Republic of Iraq
Ministry of Higher Education and Scientific Rrsearch
University of AL-Qadisiyah
College of pharmacy

Assessment of medication errors in AL-Diwaniyah maternity and pediatric teaching hospital a focus on dosing of parenteral antibiotics in patients setting

Done by:-

Eman Adnan Talib

Hwraa Abd albarry

Supervisor:-

Ph.D Hussein Ali Saheb

2017 AD **1438 AH**

Dedication

الى المعطي بلا ملل . . . . . (ربي)

((أوزعني إن اشكر نعمتك التي أنعمت علي وعلى والدي وأن أعمل صالحا ترضاه))

تقبله خالصا لوجهك الكريم

إلى خاتم الأنبياء والمرسلين سيدنا ونبينا محمد (صلى الله عليه واله وسلم)

إلى عراق العزه والآباء . . . . . (موطني)

إلى الذي علمنا كيف نجعل الصبر جسداً إلى الطموح . . . . . .

المربي الفاضل ومصدر الحلم والأناة

براً وأحسانا وأكرامنا

إلى من ليس لها في قلبي بديل

وليس لي من قدره على إيفائها وليس إلى من ذلك من سبيل . . . . . .

التي جعل الله الجنه تحت قدميها

إلى من تحلى الحياة بوجودهم

وتشرق الدنيا برضاهم . . . . . (أخواتي)

Index

CHAPTER ONE

Introduction

Introduction

1.1. Errors medication in general

Errors of medication use are among the most common types of medical errors and include mistakes of prescribing, dispensing, administering, or monitoring medications. [1, 2] Children visit the doctor an average of 1.8 times per year, and physicians prescribe medication during 30 percent to 50 percent of these encounters. In a recent survey of 1,600 American Academy of Pediatrics members, pediatricians reported writing prescriptions for 53 percent of patients seen during an average workweek. Among those prescriptions, 73 percent were for short-term acute illnesses, and 29 percent were for chronic long-term illnesses. [3] Despite how frequently medications are prescribed in ambulatory settings, little is known about the frequency and types of medication errors that occur, the clinical importance of these errors, or effective strategies for error reduction.

1.2. Errors medication in children

Children are particularly vulnerable to medication dosing errors because of the unique circumstances involved in prescribing medication to children. In the ambulatory setting, several factors likely contribute to medication errors include the following:

(1) An accurate weight must be obtained and correctly transcribed

(2) The health care provider may need to convert pounds to kilograms

(3) The health care provider must make rapid weight-based calculations for nearly every pediatric prescription he or she writes

(4) The correct preparation and concentration (liquid, chewables, tablets) of the medicine must be included in the dosage calculation

(5) The total daily dose may need to be divided into multiple doses to obtain the appropriate frequency for the medication

(6) Communication with the parent or caregiver often will occur without the medication present

(7) The prescription must be legible and correctly interpreted by the pharmacist

(8) The pharmacist must dispense the appropriate medication in its appropriate formulation labeled with the appropriate dose and frequency.

Tenfold dosing errors in children can easily occur due to a misplaced decimal point or a trailing zero. [4 – 5] For example, a 1.0 mg dose may be misread as a 10 mg dose and not recognized as an error by a pharmacist because the 10 mg dose is still within the range of adult doses for the medication. In addition, health care providers must be aware of both the pediatric dosing recommendations (to calculate a weight-based dose in mg/kg/day) and adult dosing recommendations (to ensure they do not exceed the maximum recommended adult dose in mg/day). Furthermore, children cannot always communicate symptoms that may alert parents and providers to an adverse drug reaction if a medication overdose or underdose is taken by the patient.

1.3. Errors in hospitilized patient and out patient settings

More is known about medication errors in hospitalized patients than in the outpatient setting. Errors in medication ordering are the most common cause of preventable adverse drug events in hospitalized patients. [1, 6] In one adult study, half of all preventable adverse drug events occurred at the physician ordering stage, and the most common type of error was in medication dosing. [1] A study in a tertiary care hospital in New York demonstrated that medication dosing errors were the most common type of medication prescribing error, and these errors occurred at a higher rate in children than adults: 5.89 per 1,000 orders on the pediatric service, compared with 4.12 per 1,000 orders on the adult medical service.[7] In a pharmacy-based review of medication orders in two pediatric hospitals, Folli et al. [8] found that errors occurred in approximately 0.5 percent of medication orders, and the majority of errors were dosing errors. Children under the age of 2 years and pediatric intensive care unit patients were at highest risk. In the most comprehensive study involving pediatric patients, medication errors occurred in nearly 6 percent of all medication orders. [6] Serious medication errors, those in which harm to the patient was possible, occurred at an alarming rate of 10 per 100 hospital admissions or 1 percent of all medication orders. Over half of these errors were dosing or frequency errors, and the physician ordering the medication committed the majority of these errors. Finally, in a retrospective study of medication errors reported to the U.S. Food and drug administration's adverse event reporting system, administration of the wrong dose of medication was the most common type of error resulting in death. [9]

1.4. Errors medication according to Institute of Medicine (IOM) report

The Institute of Medicine (IOM) report on error in medicine identified computerization of medication prescribing as an important patient safety strategy. [2] Computerized order entry, combined with advanced decision support systems, has been shown to reduce prescribing errors in hospital settings across many different drug classes. [10 – 11] Computerized order entry reduces medication errors by standardizing medication orders. Omissions of dose, route, and frequency are eliminated, as are errors from misinterpretation of illegible handwriting or use of nonstandard abbreviations. When coupled with computerized clinical decision support systems that provide feedback to the prescriber at the point of care, computerized prescription ordering has the potential to substantially reduce adverse drug events and improve patient safety.

1.5. Most common medications prescribed in error doses

Antibiotics and sedatives are the medications most widely prescribed in the pediatric population and are the drug classes most commonly reported involved in pediatric medication errors.[12,13,14,15] Subtherapeutic dosing of antibiotics has been identified as a frequent problem in the pediatric population as many clinicians do not consider weight when they calculate the dose or they simply calculate the pediatric dose as one half of the adult dosing.[12,16,17]Optimizing antibiotic dosing is essential to avoid treatment failure and minimize the emergence of resistant organisms.[18]

1.6. strategies to reduce rate of dosing error

Strategies that reduce the rate of dosing errors are essential to minimize harmful consequences. Implementing dosing standardization and polices that guide the medication use process in the hospital setting were found to be important in minimizing medication errors and promoting medication safety and control.[19,20–21] Antibiotic dosing standardization refers to unified antibiotic doses that are based on therapeutic ranges within child weight-based dosing without the need for dose calculation. Dosing standardization removes the risk of calculation errors and reduces the amount of time required for dose calculation by the prescriber. Dose standardization is safer than dose calculation in the pediatric environment because of the milligram per kilogram dosing method that is used for

pediatric patients. Furthermore, dose calculation with the milligram per kilogram dosing method often leads to a dose value to the 10th or 100th decimal place, which is impractical and impossible to measure with accuracy.[22]

1.7. Aim of reserch

The goal of this study was to assessment of dosing errors of parenteral antibotics in pediatric patients setting.

CHAPTER TWO

Patient and Method

Patients and Method

- This is across sectional study which was conducted in maternity and pediatrics teaching hospital , the study extended from (September/ 2016) to (April/ 2017) .
The study include 48 cases (30 male and 18 female) aged 2 month to 12 years.
The stander dose of both Ceftriaxon(50_75 mg/Kg/day) and Amikacin (15_30mg/Kg/day) were calculated according to (pediatric drug doses and BNF for children 2014-2015).
To get the dose per Kg , we divided the prescribed dose on the weight of the patient.

- ***In this study we classify patient into three groups :***
A- patient receive dose lower that mention in text book and consider as a low group.
B- patient receive dose within the range of text book and consider stander group.
C- patient receive dose higher than that mention in text book and consider as a higher group.

- Regarding to Amikacin any patient receive dose less than (15 mg/Kg per day) consider as a lower group while any patient receive dose higher than (30 mg /Kg per day) consider as a higher group , in contrast any patient receive dose range of (15_30 mg/Kg/day) consider as stander group.

- Regarding to Ceftriaxon any patient receive dose less than (50 mg/Kg per day) consider as a lower group while any patient receive dose higher than (75 mg /Kg per day) consider as a higher group , in contrast any patient receive dose range of (50_75 mg/Kg/day) consider as stander group.

CHAPTER THREE

Result

Results

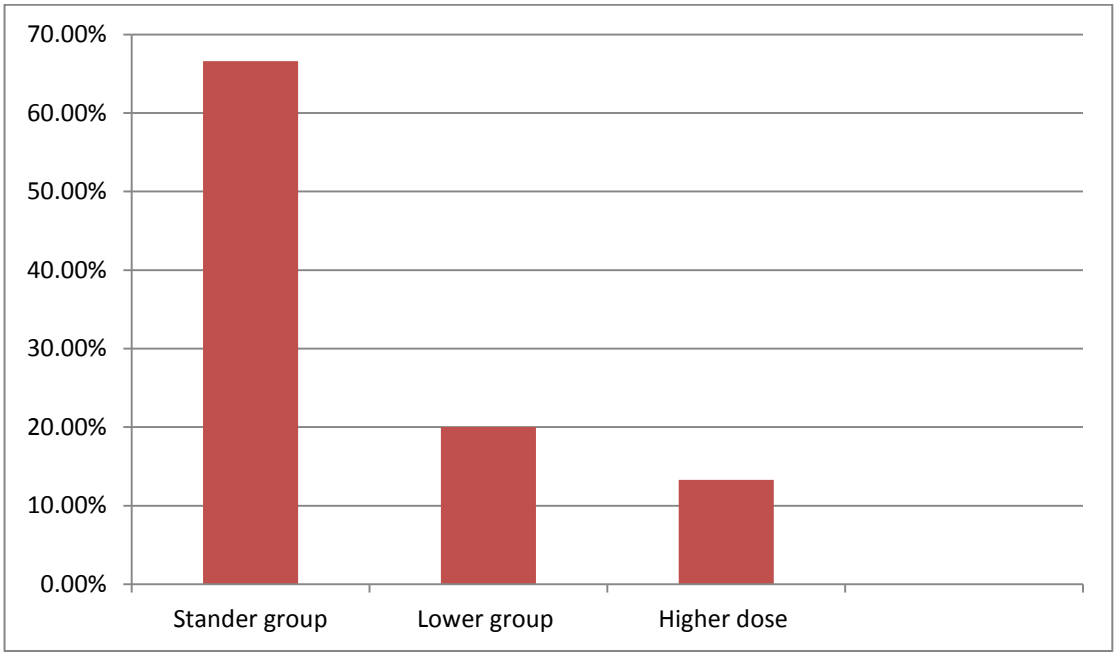
Analysis of Amickacin dose

1- Amikacin:-

1- Stander =66.6%

2- Higher =13.3%

3- Lower =20%

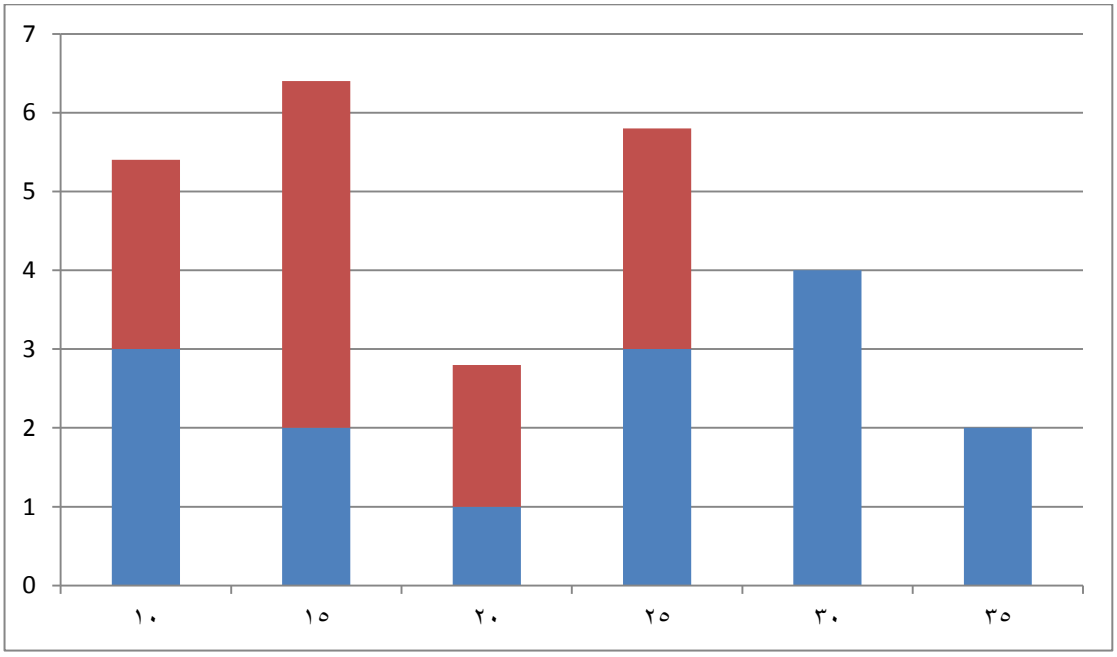


Percentages of Amikacin doeses

- From all 48 cases only 15 cases have Amikacin in there prescription and only (10 cases from 15 cases) were within referance range of dosing (15_30 mg/day). The drug in this dose will reach M.E.C and will be within the curve between M.E.C and M.T.C , the response to disease will be better and incidence of side effect will be be little, while (3 cases from all 15 cases) were have a dose lower than referance range (10_14 mg/day) in this dose the drug may not reach M.E.C.

About (2 cases from all 15 cases) were have a dose higher than normal dose (30_35 mg/day) and in those patients the drug in plasma may reach M.T.C and case sever side effects in patient with a cute disease such as : neurotoxicity, nephrotoxicity (if trough>10 mg /L) , ototoxicity , eosinophilia ,tremor and paresthesia.

Doses of Amikacin listed in below table



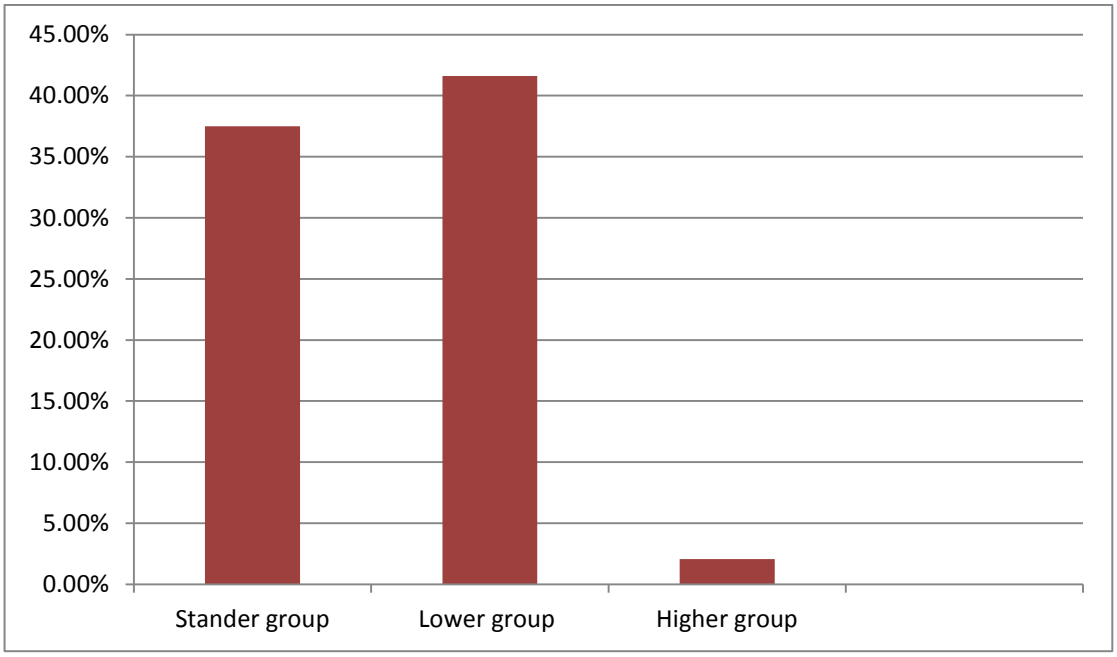
2- Ceftriaxon:-

Analysis of Ceftriaxon

1- Stander =37.5%

2-Lower =41.6%

3- Higher =2.08%



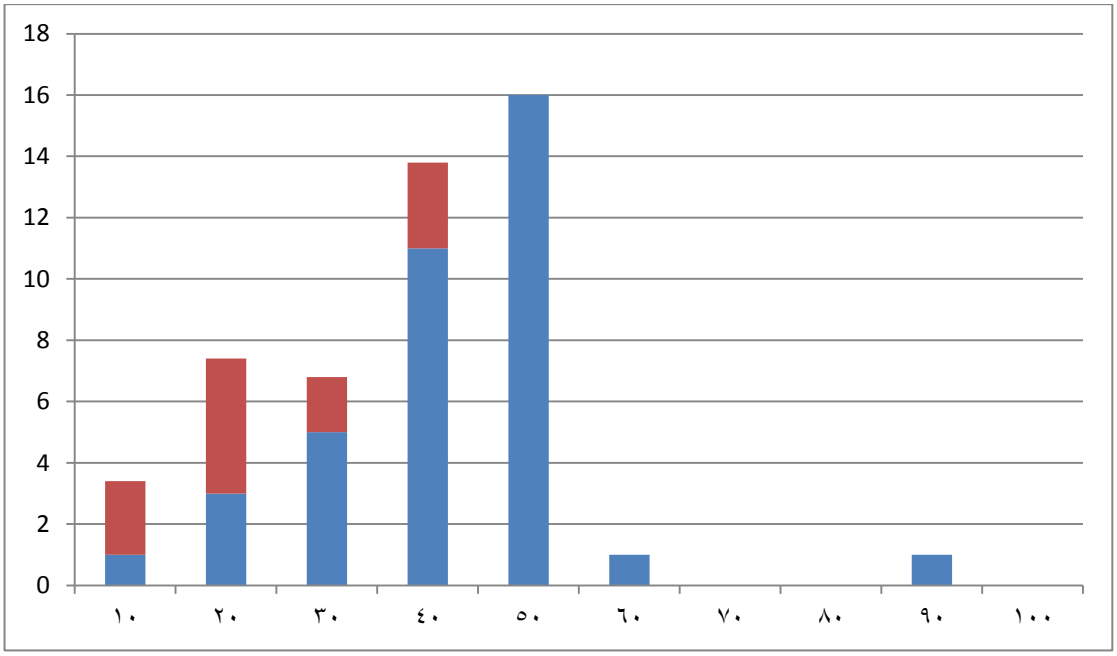
Percentages of Ceftriaxon doeses

- From all 48 cases , 38 cases of them have ceftriaxon in there prescription and about (18 cases from 38 cases) were within reference range of dosing (50_ 75 mg/dose) .

In those patients and not for prolong period of time the drug will have a constant level in plasma to show better therapeutic response, have no or little side effects on children and if the drug is given randomly at dose time (8_ 9 hr.) no resistance to the drug will occur. And from 38 cases 20 case have a dose lower than normal (18 cases) , a low dose may result in ceftriaxon resistance and increase treatment period , patient may need to additional antibiotic which increase incidence of effects and drug interaction specifically if the patients have hypbilirubinemia particularly those who are premature.

About (1 case from 38 cases) were had a dose above than reference range (18 cases) and this dose is prescribed to child have typhoid fever and because this patient have sever infection ,so he need to high dose of flouroquinolon species. However , ceftriaxon is not currently recommended for use in children and pregnant women because of observed potential for causing cartilage damage in growing animals. However , arthropathy has not been reported in children following use of Nalidixic acid Can earlier quinolone known to produce joint damage in young animals or in children with cystic fibrosis, despite high dose treatment .

Doses of Ceftriaxon listed in below table



CHAPTER FOUR

Discussion

Discussion

The result of this current study recorded the percent of error medication in parenteral antibiotics for both amikacin and ceftriaxon are (33.3% and 43.68%) respectively , from total 54 cases. Accordance with the results of the 2,380 medication orders that were analyzed in the present study, 1,333 errors (56%) were identified. The majority of these errors were classified as potentially harmful (1,051, 78.8%) orders reported by Foli for two large pediatric hospitals in the US is 5.9 per 1,000 reported by Lesar, 5.7% reported by Kaushal ,and 5.7% reported by Fortescue. Two more recent studies of medication errors in pediatric intensive care units by Potts and Cimino found that 3.4 and 11.1% of orders had at least one prescription error. However, the definition of medication error was non-uniform across these studies . Both Potts and Fortescue appeared to use a broader definition of medication error.

In general, dosing errors are the most common type of medication error in children, with overdoses generally outnumbering under-doses .In this study, dosing errors were the most common type of error, followed by incorrect t route, order clarity, and frequency.

This quality improvement project of implementing an antibiotic dosing standardization policy resulted in an overall statistically significant reduction in the rate of antibiotic dosing errors for pediatric patients at the hospital. Dosing errors for antibiotic prescriptions were the most common type of medication error in our hospital, and these errors were often not detected by the pharmacy or nursing staff prior to medication administration.

Additionally, this project has significantly improved physicians' prescribing behaviors: weight documentation on antibiotic prescriptions has increased, and dosing interval for antibiotics is more often appropriately prescribed according to the treatment indication.

Weight documentation is one of the most important elements of a prescription for pediatric patients. Without knowledge of the patient's weight, a physician cannot evaluate the appropriateness of dosing. Emergency department physicians often rush to evaluate patients who present with mild to moderate illness and may not document the weight of the child on their prescriptions. According to physicians, antibiotic dosing standardization has reduced prescribing time because clinicians do

not have to use the dose calculation process; rather, they simply need to match the desired antibiotic with the patient's weight.

Clinicians understand that underdosing antibiotics can lead to negative consequences, such as treatment failure, prolonged hospitalization, more frequent emergency room visits, and increased pathogen resistance; while overdosing antibiotics may result in increased adverse effects. The emergence of pathogen resistance has become a global issue, and one effective strategy to reduce this problem is to administer the appropriate dose of antibiotic that will help to eradicate the causative organism.

To our knowledge, this is the first published study that evaluated the impact of an antibiotics dosing standardization on dosing error reduction. However, our study has some limitations. First, it was a single-center study, so findings cannot be generalized to other hospitals. Second, the study period was short because of a limitation of resources. Third, there was no follow-up with patients who experienced inappropriate dosing, so we were not able to evaluate the consequences of dosing errors such as treatment failure or an increase in emergency room or clinic visits.

Conclusion

*The present study was conducted during the period from September 2016 until April/ 2017 , 54 pediatric cases were collected from childrens in different age and from both sexes. The study designed to evaluate the error in parenteral antibiotic dose in pediatric.

The percent of error medication in parenteral antibiotics for both amikacin and ceftriaxon are (33.3% and 43.68%) respectively, from total 54 cases.This study depend on age and weight of patients.

Recommendation

We recommended to condute other study deal with effect of low , high and normal on the response of antibiotic.

The Drs. Shoud be aware about antibiotic doses which must be within normal range to avoid any advers effect.

We hope from the next generations to enlarging researches about this study, because the study of such research is very important.

REFERENCES

Referances

1. Bates DW, Cullen DJ, Laird N. et al. Incidence of adverse drug events and potential adverse drug events. Implications for prevention.ADE Prevention Study Group. JAMA. 1995;274(1):29–34.

2. Kohn LC, Corrigan JM, Donaldson, MS, editors. To err is human: building a safer health system. A report of the Committee on Quality of Health Care in America, Institute of Medicine. Washington, DC: National Academy Press; 2000.

3. American Academy of Pediatrics. Periodic survey of fellows #44; executive summary. Division of Health Policy Research, 200 Nov.

4. Koren G, Barzilay Z, Greenwald M. Tenfold errors in administration of drug doses: a neglected iatrogenic disease in pediatrics. Pediatrics. 1986;77(6):848–9.

5. Perlstein PH, Callison C, White M. et al. Errors in drug computations during newborn intensive care. Am J Dis Child. 1979;133(4):376–9.

6. Kaushal R, Bates DW, Landrigan C. et al. Medication errors and adverse drug events in pediatric in patients. JAMA. 2001;285(16):2114–20.

7. Lesar TS, Briceland L, Stein DS. Factors related to errors in medication prescribing. JAMA. 1997;277(4):312–7.

8. Folli HL, Poole RL, Benitz WE. et al. Medication error prevention by clinical pharmacists in two children's hospitals. Pediatrics. 1987;79(5):718–22

9. Phillips J, Beam S, Brinker A. et al. Retrospective analysis of mortalities associated with medication errors. Am J Health Syst Pharm. 2001;58(19):1835–41

10. Wilson AL, Hill JJ, Wilson RG. et al. Computerized medication administration records decrease medication occurrences. Pharm Pract Manag Q. 1997;17(1):17–29.

11. Raschke RA, Gollihare B, Wunderlich TA. et al. A computer alert system to prevent injury from adverse drug events: development and evaluation in a community teaching hospital. JAMA. 1998;280(15):1317–20.

12. Kaushal R, Bates DW, Landrigan C. Medication errors and adverse drug events in pediatric patients. *JAMA*. 2001;285(16):2114–2120.

13. Wong IC, Ghaleb MA, Franklin BD, Barber N. Incidence and nature of dosing errors in paediatric medications: a systematic review. *Drug Saf*. 2004;27(9):661–670.

14. Coté CJ, Karl HW, Notterman DA. Adverse sedation events in pediatrics: analysis of medications used for sedation. *Pediatrics*. 2000;106(4):633–644.

15. Aneja S, Bajaj G, Mehandiratta SK. Errors in medication in a pediatric ward. *Indian Pediatr*. 1992;29(6):727–730.

16. Naqvi SH, Dunkle LM, Timmerman KJ. Antibiotic usage in a pediatric medical center. *JAMA*. 1979;242(18):1981–1984.

17. Van Houten MA, Luinge K, Laseur M. Antibiotic utilisation for hospitalised pediatric patients. *Int J Antimicrob Agents*. 1998;10(2):161–164.

18. Levy SB, Marshall B. Antibacterial resistance worldwide: causes, challenges and responses. *Nat Med*. 2004;10(suppl 12):S122–S129.

19.Kohn LT, Corrigan JM, Donaldson MS. *To Err Is Human: Building a Safer Health System*. Washington, DC: National Academy Press; 1999.

20. Wong IC, Wong LY, Cranswick NE. Mini-mising medication errors in children. *Arch Dis Child*. 2009;94(2):161–164.

21. Levine SR, Cohen MR, Blanchard NR. Guidelines for preventing medication errors in pediatric. *J Pediatric Pharmacol Ther*. 2001;6(1):426–442.

22. MacKay MW, Holley M, Cash J. Dose standardization of oral liquid medications in a pediatric hospital. *Hosp Pharm*. 2005;40:582–587.