Archives of Pharmacy Practice

Research Article

OPEN ACCESS

ISSN 2045-080X Vol. 2, Issue 1, 2011

Medication Errors: A Prospective Study Conducted and Reported Through Prescription Monitoring in Tertiary Care Teaching Hospital

Praveen Kumar Tavva NVR*, Mohanta GP & Parimalakrishnan S

Department of Pharmacy Practice, Annamalai University, Annamalai Nagar – 608002. Tamil Nadu, India

Citation: Praveen Kumar Tavva NVR*, Mohanta GP & Parimalakrishnan S. **Medication Errors: A Prospective Study Conducted and Reported Through Prescription Monitoring in Tertiary Care Teaching Hospital.** Archives of Pharmacy Practice. 2011;2(1), pp 33-37.

Abstract

Objective: This study was conducted to know the occurrence of medication errors by monitoring the Physician order entry (POE) error, Hand written prescribing (HWP) error.

Methodology: The study was conducted in tertiary care teaching hospital, which is located at southern part of India having 1210 beds. Totally 3600 prescriptions were audited for the POE and HWP.

Results: The total proportion of MEs was significantly lesser with POE (707 errors from 1600 prescriptions, 44.18%) than with HWP (1094 errors from 2000 prescriptions, 54.7%). The proportion of errors reduced with time following the introduction of POE. Two errors with POE resulted in morbidity to patient consequently made to increase in hospital stay and in our study, we find out various types of MEs and HWP during study period. There was a reduction in major/ moderate patient outcomes with POE.

Conclusion: Introduction of POE was associated with a reduction in the proportion of MEs and an improvement in the overall patient outcome. Moderate and major errors, however, remain a significant concern with POE.

Key words:

Medication Errors, Physician order entry, Hand written prescription, morbidity, mortality.

Manuscript History:

Article Received on: 5th Oct, 2010
Revised on: 7th Jan, 2011
Approved for Publication: 29th Jan, 2011

***Corresponding Author:**

Praveen Kumar Tavva NVR

Department of Pharmacy Practice, Annamalai University, Annamalai Nagar – 608002. Tamil Nadu, India
Phone No: +919629314747 Fax No: 04144-238080

Email: praveenkumar_nvrt@yahoo.com

Introduction

Medication errors can increase mortality and morbidity and add to healthcare costs [1]. Medication errors is defined as any preventable event that may cause or lead to inappropriate the medications in the control of the health care professional, patient, or consumer prescribing, order communication, project labeling, packaging, and nomenclature; compounding, dispensing, distribution and analysis.

Error is defined as "the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim" [2]. Errors can happen in all stages of the care process from diagnosis to drug administration. Not all errors result in side effects or adverse events. According to Reason JT, errors occur as a result of two kinds of failures as follows (1) the correct action does not proceed as intended (an error of execution) and (2) the original intended action is not correct (an error of planning) [3] , and the physician order entry.

Table No. 1: Categories of Medication Errors

Category	Results
No Error	
A	Circumstances or events that have the capacity to cause error
Error, no harm	
B	An error occurred, but the medication did not reach the patient
C	An error occurred that reached the patient but did not cause patient harm
D	An error occurred that resulted in the need for increased patient monitoring but no patient harm
Error, harm	
E	An error occurred that resulted in the need for treatment or intervention and caused temporary patient harm.
F	An error occurred that resulted in initial or prolonged hospitalization and caused temporary patient harm.
G	An error occurred that resulted in permanent patient harm.
H	An error occurred that resulted in a near – death event (e.g., anaphylaxis, cardiac arrest)
Error, death	
I	An error occurred that resulted in patient death.

Errors of omission are where a prescription is incomplete in some way where as errors of commission containing incorrect information [4]. It is the prescriber who takes the responsibility for initiating, monitoring and terminating any drug treatment, no matter what the role of the patient may be, or to what extent he or she has relied on others to undertake this responsibility. However the pharmacist on the other hand is responsible for ensuring the quality of medicines and meticulous dispensing. The pharmacist also has a task to encourage the patients to use the medicines in the best possible manner [5].

Medication error is a deviation from the prescribers handwritten or typed medication order or from the order that the prescriber has entered into the records or computer system. Medication errors are typically viewed as related to administration of a medication, but they can also include errors in ordering or delivering medications [6].

Table No. 2: Types of Medication Errors

Types	Contributing Factors	Causes
Extra dose	Distractions	Performance deficit
Improper dose/ quantity	Workload increase	Performance deficit not followed
Omission error	Inexperienced staff	Knowledge difficult
Prescribing error	Shift change	Inaccurate or lack of documentation
Unauthorized drug	Agency/temporary staff	Confusing communication
Wrong administration	No 24 hour pharmacy	Incurable or omitted transcription
Technique	Insufficient staffing	Computer entry
Wrong dosage form	Emergency situation	Drug distribution system
Wrong drug preparation	Cross coverage	Inadequate system safeguards
Wrong patient	Code situation	Illegible or unclear handwriting
Wrong route	No access to patient	

The successful implementation of POE (physician order entry) becomes even more complicated in middle and low-income countries with economic and human resource constraints [7]. One such country is the Islamic republic of Iran, a country in the Middle East with a population of 70 million as of 2006 [7,8]. Iran is cooperating with the World Health Organization to extend the use of information technology and evidence-based decision making in the health sector [9].

Studies performed in Iran demonstrate that medication dosing errors and adverse drug events (ADE) are significant problems for the Iranian healthcare system [10, 11]. In almost all Iranian hospitals that have implemented electronic medical record systems, nurses or professional operators enter medical information into the computer. Physicians do not interact with the system at all, or their interaction is limited [7].

Methodology

The study was conducted in a tertiary care teaching hospital located in southern part of India, which is having 1210 bed and with multispecialty. A prospective observation study was conducted for a period of 24 months from November 2008 to October 2010. The study was carried out in all of the in-patient wards.

Inclusion Criteria

- All prescription errors including transcription errors.
- Errors related to wrong drug, wrong time, wrong dose, wrong route, was included in the study.

Exclusion Criteria

- Outpatient department and nursing care department errors are excluded from the study.

Results

In our study we have audited and analyzed 3600 prescription during the period of 24 months. Particularly reviewing the prescription in terms of hand written prescription errors, it is seen that in majority 171 (8.55%) of the cases no formulary followed, in 152 (7.6%) of cases Administration was not in accordance with Prescription and in 150 (7.5%) prescriptions irrelevant information was mentioned that have no relevance with the dispensing/ administration of medicine. Details about the hand written prescription errors and errors in the physician order entry are shown in Table 3. Finding revealed that in about 1799 (49.9%) of prescriptions no error was observed. However, in 1676(46.5%) prescriptions errors were there but luckily no harm was reported while administration. In about 125(3.5%) prescription with potential harm to the patients were reported. Of whom 95(2.6%) were type E errors while in 30(0.8%) prescription type F errors were seen.

Discussion

MEs are preventable whereas the adverse effects of care, whether or not it is evident or harmful to the patient. This might include an inaccurate or incomplete diagnosis or treatment of a disease, injury, syndrome behavior, infection, or other ailment. Previous studies have highlighted a low compliance with POE and a high resistance to acceptance of it among physicians, as well as the failure of POE systems in developed countries [12-15]. The initial intention of this study was to investigate whether HWP (hand written prescription) as an alternative order entry method was at least as effective as POE in reducing medication dosing errors. Surprisingly, we observed that the overall rate of non-intercepted dose and frequency medication errors was in fact lower under HWP than POE.

One reason for the lower error rate is that the prescribers complied with a higher rate of warnings in the HWP than in the POE period. The result was a significant reduction in the rate of non-intercepted prescription errors. Other studies have also reported that decision support systems can reduce prescription errors if prescribers comply with the system's recommendations [16, 17]. Since in the POE period a majority of the no intercepted errors occurred in the prescription stage, reduction of prescription errors resulted in an overall reduction of no intercepted errors. Previous studies in the paediatrics and neonatal settings

show that a majority of errors occur in the prescription stage [18].

In addition, most of the errors that were not intercepted by the warnings in the prescription stage reached the patients. Only a few of these errors were caught by the care providers. This reveals the importance of the dose decision support system and prescribers' compliance with the system's recommendations in this context. In developed countries, in addition to decision support systems, clinical pharmacists in many hospitals interact with care providers and supervise the preparation and administration of medications. In many cases, the pharmacy department is responsible for preparing ready-to-administer doses. The results of two studies, one in the United States and one in the United Kingdom, demonstrated a 66% to 80% reduction of medication errors following the active involvement of a senior clinical pharmacist in the clinical rounds [19, 20]. However, in most hospitals in Iran, pharmacists and clinical pharmacologists do not participate in clinical rounds. The pharmacy does not prepare ready-to-administer doses; nurses in the wards are responsible for these. In Iranian hospitals, many responsibilities are left to the nurses. This is mostly because a very hierarchical system exists in these hospitals [21]. Hospital managers often assign to nurses, who are at the bottom of this hierarchy, tasks that physicians or pharmacists object to performing [21]. Medical data entry is one of these tasks. In Iranian hospitals, there are few legal or administrative incentives for physicians to enter medical data into electronic systems [21, 22]. Therefore, strategies such as HWP, which require less physician time, may increase physicians' compliance and result in a more sustainable implementation of computerized provider order entry systems.

In addition, there are several other possible explanations for increased compliance in the HWP errors. One explanation is that in the strictly physician order entry period, resident physicians were more likely to have focused on data entry than on the warnings. They may have ignored the warnings unintentionally because of frustration and stress following a prolonged data entry session. A previous study showed that it is difficult to successfully implement systems that physicians consider to be time consuming [23]. The authors stated that prolonged data entry and user frustration were important causes of the failure of CPOE (computerised physician order entry) in their study [23]. However, in the nurse order entry method, physicians needed only to focus on prescription errors and warnings. This could have increased their attention to the displayed warnings and resulted in better compliance. It is also possible that the new collaborative environment in the HWP error created a better understanding of the advantages of the CDSS (clinical decision support system) and resulted in better physician compliance with the system's recommendations. Today, more and more hospitals in western countries are attempting to redefine traditional borders between doctors and nurses by creating closer collaboration between them in all clinical activities [24, 25]. In countries like Iran, where a hierarchical and physician-centred atmosphere exists in clinical settings [21], for CPOE systems to be successful, it is important that managers and policy makers create a collaborative and patient-centred climate.

Another possible explanation for higher compliance in the HWP errors is that HWP was designed in close collaboration with care providers and reflected their opinions. Therefore, care providers were more compliant with the new order entry method. As other studies have emphasized, care providers' acceptance and their collaboration in the development process are key factors in successful implementation of computerized order entry systems [26].

In addition, the reduction in medication errors can also be attributed to the fact that prescription orders may have been double-checked by the prescribing physicians in the HWP errors. In the HWP model, prescribers had to check transcribed orders before signing them. This provided them with the possibility of double-checking what they had already prescribed before they received any warnings. This double-checking, independent of CDSS warnings, can also explain the observed reduction in prescription error rates in the HWP error.

In our study, despite the non significant difference in the overall rate of transcription errors between the POE and HWP errors, there are certain types of these errors that could be eliminated by POE. When a physician directly prescribes into the computer and prints the order, there can be no discrepancy between the electronic and paper-based order. In contrast, when using HWP, a physician must write a paper-based order and sign it for the nurse so that the nurse can enter the order into the computer. Since this paper-based order is a legal document, when a warning has been accepted, the resident must also update the paper-based order; negligence may result in non-intercepted transcription errors as in our study. Other types of transcription errors were not significantly different between the POE and HWP errors because after the prescription stage, the transcription and administration flows are the same in both systems.

In some region to reduce transcription errors the prescription workflow is simplified and paper is reduced to be limited. These strategies can save time, reduce costs, and may directly affect care providers' satisfaction resulting in higher acceptance. In Iran, many care providers complain that paperwork has dominated clinical care and that computerized systems have created many redundant registrations and documentation [21]. Drug use is a complex process and there are many drugs which are related with challenges at various levels, involving prescriber, pharmacists and patients. While 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, and pharmacists assume active role in appropriate use of drugs. Pharmacy practice entails a health science specialty which embodies the knowledge of pharmacology, toxicology, pharmacokinetics and therapeutics for the care of patients. Health care is nearly 10 years behind other

Conclusion

Introduction of POE was associated with a reduction in the proportion of MEs and an improvement in the overall patient outcome. Our main aim is the error does not reach to the patient is our motto. A zero medication error is impossible. Think to achieve because we are humans and not machines so the only way to reduce the medication errors is thoroughly scrutinizing of all the

steps involved in the medication process.

References

1. Classen DC, Pestotnik SL, Evans RS, Lloyd JF, Burke JP. Adverse drug events in hospitalized patients. Excess length of stay, extra costs, and attributable mortality. JAMA 1997;277(4):301-306.
2. Kohn LT, Corrigan JM, Dohaldson MS, "To errors is human. Building a safer health system", Washing ton DC: National Academy Press; 1999.
3. Reason JT, Human errors, Cambridge: Cambridge University Press; 1990.
4. Rupp MT, Schondelmeyer SW, Wilson GT, Krause JE. Documenting prescribing errors and pharmacist interventions in community pharmacy practice. Am Pharm 1988; NS28: 30-7.
5. Dukes G, Mildred M, Swartz B. Responsibility for drug-induced injury: a reference book for lawyers, the health professions and manufacturers. Amsterdam, Netherland: IOS Press, 1998.
6. Claesson C, Burman K, Nilsson J, Vinge E. Prescription errors detected by Swedish pharmacists. International Journal of Pharmacy Practice 1995; 3: 151-56.
7. Kazemi A, Ellenius J, Tofighi S, Salehi A, Eghbalian F, Fors UG. CPOE in Iran--a viable prospect? Physicians' opinions on using CPOE in an Iranian teaching hospital. Int J Med Inform 2009 Mar;78(3):199-207.
8. World Health Statistics 2008. Geneva, Switzerland: WHO Press; 2008.
9. Country Cooperation Strategy for WHO and the Islamic Republic of Iran 2005-2009. Geneva, Switzerland: World Health Organization; 2006.
10. Gholami K, Shalviri G. Factors associated with preventability, predictability, and severity of adverse drug reactions. Ann Pharmacother 1999 Feb;33(2):236-240.
11. Zargarzadeh AH, Emami MH, Hosseini F. Drug-related hospital admissions in a generic pharmaceutical system. Clin Exp Pharmacol Physiol 2007;34(5-6):494-498.
12. Aarts J, Koppel R. Implementation of computerized physician order entry in seven countries. Health Aff (Millwood) 2009;28(2):404-414.
13. Kaushal R, Jha AK, Franz C, Glaser J, Shetty KD, Jaggi T, et al. Return on investment for a computerized physician order entry system. J Am Med Inform Assoc 2006;13(3):261-266.
14. Massaro TA. Introducing physician order entry at a major academic medical center: II. Impact on medical education. Acad Med 1993 Jan;68(1):25-30.
15. Poon EG, Blumenthal D, Jaggi T, Honour MM, Bates DW, Kaushal R. Overcoming barriers to adopting and implementing computerized physician order entry systems in U.S. hospitals. Health Aff (Millwood) 2004;23(4):184-190.
16. Mekhjian HS, Kumar RR, Kuehn L, Bentley TD, Teater P, Thomas A, et al. Immediate benefits realized following implementation of physician order entry at an academic medical center. J Am Med Inform Assoc 2002;9(5):529-539
17. Eslami S, de Keizer NF, Abu-Hanna A. The impact of computerized physician medication order entry in hospitalized patients--a systematic review. Int J Med Inform 2008 Jun;77(6):365-376.
18. Kaushal R, Bates DW, Landrigan C, McKenna KJ, Clapp MD, Federico F, et al. Medication errors and adverse drug events in pediatric inpatients. JAMA 2001 Apr 25;285(16):2114-2120.
19. Leape LL, Cullen DJ, Clapp MD, Burdick E, Demonaco HJ, Erickson JI, et al. Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. JAMA 1999 Jul 21;282(3):267-270.
20. Simpson JH, Lynch R, Grant J, Alroomi L. Reducing medication errors in the neonatal intensive care unit. Arch Dis Child Fetal Neonatal Ed 2004 Nov;89(6):F480-F482.
21. Kazemi A, Ellenius J, Tofighi S, Salehi A, Eghbalian F, Fors UG. CPOE in Iran--a viable prospect? Physicians' opinions on using CPOE in an Iranian teaching hospital. Int J Med Inform 2009 Mar;78(3):199-207.
22. Pourasghar F, Malekafzali H, Koch S, Fors U. Factors influencing the quality of medical documentation when a paper-based medical records system is replaced with an electronic medical records system: an Iranian case study. Int J Technol Assess Health Care 2008;24(4):445-451.
23. Massaro TA. Introducing physician order entry at a major academic medical center: II. Impact on medical education. Acad Med 1993 Jan;68(1):25-30.
24. Aarts J, Ash J, Berg M. Extending the understanding of computerized physician order entry: implications for professional collaboration, workflow and quality of care. Int J Med Inform 2007 Jun;76(Suppl 1):S4-13.
25. Dempsey C, Larson KW. Can't we all just get along? Know your role in fostering hospital-provider collaboration. Nurs Manage 2004 Nov;35(11):32-35.
26. Ahmad A, Teater P, Bentley TD, Kuehn L, Kumar RR, Thomas A, et al. Key attributes of a successful physician order entry system implementation in a multi-hospital environment. J Am Med Inform Assoc 2002;9(1):16-24.
27. Tipnis and Bajaj, Text Book of Clinical Pharmacy, Carrier Publication, 2003, pg 140-165.

Conflict of Interests:

Authors have no Conflict of Interest

Table No. 3 Type of Medication Errors

Type of Error	Hand Written Prescribing (No. of Errors & Percentage of errors)	Physician Order Entry (No. of Errors & Percentage of errors)
Extra dose (Dose Administered more to the patient than prescribed dose)	40 (2%)	10 (0.62%)
Improper dose/quantity	35(1.75%)	22 (1.37%)
Omission error	22 (1.1%)	10 (6.25%)
Prescribing error	51 (2.55%)	23 (1.43%)
Unauthorized drug	6 (0.3%)	8 (0.5%)
Wrong administration	100 (5%)	22(1.37%)
Technique	25 (1.25%)	11 (0.69%)
Drug prescribed on incorrect drug chart section (e.g. continuous IV infusion prescribed on 'when required' part of drug chart)	8(0.4%)	3 (0.18%)
Drug needed but not given as not prescribed Properly	60 (3%)	31 (1.93%)
Inappropriate/inadequate additional information on prescription to adequately administer the drug appropriately	150 (7.5%)	60 (3.75%)
Dose/units/frequency omitted on prescription	125 (6.25%)	44 (2.75%)
Prescription not signed or change not signed/ Dated	55 (2.75%)	29 (1.81%)
Still wrong next day after pharmacist recommended appropriate correction that was agreed with doctor	15 (0.75%)	8 (0.5%)
Formulary not followed without reason	171 (8.55%)	305 (19%)
Administration not in accordance with Prescription	152 (7.6%)	79 (4.93%)
Required drug not prescribed	79 (3.95%)	29 (1.81%)
Total	**1094/2000**	**707/1600**