Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

Journal of University Studies for Inclusive Research
Vol.16, Issue 23 (2023), 11972 - 11993
USRIJ Pvt. Ltd

Improving the quality of patient service to reduce medical errors- A Narrative Review

1- **Murad Mamdouh Aleidiney**; anesthesia technology , East Jeddah General Hospital, Jeddah.

2- **Mohammed Ahmed Alzahrani** - King Fahad General Hospital - Jeddah city - Respiratory therapist.

3- **Salman Rizgullah Alnakhli** - King Fahad General Hospital, Jeddah city - Respiratory Therapist.

4-**Majed tariq eskandarani** - King fahed general hospital - jeddah City - respiratory therapist.

5- **Saud Saied Felmpan**-
King Fahad armed forced hospital jeddah -Anesthesia technology.

6- **Suhail Abdullah Eid Alzahrani** - Yanbu General Hospital - Yanbu city - anesthesia technology

**Corresponding author*

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

Abstract

Introduction: Information technology has been a mainstay for reducing medication errors. Despite success at reducing medication errors, technology such as physician order entry and bar code-assisted administration systems require considerable financial investment, health care professional training, and system maintenance. This review aimed to highlight the strategies for prevention and reduction of medical errors in different health settings.

Methods: A systematic search of literature relating to medical errors in prescribing, transcribing, dispensing, administration and documentation in adults and children. The search strategy included all ages, all languages, and all types of trials and studies. References from eligible articles were also hand-searched in order to identify additional relevant papers. We included all types of studies, such as randomized controlled trials, non-randomized controlled trials, longitudinal studies, cohort or case–control studies, and descriptive studies that reported the incidence of medication errors or identified the causes of in different countries, either in adults or children.

Results: The results of this search strategy revealed that more than 500 articles were eligible for this review however many studies were exclude as they were excluded, as the papers were reviews, letters, conference papers, opinions, reports or editorial papers. This left 14 articles for full-text retrieving and four additional relevant studies were identified after hand-searching of the references of these studies. Forty-five articles were therefore finally relevant and are included in this systematic review. The abstracts of four studies were in English but the full texts were in foreign languages which were excluded.

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

Conclusions Medical errors and adverse events are very common in various health settings, and among them the most prevalent involve medications. Many valid indicators have been developed and the prevention of medical errors and adverse events requires combined changes in ICU organization and healthcare worker behaviors. **Keywords**: ***Medications, Errors, Prescription, Prevalence, Reporting.***

Introduction

Errors in medical care are common and have important implications for patient health, physician trust, and institutional integrity. In reality, how should a physician or caregiver act if he or she is genuinely uncertain about whether a particular adverse outcome is the result of an error [1]. Medication errors are one remediable portion of the safety continuum. The complexity of modern pharmacotherapy lends itself to confusion by patients and errors by health care professionals. Additionally, studies have reported hospital inpatient medication error rates of 4.8% 4 to 5.3% 5 and a relationship between medication errors and adverse events [2].

Medication errors are an important clinical issue. However, even at the most fundamental level, the definitions associated with these errors can be confusing, and the impact on individuals and society can be underappreciated. This article provides an overview of medication errors for practicing physicians and focuses on medication error terminology and definitions, incidence, risk factors, avoidance strategies, and disclosure and legal consequences. Importantly, although some medication errors cause harm to the patient, most do not. For example, if a patient

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

is given an antibiotic for the first time and a rash develops, it is an adverse drug event that was not caused by a medication error. In contrast, if the patient is already known to be allergic to an antibiotic and is still given that drug, the rash that develops is an adverse drug event due to a medication error. Categories of medication errors have been developed in an attempt to standardize communication and reporting. When categorizing errors, it is also beneficial to account for the consequences of those errors, including patient harm [3].

Medical errors has been extensively studied during the last 25-30 years. A large dictionary of terms has evolved to describe errors from the perspective of the various observers who evaluate system function. errors have been classified with respect to those involved, location, intent, emotion, effort, extent of injury, and detectability, to name but a few . An assessment of the magnitude of the change that errors (mutations) produce, and in which direction the system is moved by the error, is a key consideration as it affects their concept of medical errors [4].Much of the problem in the provision of better and safer health care is a result of preventable adverse events due to medical errors . Some specialties in health care are more prone to errors than others. The notability of surgical specialties with respect to the rate of adverse outcomes and errors in surgical practice has been outlined earlier [5]. The low preventability of such incidents as compared to events occurring in other high-risk zones.

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

In emergency departments (EDs) and intensive care units (ICUs), where both preventability and the disability potential due to the adverse events are high . Apart from the specialties of emergency and intensive care medicine, which are highly interdependent on clinical laboratories, the authors have also reviewed the impact of errors in clinical diagnostic laboratories. In spite of this advantageous position, concern emerges about the high degree of errors reported in literature in clinical diagnostic laboratories [6]. It has been suggested that a majority of errors occurring in a laboratory process are due to preanalytical factors . The high rates of pre-and postanalytical errors undermine the quality performance of the analytical process. However, the focus of these certification and accreditation processes is most often on general performance of a laboratory than particularly on errors and other related issues closely interlinked with quality [7]. Two particularly important quality issues confronting modern laboratory services are the problems.

The other issue facing today's laboratory medicine practice is the identification of errors itself. This environment provides abundant opportunities for generating medical errors. More importantly, it has been suggested that emergency medicine is a crucial area for preventable medical errors . Emergency medicine was one of the first specialties to realize the potential of errors in compromising patient safety and quality of care. Rosen et al. was among the first researchers to study errors in emergency medicine and suggested innovative approaches toward their

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

prevention. It is generally felt that emergency physicians perform fairly well at interpreting plain radiographs, but occasionally significant findings are missed that may lead to adverse outcomes [8]. The complexity of care provided is compounded by understaffing, leading to increased workloads in ICUs. This setting may provide an ideal environment for errors to happen and results in serious consequences for those receiving care. The question arises as to the safety of the present-day ICUs. Abramson et al. was one of the first to study the rates of adverse events in intensive care units. Recently a cross-sectional study investigated the nature and causes of human errors in ICUs through a concurrent incident study. Another interesting study compared the rates of preventable adverse drug events in ICUs with general care units [9]. A recent observational study on medication errors of adult patients in ICU found promising results as compared to earlier studies and reported a rather low 3.3% incidence rate . Some of the common factors promoting errors have been identified as lack of standardization, insufficient labeling of medications, improper documentation, and most importantly, poor communication. Morrison et al. suggested that nursing staff inexperience contributed to adverse patient outcomes in ICUs. Amidst all these disturbing trends in ICUs there seems to be promise. The reporting of incidents, including both adverse events and near misses, is an essential component of improving patient safety [10].

Transitions of patient care are particularly hazardous for introducing medication errors. Voluntary reporting systems, including the US Food and Drug

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

Administration (FDA) MedWatch, the Medication Error Reporting Program, and MEDMARX, are used to track medication errors. Advanced age is a patientrelated risk factor for medication errors. However, the use of these medications in an elderly patient may be appropriate in some cases, and it is not clear which fraction of adverse effects relate to errors. Cognitive biases by health care professionals also may contribute to medication errors. Specifically, confirmation bias, which is the "tendency to look for evidence that supports an early working hypothesis," 27 and lack of situational awareness are cognitive errors that may lead to medication errors [11]. Look-alike names and the therapeutic index of the medication can predispose to medication errors and subsequent harm. Because the root causes of medication errors are diverse, multiple strategies are required to prevent them. Systems thinking such as using quality improvement methodologies to discover and correct root causes of problems rather than blaming an individual, error proofing such as a lean methodology term that means to design an environment in which a mistake cannot happen, such as a cable that can only be plugged into an outlet in one direction, and training have been suggested methods to remediate drug errors or opportunities for drug errors. Information technology has been a mainstay for reducing medication errors. Despite success at reducing medication errors, technology such as physician order entry and bar codeassisted administration systems require considerable financial investment, health care professional training, and system maintenance. Pharmacist participation as a full member of a

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

health care team on hospital rounds also is reported to decrease adverse drug events caused by prescribing errors [12]. This review aimed to highlight the strategies for prevention and reduction of medical errors in different health settings.

Methods

A systematic search of literature relating to MEs in prescribing, transcribing, dispensing, administration and documentation in adults and children. The search strategy included all ages, all languages, and all types of trials and studies. References from eligible articles were also hand-searched in order to identify additional relevant papers. The following keywords were used as search terms: medication error(s), prescribing error(s), dispensing error(s), administration error(s), documentation error(s), transcribing error(s), medication mistake(s), drug mistake(s), prescribing mistake(s), dispensing mistake(s), administration mistake(s), transcribing mistake (s), wrong medication, wrong drug (s), wrong dose(s), wrong route of administration, wrong calculation(s), physician(s), pharmacist(s) and nurse(s). Each of these key words were combined using “OR” then combined using “AND”.

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

We included all types of studies, such as randomized controlled trials, non-randomized controlled trials, longitudinal studies, cohort or case–control studies, and descriptive studies that reported the incidence of medication errors or identified the causes of in different countries, either in adults or children. We excluded reviews, letters, conference papers, opinions, reports or editorial papers. Two independent reviewers screened and selected eligible studies and in case of disagreement they set and reach a consensus.

Results and discussion

The results of this search strategy revealed that more than 500 articles were eligible for this review however many studies were exclude as they were excluded, as the papers were reviews, letters, conference papers, opinions, reports or editorial papers. This left 14 articles for full-text retrieving and four additional relevant studies were identified after hand-searching of the references of these studies. Forty-five articles were therefore finally relevant and are included in this systematic review. The abstracts of four studies were in English but the full texts were in foreign languages which were excluded. The incidence of medical errors in this review is difficult to compare between studies because different methodologies and different definitions were used. Estimates of the results were difficult to compare between studies because rates of error were expressed differently. We classified our results according to where they occurred during the

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

medication treatment process, i.e., prescribing, transcribing and administration. The strategies of prevention and reduction of medical errors were subjected to in-depth reading [13].

The Quality of Australian Health Care Study (QAHCS) reported that more than half of all the adverse events recorded in the study were associated with a surgical operation . The errors in the preanalytical or analytical or the final validation stage of the laboratory process were not included in the study. The authors also acknowledged that some errors may have gone unnoticed as the authors did not make any special efforts to scrutinize reports more intensely . However, after implementation of a zero tolerance policy to address the labeling errors in 1999, there was a gradual decrease in these events from 100% (43/43) in 1998 to 64% (16/25) of the total risk problem in 2002 [14]. Goldschmidt and Lent observed that 12.5% of laboratory errors lead to an erroneous medical decision, 75% of the results were within normal reference limits, and in the remaining 12.5% the results were too absurd to be considered for clinical decisions. The HMP Study II attributed nearly 3% of all adverse events as occurring in the EDs . This assumes significance when one considers that another study identifies EDs as having the highest rate of negligent adverse events and an approximate 95% of adverse events attributed to emergency physicians were judged negligent . The authors found a total of 145 adverse incidents filed in a general ICU. The study reported that the mortality of patients with an incident report filed during their ICU admission was

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

41% as compared to 21% for all ICU patients . A prospective two-center study of adult ICUs reported iatrogenic complications in 31% of the total 400 admissions and 13% of these admissions had major complications as a result of the adverse event [15]. The study suggested that an estimated 1.7 errors occurred per patient per day, and for the whole ICU they reported a severe or potentially detrimental error occurred, on average, twice a day. The study revealed that the rate of preventable adverse drug events was twice as high in ICUs as compared to non-ICUs. The investigators conducted structured interviews that indicated almost no differences between ICUs and general care units for many characteristics of the patient and care giving teams. The authors also failed to notice any correlation of adverse drug events in the units and working environment of the staff [16]. Specific strategies to reduce medication errors were developed.

The variables that showed an important association with medication errors in the univariate analysis were included in the multivariate analysis by using multiple logistic regression. Prevalence of total errors was significantly lower in 2004 compared with 2002 [17].Likewise, the prescription error prevalence was significantly lower in the second phase, and an important reduction in administration errors was also observed. In the second cross-sectional analysis, a reduction of errors was observed in most of the variables related to the category of physicians and nurses, time shift, and area. The most frequent errors were the

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

omission of the prescription order time and not administering a medication. There was a significant reduction of potentially harmful administration errors in the second phase of the study [18]. Only, one study of the frequency of medication errors discovered that fewer than 1% of medication errors resulted in an adverse drug event. Examples of medication errors could include giving a medication to the wrong patient, giving the wrong dose of a medication, not prescribing a medication that was indicated, entering an order for the wrong patient, or forgetting to give a medication that was due [19]. The American Society of Health-System Pharmacists has identified common causes leading to these errors, including drug product nomenclature, illegible handwriting, labelling errors, excessive workload (among physicians, nurses, or pharmacists), and medication availability (manufacturer shortages of medications). In another study, prescribing errors for inpatients occurred 12.3 times per 1000 patient admissions. More than 10,000 medication orders were studied and 5.3 errors per 100 orders were identified. However, they concluded that only 0.9% of the errors actually resulted in adverse drug events. They reported that 19% of the doses were in error; yet, only 7% were judged to potentially contribute to adverse drug events.

The top 10 drugs most commonly implicated in drug errors were (in descending order) insulins, albuterol, morphine, potassium chloride, heparin, cefazolin, furosemide, levofloxacin, and vancomycin [20]. The contributing factors related to these inpatient errors included but were not limited to staffing issues,

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

distractions, workload increases, patient issues, shift changes, cross coverage, and fatigue. The 5 most commonly implicated drug classes, collectively accounting for 27.7% of the estimated adverse drug events, were insulins, opioid-containing analgesics, anticoagulants, amoxicillin-containing agents, and antihistamines/cold remedies. The events included allergic reactions to drugs (33.5%), unintentional overdoses (32.1%), adverse drug effects not related to allergy (28.6%), secondary drug effects (3.5%), and vaccine reactions (2.3%). In the adverse drug events that required hospitalization, the investigators reported that the 5 most commonly implicated drug classes were anticoagulants, insulins, opioid-containing analgesics, oral hypoglycemic agents, and antineoplastic agents. The authors discovered that drugs that are usually monitored on an outpatient basis for toxicitydie, warfarin, insulin, and digoxind accounted for 41.5% of adverse drug event hospitalizations [21]. During the 2-year prospective study, nurses recorded 141 medication administration errors in 4.752 patient admissions (0.03 medication administration errors/patient admission) or 0.04% of medication administrations. 41% were nurse administration errors (predominantly omitted medications and wrong doses), 21% were errors in order writing or transcription (predominantly pharmacy errors) and 38% were errors in medication dispensing (predominantly nursing dispensing errors such as incorrect dose or wrong medications). At the first transcription, 12% of chemotherapy orders had transcription errors [22]. The most common types of errors were missing parenteral formulations (31% of errors) and unreadable transcriptions (25% of errors). At the second transcription, 6.3% of

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

chemotherapy prescriptions included errors, predominantly wrong doses (86%). Nearly half of errors occurred in medication administering (48%), followed by dispensing (30%) and prescribing (10%) [23].

While administration errors were common among inpatients, reports relating to outpatients were more likely to involve dispensing and prescribing errors. Improper dose, wrong time, omission and wrong administration route were the most common types of errors. They report a medication error rate of 3% of all orders in both adult and paediatric patients. 4% of all chemotherapy orders in adults and 1% of chemotherapy orders in children involved errors. Among the medication error subset of potential adverse drug events, 27% were serious (26% in adult and 32% in paediatric patients). Chemotherapy-related potential adverse drug events were more likely to be serious. Prescribing and administration errors occurred in nearly 10% of all medications (7% administration, 3% prescribing errors, 0% pharmacy dispensing errors) [24]. All errors were due to incorrect dosing or failure to administer an indicated medication. Children in the maintenance phase of treatment were at highest risk for experiencing medication errors. Chemotherapy medication errors were reported to have occurred in the workplace of 63% of the respondents in the previous year, and 140 errors were described in total. Common errors include under-and overdosing (39% of errors), schedule and timing errors (21%), wrong drugs (18%), chemotherapy given to the wrong patients (14%) and other incidents, such as infusion-rate errors,

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

omission of drugs or hydration, improper preparation of drugs. 10% of errors required medical intervention and prolonged hospital stays. Analysis of errors described by oncology nurses also includes a number of examples in which patients identified and intercepted the error. Patients' reports were analyzed and classified by trained clinicians. 1% of patients reported adverse events, 2% reported close calls, 7% reported medical error without risk of harm and 52% of patients reported events that were classified as quality problems such as waits and delays and poor communication and information [22]. In recognition of the important role medication errors play in patient injury the Joint Commission for the Accreditation of Healthcare Organization (JCAHO) now requires its 17,000 member organizations to have specific procedures in place that target the prevention of medication errors [25].

In the past, much focus has been placed on individual culpability for the occurrence of medication errors, and health care organizations have taken a punitive approach to adverse drug events. Professionals in industry have learned that most workplace errors occur because of underlying systems defects and that individual conduct serves only as a common final pathway to an adverse event. The specialty of emergency medicine is characterized by unique systems challenges that place patients at increased risk for medication errors. In addition, the route of administration used in an emergency can lead to a greater risk of an adverse event. A breach along any one of the links in the chain may lead to an

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

adverse drug event. The two most common factors associated with prescribing errors are lack of knowledge pertaining to the drug prescribed and lack of knowledge regarding the patient for whom the drug is prescribed . An inadequate knowledge base pertaining to the use of medications has been cited as one of the most common causes of medication prescription errors. In addition to each drug having its own potential for toxicity, the occurrence of adverse drug interactions when two or more medications are combined can be difficult to predict. Order appropriate laboratory studies to identify patient characteristics that may place a particular patient at risk for an adverse drug event. Under many circumstances, a hospital pharmacist can assist the EP or nurse by providing useful information about a drug's proper indications, dose, route of administration, adverse effects, contraindications, and other important information.

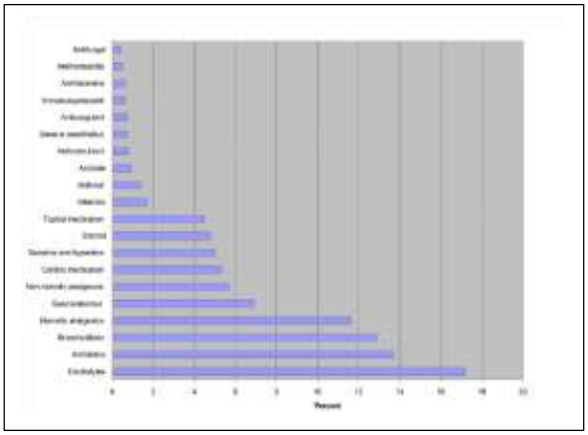
The second most common systemic factor contributing to prescription errors is a lack of familiarity with the unique individual patient factors at play in the therapeutic plan [26]. There are too many possible combinations to be able to explore all the possibilities during the treatment of any given patient. A systems approach, however, in which results are assessed with respect to the overall effects on organizational function, can help overcome some of these challenges. Four variables: human behavior, system behavior, simple systems, and complex systems, will as serve as vehicles to explain why a systems approach can give deep insight into a highly evolved healthcare system [27]. It is unlikely that it will be possible to obtain the same understanding by using other methods of investigation.

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

The matrix of potential interactions is simply too massive. Application of systems methodologies allows the utilization of mathematical probabilities rather than a firm prediction to derive options that can minimize the occurrence of serious errors while simultaneously recognizing that prevention, or reduction of errors, may be achieved only by altering the system to the extent that it is unrecognizable with respect to its original form. Furthermore, changes that are initiated may cause new, unexpected, unintended and possibly unacceptable outcomes. In all the recognizable universe, as a system becomes larger, it's interface with adjoining systems becomes more intense [25].

Conclusions

Medical errors and adverse events are very common in various health settings, and among them the most



Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

Figure (1): Incidence (%) of medication errors in the different medication categories.

prevalent involve medications. Identification of these errors requires efficient reporting systems, usually based on a combination of methods. Many valid indicators have been developed. The prevention of medical errors and adverse events requires combined changes in ICU organization and healthcare worker behaviors. Sharing values and behaviors within the team with the support of hospital leaders is probably the most powerful means of building a safety climate for the patients. Multi-layered programs associated with a profound change in the approach to patient safety offer the greatest likelihood of success.

Conflict of interests

The authors declared no conflict of interests.

References

1. Miller, Marlene., Robinson, Karen., Lubomski, Lisa., Rinke, Michael. and Pronovost, Peter. Medication errors in paediatric care: a systematic review of

epidemiology and an evaluation of evidence supporting reduction strategy recommendations. (2007) Quality and Safety in Health Care. 16(2); 116-126.

2. Sandars, John. and Esmail, Aneez. The frequency and nature of medical error in primary care: understanding the diversity across studies. (2003) 20(3); 231-236.

3. Mazor, Kathleen., Simon, Steven. and Gurwitz, Jerry. Communicating With Patients About Medical Errors A Review of the Literature. ( )

4. Garrouste-Orgeas, Maité., Philippart, François., Bruel, Cédric., Max, Adeline., Lau, Nicolas. and Misset, B. Overview of medical errors and adverse events. (2012) Ann. Intensive Care. 2(1);

5. Pham, Julius., Aswani, Monica., Rosen, Michael., Lee, Heewon., Huddle, Matthew., Weeks, Kristina. and Pronovost, Peter. Reducing Medical Errors and Adverse Events. (2012) Annu. Rev. Med. 63(1); 447-463.

6. Ioannidis, John. and Lau, Joseph. Evidence on Interventions to Reduce Medical Errors An Overview and Recommendations for Future Research.

7. Lewis, Erica., Baernholdt, Marianne. and Hamric, Ann. Nurses' Experience of Medical Errors. (2013) 28(2); 153-161.

8. Kalra, Jawahar. Medical errors: impact on clinical laboratories and other critical areas. (2004) Clinical Biochemistry. 37(12); 1052-1062.

9. Lehmann, Christoph. and Kim, George. Prevention of Medication Errors. (2005) Clinics in Perinatology. 32(1); 107-123.

Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة
ISSN: 2707-7675

10. Otero, Paula., Leyton, Andrea., Mariani, Gonzalo., ´marı ´a, Jose., Cernadas, Ceriani., Patient, The. and Committee, Safety. Medication Errors in Pediatric Inpatients: Prevalence and Results of a Prevention Program. (2008) 122(3); e737-e743.

11. Kaufmann, Jost., Laschat, Michael., Wappler, Frank., Kaufmann, ., Laschat, ., Wappler, . and Kaufmann, . Medication Errors in Pediatric Emergencies. (2012)

12. and Peth, Howard. Medication errors in the emergency department A systems approach to minimizing risk. ( )

13. Rosner, Fred., Berger, Jeffrey., Kark, Pieter. and Bennett, . Disclosure and Prevention of Medical Errors. ( )

14. Schwappach, D. and Wernli, M. Medication errors in chemotherapy: incidence, types and involvement of patients in prevention. A review of the literature. (2010) 19(3); 285-292.

15. Selbst, Steven., Levine, Stu., Mull, Colette., Bradford, Kathleen. and Friedman, Marla. Preventing Medical Errors in Pediatric Emergency Medicine. ( )

16. Shojania, Kaveh., Wald, Heidi. and Gross, Richard. Understanding medical error and improving patient safety in the inpatient setting. ( )

17. Thomas, Jeffery., Wieman, ., Wieman, Eric., Ba, . and Wieman, Thomas. A systems approach to error prevention in medicine. (2004) J. Surg. Oncol.
88(3); 115-121.

18. Wittich, Christopher., Burkle, Christopher. and Lanier, William. Medication Errors: An Overview for Clinicians. (2014) Mayo Clinic Proceedings.
89(8); 1116-1125.

19. La Pietra, L., Calligaris, L., Molendini, L., Quattrin, R., & Brusaferro, S. (2005). Medical errors and clinical risk management: state of the art. Acta otorhinolaryngologica italica, 25(6), 339.

20. Guchelaar, H. J., Colen, H. B., Kalmeijer, M. D., Hudson, P. T., & Teepe-Twiss, I. M. (2005). Medication errors. Drugs, 65(13), 1735-1746.

21. Riaz, M. K., Riaz, M., & Latif, A. (2017). Medication errors and strategies for their prevention. Pakistan journal of pharmaceutical sciences, 30(3).

22. Procyshyn, R. M., Barr, A. M., Brickell, T., & Honer, W. G. (2010). Medication errors in psychiatry. CNS drugs, 24(7), 595-609.

23. Saedder, E. A., Brock, B., Nielsen, L. P., Bonnerup, D. K., & Lisby, M. (2014). Identifying high-risk medication: a systematic literature review. European journal of clinical pharmacology, 70(6), 637-645.

24. Jacobs, B. (2007). Electronic medical record, error detection, and error reduction: a pediatric critical care perspective. Pediatric Critical Care Medicine, 8(2), S17-S20.

25. Jacobs, B. (2007). Electronic medical record, error detection, and error reduction: a pediatric critical care perspective. Pediatric Critical Care Medicine, 8(2), S17-S20.

26. Landrigan, C. P. (2005). The safety of inpatient pediatrics: preventing medical errors and injuries among hospitalized children. Pediatric Clinics, 52(4), 979-993.

27. Ammenwerth, E., Schnell-Inderst, P., Machan, C., & Siebert, U. (2008). The effect of electronic prescribing on medication errors and adverse drug events: a systematic review. Journal of the American Medical Informatics Association, 15(5), 585-600.