RESEARCH ARTICLE

Prescription, Transcription and Administration Errors in Out-Patient Day Care Unit of a Regional Cancer Centre in South India

Jayanthi Mathaiyan[1]*, Tanvi Jain[2], Biswajit Dubashi[3], Gitanjali Batmanabane[1]

Abstract

Background: Medication errors are common but most often preventable events in any health care setup. Studies on medication errors involving chemotherapeutic drugs are limited. Objective: We studied three aspects of medication errors - prescription, transcription and administration errors in 500 cancer patients who received ambulatory cancer chemotherapy at a resource limited setting government hospital attached cancer centre in South India. The frequency of medication errors, their types and the possible reasons for their occurrence were analysed. Design and Methods: Cross-sectional study using direct observation and chart review in anmbulatory day care unit of a Regional Cancer Centre in South India. Prescription charts of 500 patients during a three month time period were studied and errors analysed. Transcription errors were estimated from the nurses records for these 500 patients who were prescribed anticancer medications or premedication to be administered in the day care centre, direct observations were made during drug administration and administration errors analysed. Medical oncologists prescribing anticancer medications and nurses administering medications also participated. Results: A total of 500 patient observations were made and 41.6% medication errors were detected. Among the total observed errors, 114 (54.8%) were prescription errors, 51(24.5%) were transcribing errors and 43 (20.7%) were administration errors. The majority of the prescription errors were due to missing information (45.5%) and administration errors were mainly due to errors in drug reconstitution (55.8%). There were no life threatening events during the observation period since most of the errors were either intercepted before reaching the patient or were trivial. Conclusions: A high rate of potentially harmful medication errors were intercepted at the ambulatory day care unit of our regional cancer centre. Suggestions have been made to reduce errors in the future by adoption of computerised prescriptions and periodic sensitisation of the responsible health personnel.

Keywords: Medication errors - administration errors - chemotherapeutic drugs - Regional Cancer Center, South India

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Introduction

Medication errors are common in hospitals and account for a major cause of preventable mortality worldwide (Institute of Medicine, 2000; Schachter, 2009). Studies world-wide have reported different types of medication errors like prescription errors, transcribing errors, dispensing errors and administration errors (Karna et al., 2012; Saghafi and Zargarzadeh, 2014). The error rates range from 7.6% to 44% in the Indian studies reported on medication errors (Tavva et al,. 2011; Phalke et al., 2011; Karna et al., 2012). Medication errors can result in increased costs, prolonged hospital stays or even life threatening harm. Hence it is important to identify, classify, analyze medication errors and institute appropriate steps to minimize them.

Medication error is "any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in control of the health care professional, patient, or consumer" (NCCMERP 2016). It is a failure in the prescribing, dispensing, preparation, administration or monitoring process that leads to or has a potential to lead to harm in the patient. Many studies in India have reported prescription errors (Patel et al., 2005; Kumari et al., 2008; Tavva et al., 2011; Phalke et al., 2011) and very few have reported drug administration errors (Karna et al., 2012, Karthikeyan and Lalitha, 2013).

Prescription errors can occur due to omissions, wrong choice of drugs or the dose, brand name prescribing, inaccuracy in writing and poor legibility of handwriting (Bates et al., 2010; Biswas et al., 2014; Keers et al., 2014) Administration errors also have been reported to occur quite frequently involving wrong dose, wrong timing, wrong patient and omission of doses (Biswas et al., 2014). However, the detection of the medication errors is a difficult task because the health professionals do not

*[1]Department of Pharmacology, [2]Student Body, [3]Department of Medical Oncology, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India *For correspondence: drjayanthi2008@gmail.com*

voluntarily report them for the fear of any disciplinary action that could be taken by the higher authorities or just the ignorance about the importance of reporting. Moreover, there is no legal obligation to report medication errors in India. Encouraging a blame free error reporting culture and non-punitive atmosphere in the hospital could help in detecting the medication errors and formulating effective steps for minimizing these errors (Williamson 2009). This involves co-operation from various disciplines of health care because the medication process involves the whole medical team including physicians, pharmacists and the nurses.

Medication errors have been reported among adults and children receiving anticancer medications (Walsh et al., 2009). Various guidelines have been drafted to minimize errors and practice safe chemotherapy practices (Joshi, 2007; Clinical oncological society of Australia, 2008; Williamson, 2009). But the errors continue to pose a major health problem even in the developed countries with advanced infrastructure and system facilities. It is needless to say that medication errors are a neglected field in developing countries or in limited resource settings. Anticancer drugs with their wide range of toxicity profile and a narrow therapeutic index can pose a major threat to the quality of life of cancer patients being treated in government hospitals of the developing countries. In addition to in-patient therapy, many of the anti-neoplastic drugs are administered on out-patient basis in day care centres. Therefore extra care needs to be taken while prescribing, calculating and administering the correct dose and drug to the correct patient. In addition, caution needs to be taken in storing, diluting, administration of chemotherapeutic drugs and disposing the waste resulting from anticancer drug use (Joshi, 2007). A systematic planning to identify and prevent medication errors can help to rationalize anticancer drug use and safeguard the health of patients as well as that of all the personnel working in the cancer unit. Ours is a multispecialty hospital with a separate Regional Cancer Centre (RCC) that caters to the needs of cancer patients from the neighboring South Indian states. Every day around 200 patients visit RCC and about 50 patients receive chemotherapy on outpatient basis alone.

This being a government hospital where patients receive treatment free of cost and with a large number of patients to be catered to, errors are likely to happen. No study identifying and analyzing anti-cancer drug administration errors has been done in the institute so far. Recently a 'Quality council' has been constituted for the institute with a mission to assess and improve the quality of care provided in our hospital. This study was an initiative to obtain preliminary data on the drug administration errors at RCC so as to plan the corrective measures in the pursuit of ensuring quality and safety.

Hence the objective of this study was to estimate the prevalence, types of prescription and transcription errors as well as the errors in administration of drugs to cancer patients treated at the day care unit of Regional Cancer Centre of our hospital so as to take necessary steps to minimize these errors in future.

Materials and Methods

Study Setting

The Institute Scientific Advisory Committee and the Research Ethics Committee approved the study. The study was conducted in the day care unit of a Regional Cancer Centre of a multi-speciality government teaching hospital in South India. This is a cross-sectional observational study involving cancer patients visiting RCC as out patients. The study was approved by the Institute Scientific Advisory Committee and the Research Ethics Committee.

Medication dispensing at RCC

The day care centre is a 12-beded unit functioning from 9.00 AM to 1.00 PM on six week days (Monday to Saturday) except during the national holidays with 3-4 nurses on duty on any working day. About 30 – 50 patients are treated on every working day at the day care clinic of RCC for different cancers. They receive anticancer drugs as monotherapy or as combination chemotherapy with other adjuvant drugs like antiemetics and intra-venous fluids. After examination in the out-patient clinic, the patients are given a prescription order by the oncologist. The patients visit the pharmacy and the pharmacist gives the prescribed drugs i.e. no. of vials or ampoules as per the required dose. The prescription order is then submitted to the staff nurse at the day care clinic for further action. The nurse transcribes the prescription order into the nurses' chart and then administers the drugs.

Details of participant recruitment

Patients who were prescribed anticancer medications or premedication by the parenteral route to be administered in the day care centre of RCC were included in the study. Very sick patients or patients receiving only oral anticancer medications were excluded from the study. The study was done from June to August 2013 and it is part of a larger study that analyzed 1500 prescriptions for prescription errors only which has recently been published (Mathaiyan et al., 2015). The nurses and physicians were informed once about the objectives and purpose prior to start of the study.

Method of collecting charts and observing administration errors

After a short period of training in reporting medication errors, guided by a pharmacologist and a medical oncologist, the principle investigator T.J. started to observe the anticancer drug administrations for potential errors. During the three month period, the investigator visited RCC Day Care Centre in the forenoon of a working day and selected about 8-10 patients per day as a convenient sample.

The nurses prepared anti-cancer medications in the ward and administered them to the cancer patients as per the instructions on the prescription. The nurses were trained in the general principles of anticancer medicine use, preparation and administration of commonly used cancer chemotherapy drugs at the RCC. For this study, the nurses were observed by undisguised direct observation

technique for administration of the medicines (at the time of the index visit) and medication errors if any were noted. For these patients, the prescriptions as well as nurses' records were observed for prescription and transcription error respectively. Digital photographs of the Doctor's prescription order for these selected patients were obtained and filed. These prescriptions were compared with the standard protocol guidelines pre-designed by the medical oncologist team working at RCC. This manual of guidelines contains the protocol routinely followed in RCC in the treatment of common cancers and is in accordance with the standard treatment guidelines recommended by international cancer societies. The prescriptions were analysed for different errors like errors in omission, number of prescriptions containing brand names of drugs, abbreviations and legibility of the prescriptions. Further these errors were classified into potentially harmful ones and those which were not, based upon the likelihood of the errors to results in harm to the patient. The dose of drug to be considered for a significant error was given an allowance of 5%.

Other details that were also noted were: Number of beds, number of nurses per shift, patient to nurse ratio, number of patient admissions/month, total number of observations, characteristics of the patient & completeness of the prescription for each observation, the characteristics of the nurses and their workload. Whether proper sterile precautions were followed during administration of anticancer drugs which included wearing of gloves and gown were noted. The administration of drugs by the nurse was observed by one investigator. The consistency of data collected and entries made into the data-sheet were checked by a second investigator. The errors were evaluated after consultation with a medical oncologist. Total number of errors (expressed as No. of errors/ No. of patient records observed for treatment), types of errors, number of potentially harmful errors and adequacy of prescriptions were evaluated. Five hundred of these prescriptions collected during the study period as mentioned previously were followed up for observing the transcription and administration errors.

Definition and Classification of Medication Errors

Data collected was analyzed and the medication errors were categorized into omission errors, prescription, transcription and administration. The observer assigned consecutive numbers to each nurse-patient observation during the course of the study. The observer was to intervene only if any potentially life-threatening error was detected. Medication errors were classified into 3 categories which are defined for the purpose of this study as : Prescription error - Incomplete prescription, brand names for drugs, abbreviations for drug names, incorrect/illegible drug names, illegible overall prescription, Transcription error - Any discrepancy between the prescribed medications and that entered into the nurse's record and Administration error - Inadequate premedication, wrong dilution, wrong drug/dose, wrong patient, wrong time of infusion, inadequate sterile precautions

Errors considered potentially harmful were those which could have serious consequences for the patient receiving chemotherapy drugs like patients name, pre-medication, dosage form, dose, unit, diluent, route, time of infusion and use of non-standard abbreviations in the prescriptions. On the other hand, the omission of age, diagnosis, usage of brand names, standard abbreviations or abbreviated premedication drug names were not considered to be potentially harmful in this study.

Statistical analysis

All the prescriptions were analysed by two investigators for prescribing errors. Those in which medication errors were identified were discussed with one or more oncologists at RCC. In total, 500 prescriptions were analysed for prescription, transcription and administration errors. All categorical variables were expressed as counts with percentages.

Results

Patient details

Five hundred cancer patients who were prescribed medications to be administered at the ambulatory day care centre of the Regional cancer centre of our hospital were included for the study during a three month period in June- August 2013. Medication errors were evaluated for the 500 patient observations as well as the corresponding prescriptions and transcriptions.

Medication errors

In the 500 patient observations, medication errors were observed in 208 (41.6%) patients. Out of a total of 208 medication errors, 114 (54.8%) were prescription errors, 51 (24.5%) were transcribing errors and 43 (20.7%) were administration errors.

Prescription details

The prescriptions were handwritten on standard printed prescription order sheets. The age, status and experience of the prescribers at RCC varied, which included both junior and senior faculty of the departments of medical oncology and radiotherapy. Patients with different cancers received chemotherapy treatment at the day care centre like cancers of breast, ovary, colon, stomach, lung, tongue and larynx, osteosarcoma, cholangiocarcinoma, acute myeloid leukemia, acute lymphoblastic leukemia, Hodgkins lymphoma, Non Hodgkins lymphoma and Ewings sarcoma

Prescription errors

Out of the 500 prescriptions analysed, 114 prescriptions had errors. We identified 286 potentially harmful errors in the 114 prescriptions and 1200 errors in total that did not fit into our criteria of potentially harmful errors. A total of 1486 prescription errors were observed in the 500 prescriptions out of which 45.5 % were due to missing information or omissions. Abbreviations in premedication accounted for 25.4 % and brand names for 23.4% of the total prescription errors. (Table 1).

Common drugs prescribed under brand names were ondansetron (Emeset), ranitidine (Rantac), chlorpheniramine (Piritone), pheniramine (Avil),

promethazine (Phenargan), dexamethasone (Dexona), omeprazole (Omez) and furosemide (Lasix). None of the anticancer drugs were prescribed under a brand name though abbreviations were used. The standard abbreviations used for some drugs were Ara-C (cytarabine), Vp-16 (etoposide), GCSF (Granulocyte-Colony Stimulating Factor) ,L-Asp (l-asparaginase), MTX (methotrexate), VCR (vincristine), 5-FU (5 Fluorouracil) and VBL(vinblastine). Non standard abbreviations were used in 8 prescriptions. Common non-standard abbreviations for anti-cancer drugs were pacli (paclitaxel), carbo (carboplatin), cyclo (cyclophosphamide), gemcite (gemcitabine) and doce (docetaxel).

Incompleteness of the prescription with regards to omission of patient's age, diagnosis, premedication and cytotoxic drug details- dosage form, drug name, dose with unit, diluent, route and time of administration are shown in Fig 1. Prescriptions without diagnosis and incomplete premedication accounted for majority of the omissions. In all prescriptions, name of the patient was written but in 86 prescriptions, age was missing.

Incomplete premedication was prescribed in 189 prescriptions. Premedication was considered complete when drug name, dose, route and time of infusion were all mentioned. The premedication in general consisted of hydration with normal saline, ondensetron (antiemetic) at a dose of 8mg i.v. for adults and 4mg or 2mg i.v. for children, dexamethasone(steroid) 4mg or 20mg and ranitidine (anti-ulcer) 50mg i.v. Some medications like cisplatin were prescribed along with all the four pre-medications both before as well as after anticancer chemotherapy medications. The incompleteness of pre-medication was confirmed with the medical oncologist.

Under the head 'others', omission of adjuvant drugs like morphine as analgesic, laxatives to get relief from morphine induced constipation and antiemetics were included. Error per prescription was calculated to be 2.97 (total errors/500). Out of the 1486 errors, 286 (19.3 %) errors were potentially harmful (Table 2). Potentially harmful error per prescription was found to be 0.57 (total potentially harmful errors/500)

Administration and transcribing errors

The relative frequency of prescription, transcription and administration errors were 58%, 23% and 19% respectively. Here prescribing and administering errors refers to the potentially harmful and signifi cant administration errors respectively. 114 (22.8%) prescriptions were found to contain potentially harmful prescription errors. Errors were found in 43 (8.6%) administrations, 24 in drug preparation (55.81%), 3 in premedication (6.9%) and 1 in route of administration (2.3%)(Figure 2). While considering only potentially harmful prescribing errors, significant transcribing and administering errors, the relative frequency of prescription, transcription and administration errors were 58%, 23% and 19% respectively.

Significant drug preparation errors included those preparations where the difference between the prepared dose strength and the prescribed dose strength was more than 5%. The drugs given in a wrong dose (including

Table 1. Types of prescription errors and their frequency

Prescription error type	Frequency of errors (%) (Out of 1486 total errors)
Missing information	676 (45.5)
Brand names	348 (23.4)
Prescriptions with abbreviations in:	
Premedication	378 (25.4)
Anticancer drugs	76 (5.1)
Poor legibility (overall)	5 (0.3)
Drug dose unclear or wrongly written	3 (0.2)

Table 2. Distribution of potentially harmful prescription errors

Prescription error type	No. of errors (%) N= 286
Incomplete Premedication	189 (66.08)
Dosage form missing	3 (1.05)
Non-standard cytotoxic drug abbreviations	8 (2.80)
Wrong Dose	3 (1.05)
Unit missing	12 (4.2)
Diluent missing	5 (1.75)
Route of administration missing	7 (2.45)
Time of infusion missing	59 (20.63)

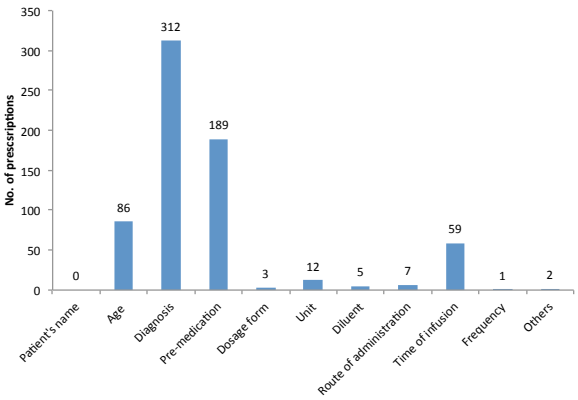

Figure 1. Distribution of missing information in drug prescriptions

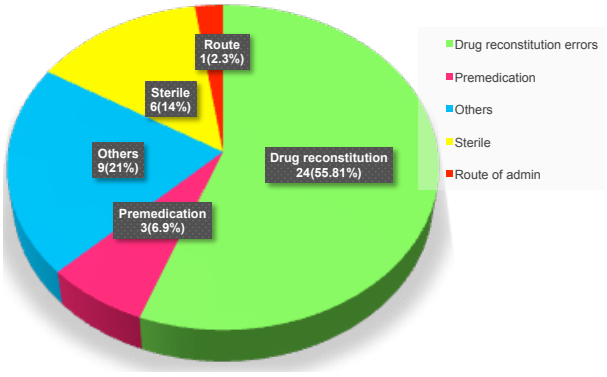

Figure 2. Distribution of Significant Administration Errors

Table 3. Drugs Implicated in Preparation/Reconstitution Errors

Sl. No.	Chemotherapeutic Agent	Number of errors			
		Overdosage	Underdosage	Not quantifiable	Total
1	Adriamycin	2	1	1	4
2	Carboplatin	3	1	1	5
3	Cyclophosphamide		6	2	8
4	Cisplatin	3	1		4
5	Daunorubicin	1			1
6	Dacarbacin	3			3
7	Docetaxel	5		3	8
8	Epirubicin		1		1
9	Etoposide	1	2	1	4
10	Gemecitabine	2	2		4
11	L-ASP		1		1
12	MESNA		1		1
13	Oxaliplatin		2		2
14	Paclitaxel	3	4		7
15	Pemetrexed	1			1
16	Vincristine	2			2
	Total	26	22	8	56

the non- significant ones) are shown in Table 3. In one instance there was an error in preparing two drugs for the same patient. In another instance more than double the prescribed dose of adriamycin was prepared by the nurse. Eight preparation errors could not be quantified in these categories and hence not included here.

Route of administration was wrong on one occasion. G-CSF injection was wrongly being given by intramuscular route instead of subcutaneous route. The error was prevented due to intervention by the principal investigator and the head nurse, hence the nurse giving the injection was alerted before she could inject the drug by intramuscular route.

Premedication was incompletely given on three occasions, the dose of the drug was incorrect on two occasions and antihistamine was omitted on one occasion.

In one instance, the pharmacy did not provide a drug but the error of missing a drug administration (omission) was prevented as the nurse checked the prescription and obtained the drug from the pharmacy. In several occasions if the pharmacy provided inadequate dose of the drug, the nurse rechecked and errors were prevented. In another instance, a wrong labelling was made for a set of drugs with a patient's name who was not supposed to receive those drugs. However, the nurse realised the mistake herself and corrected the labelling. In another instance, oxaliplatin had been prescribed to be diluted in saline which was a mistake. The physician himself remembered, called for the patient and made the necessary changes on the prescription. In cases of doubt regarding the dose, the nurses clarified the same with the physicians for most of the administrations. Such errors were included in the 'other errors' category. No site extravasations were noted during the study and never was a drug omitted while administration. Sterile precautions were not followed in six administrations as judged by the principle investigator.

The total administration errors per prescription were found to be .086 (43/500). Out of 500 nurses' records that were compared with doctor's prescriptions, 51(10.2%) were found to have errors in recording (transcribing errors) which were mainly in copying units for drug dose or diluents.

Discussion

We have observed that medication errors are quite common in the ambulatory day care unit of our regional cancer centre. In our study 41.6% of chemotherapeutic medication errors were detected by chart review and direct observation. This is quite a large number while compared to the chemotherapy medication error rates reported in literature which ranges from 0.04% to 23.1 %. (Walsh et al., 2009; Ford et al., 2006; Gandhi et al., 2005; Ranchon et al., 2011). The lower rates in the published studies reflect the different setting and methodology in these studies reported from the developed countries of the United States and France. Prescription charts were only reviewed in three of these studies and in only one administration error was studied where the nurses self-reported the errors and the authors describe it as gross underreporting. Moreover these studies did not include slips or omissions and brand name prescribing, which accounted for majority of the prescription errors in our study (Table 1). In addition, computerized prescription order entry were adopted in the hospitals where these studies were done or hand written prescriptions were entered into a computer and later validated. Two of the recently reported studies from India (Dhamija et al., 2014; Oberoi et al., 2014) observed an error rate of 13.6 and 12.1 %, far less than that found in our study. But in these studies, chemotherapeutic errors were evaluated in pediatric cancer units in a smaller number of patients and in our study the subjects were predominantly adults. Moreover, the type of cancers, their frequency and the anticancer drugs used differ in children while compared to the adult cancers. However, comparable error rates of upto 39.1% have been found in studies involving medicines other than anticancer drugs (Nguyen et al., 2015; Karna et al., 2012) indicating a generalized tendency to error with medications.

Prescription errors accounted for half of the medication error cases at a rate of 3 per prescription. The majority of the prescription errors were due to missing information

followed by premedication abbreviations and brand name prescribing. The potentially harmful prescription errors in our study was 23% which is much higher than that reported by Gandhi et al (2.5% of prescription orders) Potentially harmful prescription errors were quite high in our hospital as we have reported with 1500 prescriptions earlier (Mathaiyan et al., 2015). A high patient load and inattention to ensure completeness in prescription writing by the physicians were the attributable reasons for the errors. A variety of methods have been used to assess the severity of prescription errors and many studies have estimated the potential harm rather than the actual harm (Gandhi et al., 2005; Garffield et al., 2013; Bobb et al., 2004; Gijssel-Wiersma et al, 2005).

An administration error of 11.2 % (8.6% significant errors) was observed in 500 patient drug administration. This is lower than that observed by Ford et al (43%) but higher than that reported by Ranchon et al (1%). The majority of the administration errors were due to errors in dispensing. There was one instance where an error was intercepted before it reached the patient. Some attributable reasons were that the reconstitution and drug administration were done in the same room with a large turnover of patients for day care chemotherapy injections with 2-3 nurses taking care of 8-15 patients at a time. There were problems in handling the medications- docetaxel injection froths during withdrawal and it was difficult for the nurse to withdraw all of the liquid from the vial, the total volume being made up with withdrawal of saline in some cases resulting in underdosage. Paclitaxel was available as 260 mg in 43.34 ml liquid making it difficult to self-calculate and administer the correct dose prescribed. Cyclophosphamide injection required vigorous shaking over 10 min after reconstitution and had to be administered immediately after shaking. Cyclophosphamide and docetaxel were commonly involved in drug dosing errors in our study. In study by Ranchon et al, carboplatin and fluorouracil attributed to highest drug dosing errors. The details of drug reconstitution and their problems have not been described in that study.

In 51 out of the 500 Nurses' records, there were discrepancies with the doctors' prescription like incorrect or absent units for drug dose or diluents. This is mainly attributed to the increased workload of the nurses.

The results of this study highlights the need to take measures at our hospital to reduce the prescription errors by improving the physician recruitment and sensitizing the existing prescribers towards the need to reduce prescription errors. Implementation of Computerized Prescription Order Entry (CPOE) may reduce the errors to some extent as it would save time for the prescribers to avoid writing patient particulars in the prescription order for a second time after registration and this time could be utilized to take care to write the body of the prescription containing drug details, dose, frequency, premedication details etc. However this would take some time to be implemented in resource poor settings where free medical care is provided. The problems of adoption and implementation of computerized prescriptions has been recognized and discussed (Charles et al., 2014; Baysari et al., 2011) which reinforces that they are only a part of the process in improving patient safety.

It is very important to take adequate measures to reduce the administration errors to minimum possible. Many errors have been prevented by nurses due to vigilant intervention. In case of doubts regarding dose or diluents, the nurses always confirmed with the doctor before administering. No serious adverse event came to the investigator's notice during the observation period. Despite patients with same names, mix-ups were never reported due to proper labelling of all drugs to be administered and the 'box system' where the injections to be given were kept into separate boxes and labelled appropriately. To avoid any further mix-ups the nurses confirmed the patient's name from the patient or their attender before each drug administration. However, taking into consideration the toxicity profile of the anticancer drugs, it is imperative for a trained nurse or pharmacist to check the calculated or reconstituted dose before being administered by the nurse. Standard operating procedures (SOPs) and check lists at the administration area needs to be maintained and a dedicated teamwork from the physicians, pharmacists and nurses is mandatory for minimizing the administration errors at ambulatory day care cancer centres. In addition, periodic training of the nurses to emphasize the consequences of the transcription errors, the risk of harm to the patients and the need to minimize these errors needs to be put into routine practice. Introduction of CPOE can avoid transcription errors to a large extent. Blame free error reporting among the nurses and pharmacists needs to be emphasized time and again and implemented.

The strength of our study is that it considers three aspects of medication errors- prescription, transcription and administration involving a group of drugs with high level of toxicity and a narrow therapeutic index in a resource poor setting. Even trivial errors like writing brand names, use of abbreviations have been included paving way for improvement in prescription writing in a rational way thus avoiding errors to a high risk population of patients. However there are some limitations in our study. Observations were not followed up to check the consequence of medication error which would have helped to classify the severity of errors based on severity classification system developed by the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) and used by other studies (Fyhr and Akselsson, 2012). However we have identified potentially harmful prescription errors and significant administration errors out of the total errors, based on short term observation and judgements made in the absence of actual harm.

In conclusion, a high rate of medication errors have been found in the ambulatory day care unit of RCC which involve prescription writing, transcribing into nurses records as well as in administration of anticancer drugs. However, none of the errors resulted in any harm to the patient during the short observation period, although there were errors with the potential to cause patient harm. Our study has highlighted the need to establish a blame free error reporting system particularly in wards dealing with high risk medications such as anticancer drugs,

double checking of the calculated drug doses before administration, SOP preparation and adherence. Measures like computerized prescription writing, periodic training of the doctors, nurses and the pharmacists to sensitize them towards patient safety and improving quality of care at the cancer units may help to reduce medication errors to a large extent in the future.

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