%
	>10 years	9	14.2%
Professional qualification	Diploma	27	42.0%
	Degree	16	25.3%
	Post graduate	07	11.1%
	others	13	20.6%

Table 3. Characteristics of observations

Ward	No. of Preparation observations (%)	No. of Administration observations (%)
ICU	79 (18.9)	81 (19.7)
Medical	126 (30.2)	143 (34.7)
Surgery	134 (32.2)	118 (28.7)
Pediatrics	77 (18.5)	69 (16.7)

The major error (n=110) is wrong dose 36(32.72), and minor error is preparation of an unordered drug dose 03 (2.72).

Table 4. Preparation errors (n=110)

Sl.No	Errors	No. of errors	% of error
1	Preparation of wrong drug	--	00
2	Wrong dose	36	32.72
3	Wrong dosage form	07	6.36
4	Wrong preparation technique	06	5.45
5	Omission error	33	30
6	Preparation of an unordered drug dose	03	2.72
7	Incorrect labelling	21	19.09
8	Wrong diluent	04	3.63

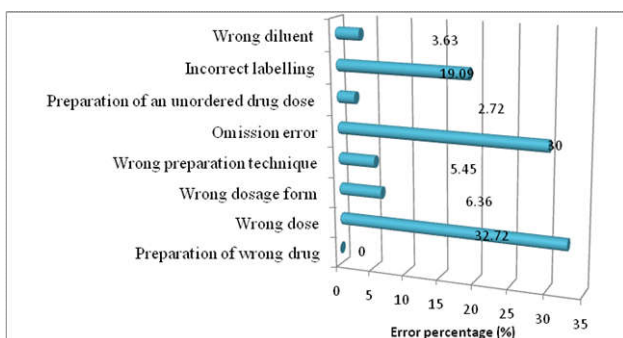


Figure 3. Preparation errors (n=110)

Table 5. Administration errors (n=311)

Sl. No	Errors	No. of errors	Percentage (%)
1	Wrong rate of administration	74	23.79
2	Compatibility errors	21	6.75
3	Wrong dose administered/Wrong infusion volume	36	11.57
4	Wrong route errors	--	--
5	Wrong patient	--	--
6	Expired drug	--	--
7	Wrong drug	--	--
8	Wrong time	143	45.98
9	Drug omission	37	11.89

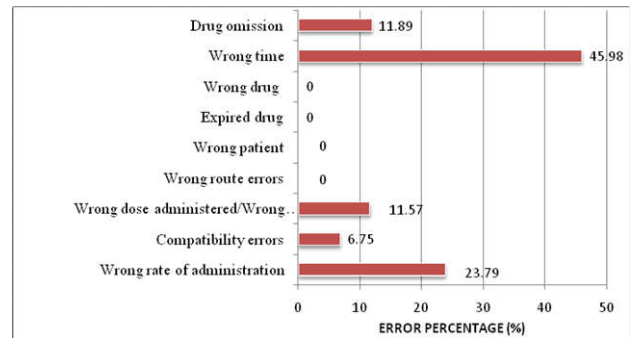


Figure 4. Administration errors (n=311)

The comparison of preparation error rates in different rates and confidence interval (CI) is calculated are ICU (79) error rate is 35.44 and 95% CI is between 24.89% to 45.99%, Medical (126) error rate is 28.57 and 95% CI 20.68% to 36.46%, Surgery (134) error rate is 23.88 and 95% CI 16.66% to 31.11%, Pediatrics (77) error rate is 5.19 and 95% CI 0.24% to 10.14%. The comparison of administration error rates in different rates and confidence interval (CI) is calculated are ICU (81) error rate is 72.83 and 95% CI is between 63.14% to 82.52%, Medical (109) error rate is 84.37 and 95% CI 75.8% to 92.94%, Surgery (89) error rate is 75.42 and 95% CI 67.65% to 83.19%, Pediatrics (54) error rate is 84.37 and 95% CI 75.8% to 92.94% 18 errors were reported based on the severity of preparation and administration among that 16 were moderate sever and 03 were minor.

DISCUSSION

We have explored the causes of four drug errors using a frame work of human error theory observation of actual practice has shown that IV drug errors are not only caused by the immediate individual act, but a range of organizational and managerial issue including training, cultural context, choice of product, purchasing policy, and design of technology also contribute to errors. 438 patients were observed during study period, of which 231 (52.83%) were females and 207 (47.27%) were male patients. Most of the prescriptions containing 1 (32.14%) or 2 (25.16%) IV drugs. The most commonly prescribed individual IV drugs were ranitidine, ceftriaxone, metronidazole. A total of 63 nurses were observed during the study period. All together, 1201 regular IV doses representing 36 different drugs were prescribed for 438 patients during the study. Our observations were representing of the study period 34% (122) of all IV doses prescribed were observed; administration of 77% (14) of the prescribed drugs was observed on at least one occasion and 82% (27) of patients who were prescribed regular IV drugs were observed at least once.

**Table 6. Comparison of error rates in four different wards**

Ward	No. of preparations observed	Preparation			Number of administrations observed	Administration		
		Error	Rate	95% CI		Error	Rate	95% CI
Medical	126	36	28.57	20.68% to 36.46%	143	109	76.22	± 69.24% to 83.2%
Surgery	134	32	23.88	16.66% to 31.1%	118	89	75.42	67.65% to 83.19%
Pediatric	77	14	5.19	0.24% to 10.14%	69	54	84.37	75.8% to 92.94%
ICU	79	28	35.44	24.89% to 45.99%	81	59	72.83	63.14% to 82.52%

**Table 8. Severity of errors**

Severity	No. of errors (n=18)	Percentage (%)
Minor	03	72.72%
Moderate	16	27.77%
Severe	--	--

One or more errors were occurred in the preparation/administration of 421 out of 827 drug doses (50.90%). Preparation errors occurred in 110 IV doses (26.44%), administration errors in 311 IV doses (75.66%). Most of the errors are associated with an wrong time of administration (34.79%) followed by wrong rate of administration (18.00%), in most of these cases the dose was given faster than recommended which is usually 3-5 minutes. The different types of errors observed during study period were shown in Figure 3 and 4. Different types of errors were scored out of which 16 were moderate severity. At least one deviation from aseptic was observed. Although the proportion of serious errors is small, the number of patients and intravenous dose in a hospital means that errors may be more common than expected.

## REFERENCES

- Bruce J, Wong I. 2001. Parenteral drug administration errors by nursing staff on an acute medical admissions ward during day duty. *Drug Safety* 24: 855-62(8).
- Cousins D H, Sabatier B, Begue D, Schmitt C, Hoppe-Tichy T. 2005. Medication errors in intravenous drug preparation and administration : a multicentre audit in UK, Germany and France; *QualSaf Health Care*.14:190-195.
- Crowley C, Scott D, Duggan C, Whittlesea MC. 2004. Describing the frequency of IV medication preparation and administration errors. *Hospital Pharmacist* Sep; 11: 330-5.
- Dean BS, Barber ND. 1999. A validated reliable method of scoring the severity of medication errors. *Am J Health Syst Pharm*, 56(1): 57-62.
- Guidelines on medication error reporting, first edition July 2009. [www.pharmacy.gov.my](http://www.pharmacy.gov.my).
- Han P Y, Combs I O and Green B. 2005. Factors predictive of intravenous fluid administration errors in Australian surgical care wards; *QualSaf Health Care*.14:179-184.
- Ingram P, Lavery I. 2005. Peripheral intravenous therapy: key risks and implications for practice. *Nursing Standard* Jul 27; 19(46): 55-64.
- McDowell S E, Mt-Isa S, Ashbby D, Ferner R H. 2009. Where errors occur in the preparation and administration of intravenous medicines: a systematic review and Bayesian analysis, *QHC*.10.1136.
- ParthasarathiG, Hasen K N and Nahata M C, clinical pharmacy practice, reprinted 2009, pg : 437-438.
- Preventing Medication Errors: Quality Chasm Series. accessed 2010. [www.nap.edu/catalog/11623.html](http://www.nap.edu/catalog/11623.html)
- Ross LM, Wallace J, Paton JY. 2000. Medication errors in paediatric teaching hospital in the UK: five years operational experience. *Arch Dis Child* Dec; 83:492-7.
- Shargel L, Alan HM, Paul FS. 2013. Editors comprehensive pharmacy review eight edition, pg:348-356.
- Sorgini C S, Fernandes V, Lubehansky S et al 2012. Errors associated with IV infusions in critical care, *Can J Pharm*; 65(1):19-26.
- Taxis K and Barber. N. 2003. Ethnographic studies on incidence and severity of intravenous drug errors. *BMJ*. Volume 326. 29 march.
- Taxis K, Barber N. 2003. Causes of intravenous medication errors, *QualSaf Health Care*. 12: 343-348
- Valentin A, Capuzzo M, Uidet B, et al. 2009. errors in administration of parenteral drugs in intensive care units: multinational prospective study, *BMJ*.338:b814.
- Williams DJP. 2007. Medication errors, *J R Coll Physicians Edinb* 37:343-346.

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