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The Most Efficient Methods for Preventing Medication Errors and Enhancing Reporting Systems

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Abstract

Background: Numerous population-based studies have repeatedly found alarmingly high rates of medication errors and avoidable deaths. Reliable practice is built on an effective reporting system for medication errors, which also serves as a gauge of how far we have come in achieving safety. The goal of medication error reporting systems' improvement efforts and system changes should be to lessen the risk of harming future patients. However, the objective of this review is to provide an overview of the culture surrounding reporting medication errors, incidence reporting systems, developing efficient reporting techniques, analyzing medication error reports, and making suggestions to improve reporting systems. **Methods**: From 1 January 1998 to 30 June 2020, electronic databases including PubMed, Ovid, EBSCOhost, EMBASE, and ProQuest were examined. There were 180 articles found, and 60 papers were eventually used in the review. Two reviewers mined the data, and two additional reviewers verified it. The search produced 684 articles, which were then whittled down to 60 by eliminating duplicates through title, abstract, and full-text paper vetting. **Results**: The majority of the studies came from the United States and the United Kingdom. Studies from Canada, Australia, New Zealand, Korea, Japan, Greece, France, Saudi Arabia, and Egypt were among the few that were submitted. Medication error detection, measurement, and analysis demand an active strategy rather than a passive one. There must be initiatives to promote reporting of medication errors, including educating staff about areas for development and identifying the underlying causes (s). A classification system for describing and examining the specifics surrounding individual medication error events is the taxonomy developed by the National Coordinating Council for Medication Error Reporting and Prevention. **Conclusion**: A successful program for reporting medication errors should be safe for the reporter, yield beneficial suggestions and changes that benefit everyone, while also being inclusive and supported with the necessary resources. To move toward a more reliable practice, health organizations must adopt an effective reporting environment for the medication use process.

Keywords: medical errors, medication error, improve, medication error reporting program, health care professional, patients, health organizations.

I. Introduction

Unintentional mistakes made either by commission or omission are referred to as medical errors. Medical errors can be categorized as errors of execution or errors of planning, which are defined as, respectively, the unsuccessful use of deliberate action or the exploitation of an improper plan to achieve a goal or by deviating from the process of care that may potentially harm the patient [1]. According to the US Department of Health and Human Services Office, 180,000 hospitalized patients died as a result of medical mistakes in 2008 [1]. Medication errors account for a significant portion of medical errors, accounting for nearly 1.5 million victims annually [2]. A medication error, according to the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP), is "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is under the control of the health care professional, patient, or consumer." Procedures, medical supplies, professional practice, and systems including prescription, order communication, dispensing, monitoring, product labeling, distribution, compounding, administration, nomenclature and packaging, education, and use can all be connected to these events. These occurrences can be connected to healthcare products, practices, and professional standards, as well as systems that began with nomenclature and packaging, continued with drug administration and monitoring, and were completed with prescribing, transcribing, documenting, reviewing, preparing (or compounding), product labeling, education, and dispensing [3]. The wellbeing of people, organizations, and healthcare systems is significantly impacted by medication errors. Medication errors are the sixth leading cause of death in the United States, and 5-10% of reported medication errors are considered harmful, according to an NCCMERP report [3]. Recent years have seen a rise in medication errors, which are now a problem for healthcare systems and are directly related to hospital mortality and morbidity rates [4]. Particularly, medication errors harm hospitalized patients and erode the public's faith in the healthcare system and the quality of the services being delivered [5]. Additionally, medication errors have a detrimental effect on clinical outcomes like length of stay (LOS) and result in high costs of about USD 2000–2500 per patient [2,6]. Another problem is the high rate of underreporting of medication errors, which is estimated to be between 50 and 60 percent across healthcare organizations [2]. This is due to the fact that many hospitals lack medical recording systems. Because of this, various prevention programs were put into place to keep track of errors, targeting the causes and/or influencing factors of medication errors [7,8,9,10] through the use of carefully designed establishment-wide reporting systems to identify the likely sources of medication errors [11]. Although the reporting of medication errors provides useful information for pinpointing patient safety improvement opportunities, patient safety advancement is hampered and the absence of formal reporting is widely acknowledged [12]. A number of institutional and higher-level governmental standards exist for creating an efficient reporting system for medication errors [12]. Changing medication error reporting systems is also necessary to facilitate easily avoidable errors and their frequently serious side effects [12]. Therefore, better patient care may be achieved in the future by understanding what prevents reporting [12]. Numerous studies have examined the causes [7,8,9,10], rates of prescription errors, and adverse events [13,14,15], but none have addressed the root causes. The traits of effective reporting systems for medication errors have not been sufficiently studied.

II. Material and Methods

2.1. Aims and Objectives

We conducted a review of the currently available literature evidence in order to provide basic information about the medication error reporting culture, incidence reporting systems, effective reporting method(s), analysis of medication error reports, and also suggest recommendations to improve medication errors reporting systems.

2.2. Search Strategy

Using elements deriving from the following subject headings and keywords: characteristics, effective, error, improve, medication, report, reporting, successful, system, five electronic databases (PubMed, Ovid, EBSCOhost, Embase.com, and ProQuest) were methodically searched for articles. To find more studies, we also looked up citations from pertinent papers. The search was restricted to journals written in English and released between January 1998 and June 2020

.2.3. Inclusion and Exclusion Criteria

Primary research publications of any design (quantitative and qualitative studies: observational cohort or case-control studies, clinical trials, cross-sectional and systematic reviews) that are easily accessible, peer-reviewed, full-text, and written in the English language were included. We searched for studies that discussed the culture of reporting medication errors, incident reporting systems, development of efficient reporting techniques, examination of reports of medication errors, and suggestions for improving reporting mechanisms. The studies found by the search were manually assessed for this article's applicability. We also included a small number of articles that focused on medical mistakes (not medication mistakes) and nursing practice mistakes. Conference papers, op-eds, letters to the editor, organizational reports, opinion papers, and case studies were all eliminated.

2.4. Data Extraction and Analysis

Titles with abstracts were individually reviewed by two reviewers (AA and SA), and any areas of uncertainty were then thoroughly examined. After full-text vetting, disagreements between two reviewers were settled by a third reviewer (AS) and a fourth reviewer in unanimity (ARZ). The data extraction process included locating supporting information in each pertinent article chosen that addressed medication error reporting systems, reporting culture, developing a successful reporting process, analyzing medication error reports, and/or making suggestions to enhance medication error reporting systems. Due to the variety of tools and reported data, a narrative synthesis was done to examine the literature. A narrative synthesis is distinguished by its textual methodology, which tells an accurate story of the conclusions drawn from the chosen literature [16]. Critical appraisal tools were also used to evaluate the eligible studies. The appraisal consists of ten items that evaluate a study's methodology and determine how well it has addressed the possibility of bias in its planning, execution, and analysis. The synthesis and interpretation of the findings of the recommendations have fully taken into account the findings of the appraisal.

III. Results and Discussion

Overall, we found 684 articles after screening 5 literature databases. 384 duplicate articles in all were not included in the review. Then, the title and abstract of 300 articles were evaluated for potential inclusion. The 60 articles that make up the narrative review were chosen from 180 articles that were chosen for full-text vetting (Figure 1). After full-text screening, an estimated 120 articles were excluded (the reasons being: conference papers, editorials, letters to the editor, organizational reports, opinion papers, and case reports = 80; not applicable to hospital settings = 17; focused on an error involving a particular medication or associated with a particular medical condition = 14; or study with no comparative data = 9). A summit of papers was held between 2006 and 2014, and articles were published between 1998 and 2020. There were fewer studies from Canada, Australia, New Zealand, Korea, Japan, Greece, France, Saudi Arabia, and Egypt compared to the United States and the United Kingdom, whose articles predominated.

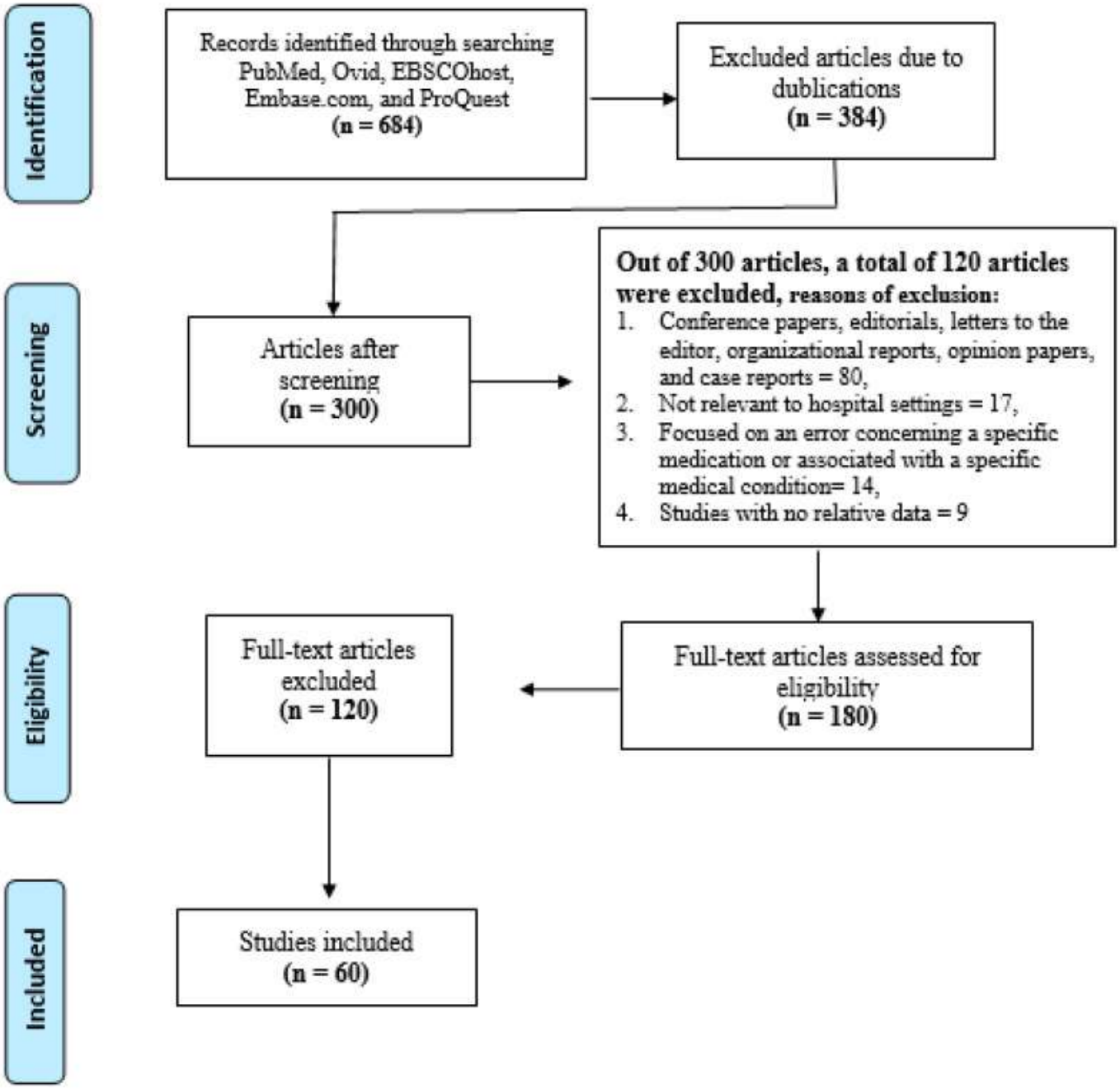

Figure 1
Flowchart.

3.1. Reporting Culture

A reporting system for medical errors can help identify potential future instances of medical error [17,18]. To meet upcoming healthcare challenges, patient safety must advance more quickly [19]. In the past, medical errors weren't often reported; today, not reporting an error in a hospital is viewed as a breach of the code of ethics and can result in legal action [17,20]. But do all medical professionals disclose medical errors? A healthcare provider's choice to disclose a medical error is problematic [17]. Fein and others have discussed the four categories of provider elements, patient elements, error elements, and institutional culture as the most effective influences on decisions to disclose a medical error [17,18,19,20,21]. In the medical field, there is a dearth of reporting of medical errors, and factors influencing motivation to report medical errors have been researched in several nations.

Because they worry about losing their jobs, 16–20% of nurses [22,23,24,25] choose not to report incidents. Due to a lack of management feedback [22,25,26], unsupportive coworkers [26], a lack of time [25], and a lack of knowledge [27], some healthcare providers choose not to report an incident. Cultural adjustments must be made in order to realize the advancement in this field; feeling secure enough to report a medical mistake and being willing to learn from past errors are two essential elements that may enhance patient safety [19,28]. The question of whether reports should be required or optional is one of the contentious issues with reporting systems. Mandatory reports could result in lawsuits [29] and damage the doctor-patient bond, which could force medical professionals to practice "defensive medicine" [29,30]. Healthcare professionals shouldn't be required to report medical errors, both ethically and professionally. Voluntary reporting fosters a culture of safety and is advantageous for medical learning. However, mandatory reporting has demonstrated the value of participation in the reporting of medical errors. As an illustration, the voluntary reporting rate in Australia is 1% while it is 50% in Denmark [19]. England has changed its reporting requirements from voluntary to mandatory, and if an error is not reported, the medical Trust may be subject to a £4000 fine. The two reports "To Err is Human" and "An Organization with a Memory" both recommended the use of a mandatory reporting system in harmful accidents in order to have organizational accountability, to improve patients' safety, and to improve effective prevention systems [19,30].3.2.

Incidence Reporting Systems

IRSs (Incidence Reporting Systems) are known to reduce incidents on airplanes; conceivably, they would also reduce medical errors in healthcare systems [31]. Medical error reporting systems are frequently used today. The New Zealand Pharmacovigilance Centre (NZPhvC), in conjunction with the Centre for Adverse Reactions Monitoring (CARM), is the national organization in charge of keeping track of adverse drug reactions in New Zealand [32]. The United Kingdom has been using the National Reporting and Learning System (NRLS) since 2003, while Australia implemented the Advanced Incident Monitoring System (AIMS) around 2005 [31]. The National Adverse Event Management System (NAEMS), formerly known as the STARS web IRS, was also implemented and has been in use in Ireland since 2004 [31]. The Medical Event Reporting System for Transfusion Medicine (MERS-TM) and the MEDMARX Reporting System by the United States Pharmacopeia were first introduced in the United States a number of years ago. The various systems the United States has introduced can be viewed as demonstrating a high level of expertise in reporting systems [33,34]. The two types of reporting systems are optional and required. The most important systems are modeled after NASA's Aviation Safety Report System (ASRS), a voluntary and anonymous system used by the Federal Aviation Administration [35]. The Patient Safety Reporting System (PSRS) of the Veterans Administration, the Institute for Safe Medical Practice (ISMP), which is intended for reporting medical errors, and Data Watch, which was established by the US Food and Drug Administration (US FDA) for recording adverse events resulting from medications and therapeutic devices, are just a few of the voluntary systems that are being modeled after the Aviation Safety Report System (ASRS). In order to track and report preventable medication errors on a national scale, Health Canada, ISMP Canada, and the Canadian Institute for Health Information (CIHI) established the Canadian Medication Incident Reporting and Prevention System (CMIRPS) [39]. Additionally, neonatal intensive care units (NICUs) in Egypt use the Egyptian Neonatal Safety Training Network (ENSTN), which enables anonymous and confidential reporting of medical errors [40]. The Saudi Food and Drug Authority (SFDA) established the National Pharmacovigilance Center (NPC) in Saudi Arabia to monitor for surveillance of medication safety issues and it is crucial in the identification of adverse drug reactions (ADRs), their evaluation, and prevention [41]. Similar systems, which have demonstrated significant positive benefits, have been adopted by many nations, including Greece [42], Korea [43], Japan [44], and France [45]

.3.3. Creating an Effective Reporting Method

To determine the baseline rates of prescription errors, an efficient multiple-phase reporting method must be developed. As a result, this can help identify the common types of medication errors and support risk reduction through the use of various preventative measures [50]. Pre-intervention, intervention, and post-intervention phases may be included in a successful strategy to stop and identify drug-related issues [51]. The voluntary reporting of

medication errors by healthcare staff using standardized forms is reinforced during the pre-intervention phase. Throughout the pre-intervention phase, reports must be routinely tracked, examined, and recorded [51]. Pre-intervention activities include reviewing patient records, keeping track of the medication handling stages, and documenting all actions. There will be an identification of the incident(s) and type(s) of medication error(s) within the healthcare facility. During the intervention phase, quantitative and qualitative analyses of the gathered reports should be conducted [50,51]. Based on the available data, a variety of quantitative and qualitative data analyses, such as a quantitative root-cause analysis or a qualitative content analysis, can be used. Thus, it is possible to identify the underlying causes of prescription errors that have hurt patients or have the potential to do so [50]. The intervention phase is a crucial corrective phase because it needs to include educational opportunities for the targeted healthcare professionals [51]. To promote patient safety standards within the healthcare facility, training programs should focus on the identification of medication errors, their causes, the harm they cause, and the significance of effective communication. After the intervention's corrective phase, the post-intervention phase should include ongoing monitoring [51]. The importance of gathering new data and comparing it to the pre-intervention data should also be emphasized. This stage investigates the staff's willingness to report medication-related incidents. After that, the incident is reported across the country using the organization's system or an online electronic form.

IV. Analysis of Medication Error Reports

To help healthcare professionals and organizations characterize, trace, and analyze medication errors in a standardized, methodical manner, NCCMERP has created a medication error taxonomy tool [52]. The taxonomy is helpful for creating a database of medication errors and designing a form for collecting data or reporting errors. Healthcare organizations should develop systems and procedures to gather the necessary data to examine and report medication errors as soon as they occur (ideally, all the elements identified in the taxonomy). The NCCMERP medication index is a crucial part of the taxonomy, which classifies an error according to the severity of the outcome on a scale from A to I [52]. The index takes into account elements like whether the patient knew about the error, whether they were affected by it, and how much. All healthcare delivery settings are encouraged to use the NCCMERP medication error-index [52].

V. Recommendations to Improve Medication Errors Reporting Systems

Every medical facility should work toward implementing methods that prevent patients from being put in danger as a result of medication errors. Healthcare organizations should investigate errors that have already happened as well as those that could potentially happen in order to prevent these from happening in the future. In this way, it is possible to spot the ways that medication consumption is falsely reported, reducing the health risks that patients are subjected to. To monitor and assess medication safety, an organized framework must be used consistently. Establishing a culture of safety depends on encouraging the reporting, monitoring, and open discussion of medication errors. More data entries will help the system become more accurate; these can be from known errors, ones that may have been overlooked in the past, or even other unrelated errors. Based on research conducted by other academics, the following (Table 1) presents a list of important factors that should be taken into account [53,54,55,56,57,58,59,60,61,62,63].

Table 1

Characteristics of Successful Reporting Systems.

Non-punitive	No punishment for the reporter as a result of error reporting.
Anonymous	The reporter is not identified by name.
Responsive	Recommendations are disseminated and changes implemented when possible.
Inclusiveness	Engaging everyone (prescriber, pharmacist, nurse, allied health professionals, patient, and family).
Accountability	Holding an individual accountable for continuing unsafe practices.
Supportive environment	Utilize preventive strategies (e.g. information technology) and increase comfort level by considering system design changes.
Summary review	Analyze summary of medication error information on a quarterly, semi-annual, or annual basis.
System-oriented	Focusing on the context and external environment in which an organization operates.
Expert analysis	Understanding the circumstances under which incidents occur and recognizing defects.
Psychological safety	The reporter is able to report without fear of negative consequences of self-image, status, or career.
Resources	Sufficient resources are available where and when they are needed.

5.1. Blame-Free or Non-Punitive Culture

If a system is to produce accurate, useful data, it must be non-punitive and able to evaluate and correct errors [53]. There needs to be a system where the people who make the errors or who annotate them are not held accountable. An efficient system for reporting medication errors must focus on preventative and corrective measures rather than assigning blame to specific parties. Corrective measures can reduce prescription errors, stop incidents from happening again, and improve patients' long-term wellbeing, all of which raise the standard of care they receive [54].

5.2. Anonymity

In order to protect the reporter's anonymity while reporting the medication error, the reporting system should also take into account anonymity in the incident data [54]. People can improve their understanding by taking a cue from Australian and British efforts in "open disclosure" and "being open," as the majority of these are unintended and can later be seen with transparency [55].

5.3. Responsive and Productive

A responsive system for reporting medication errors significantly increases internal reporting within a healthcare organization [56]. In particular, those reports that are found to be more critical or harmful need to be analysed right away. These reports then need to be made easily accessible to those who can take the necessary action. The response needs to be understandable, practical, and beneficial for changing the healthcare system [56].

5.4. Encourage Involvement

Everyone working for the healthcare organization has a responsibility to ensure patient safety. Engaging important stakeholders will boost support for the priorities and ensure that improvement initiatives are carried out successfully [57]. The chief executive officer, chief nursing officer, chief operating officer, chief medical officer,

director of pharmacy or chief pharmacy officer, and chair of the Pharmacy and Therapeutics (P&T) Committee are examples of important stakeholders. Thus, it is clear that it is crucial to incorporate patient education into as many programs as possible (both medical and non-medical) [57].

5.5. Accountability

To establish formal or informal authority to make sure that any unsafe practices are examined and immediately addressed if necessary, coordination with senior leadership is required [57]. The success of medication safety initiatives depends on creating a system for holding people accountable through committees or senior leaders [57]. Patients themselves will be trained to prevent such medication errors and assist the staff and the system that is intended to help them through proper education and subsequent guidance [57].

5.6. Create an Environment That Supports Reporting

With the development of contemporary infrastructure and technologies, it is essential to make use of such data analyses to reduce medication errors even more. This is more feasible than ever, especially given the way that barcoded medication distribution and computerized physician entries interact and complement one another [58]. It has been demonstrated that hospitals using mechanisms like assisted journal entries and a suitable system to aid them in making decisions can lower complications and mortality rates and, as a result, operating costs [59,60]. All staff members, students, and teaching personnel (if they are not employees) should be able to use and access an organizational reporting system [58]. To make reporting simple and meaningful, system design changes should be taken into account. For instance, fewer screens or paper pages could be needed for reporting, the need for detail could be balanced with usability, and checkboxes or drop-down menus could be used [59]. These methodologies will work best when each user is familiar with the system's operational and structural design [59].

5.7. Review Summary on a Regular Basis

In order to reduce harmful events, the reporting and analysis of reports that did not endanger patients should be prioritized when improving a medication error reporting program [60]. If the analysis of root causes, which can result in corrective actions and process improvement, is underemphasized as a result of an excessive focus on trends and "the numbers" in monthly statistical reports, this can be counterproductive [60]. To refocus safety improvement efforts and find organizational areas that are underreporting, a review of summary data on a quarterly, semi-annual, or annual basis is frequently helpful [61].

5.8. System-Oriented

People must believe they are not being held accountable in order to fully improve the system and keep it in an improving state. They ought to feel motivated to enhance the system's various components [61]. By doing this, a culture of safety will be established that can be supported on a personal level [61]. This will support the idea that even if a mistake is the result of a single human error, it will eventually be possible to repeat it because of flaws in the reporting system [61].

5.9. Expertise

The fundamental system architecture that made it possible for this to exist in the first place as well as the clinical requirements of a specific case need to be properly assessed by experts [50]. If a reporting system is to be fully utilized, such a task necessitates technically compatible experts [50].

5.10. Psychological Safety

Healthcare organizations should be mandated to provide psychological safety. Essentially, it means "having the confidence to present oneself and engage in employment without fear of adverse effects on one's self-image, status, or career" [62]. By putting these core values into practice, the workplace can become one where employees

are treated with respect and with trust [62]. By doing this, the reporting system as a whole can be improved in terms of feedback-giving and -receiving and error-identification [62].

5.11. Enough Resources

Without sufficient funding, implementing reporting systems will be useless [63]. Improvements may depend on small margins, so it is important to pay attention to the analysis and understanding of the fundamental or underlying causes of why different errors are occurring [63].

5.12. Physical Wellbeing

In an emergency, especially, healthcare providers need to be physically healthy and able to focus [64]. Errors in the prescription and administration of medications may occur as a result of healthcare providers' declining awareness or memory coordination [65]. Previous studies have shown that sleep deprivation among medical professionals is associated with the occurrence of medical errors [66]. Evidence suggests that because night shift healthcare workers get poorer quality and shorter sleep duration than their day shift counterparts, they make medical errors more frequently [67]. Therefore, offering shorter night shifts and having fewer working hours may result in better sleep and fewer instances of medication errors.

Limitations

This review has some restrictions, just like any other. The review mainly concentrated on the various reporting systems and suggestions to enhance reporting systems for medication errors. A narrative approach was chosen over a more thorough literature search because of the broad scope this covers. This preference was favored because it permitted the inclusion of evidence; however, it also created the possibility of bias when choosing the various studies, and it prevented us from assessing the quality of the evidence presented. To better understand the various topics covered in this report and the extensive body of literature that is currently available on the subject, we advise further academic investigation. As a result, these medication errors and the systems in place that enable them to spread can be further investigated, providing a knowledgeable, better understood overall picture that can then be put into practice. Additionally, the richness of the data used in this review may have been impacted by using only English-language papers.

VI. Conclusions

Medication errors are a widespread issue that place a heavy burden on healthcare systems and are frequently preventable by using efficient preventive measures. How well the acquired information is used to improve patient safety is a key criterion for evaluating the efficiency of a reporting system. The following qualities define a successful medication error reporting program: it is safe for the reporter, yields helpful recommendations and practical changes, involves everyone, and is backed by the necessary resources. For the medication use process to develop into a safer practice, organizations must adopt a successful reporting environment. It is the organization's duty to offer its users a setting where reporting is done in a methodical, ongoing manner so that medication is prescribed using a safer infrastructure.

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