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BEST METHODS FOR MEDICATION ERROR PREVENTION AND REPORTING SYSTEM IMPROVEMENT

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Abstract
Background: Numerous population-based studies have continuously demonstrated alarmingly high rates of medication errors and avoidable deaths. An effective practice relies on a robust reporting system for pharmaceutical errors, which also serves as an indicator of our advancement in achieving safety. The aim of improving drug error reporting systems and enacting systemic reforms is to reduce the danger of harming future patients. This study aims to provide an overview of the culture surrounding medication error reporting, incidence reporting systems, the development of successful reporting methodology, the analysis of medication error reports, and recommendations for improving reporting systems. Approaches: Electronic databases, such as PubMed, Ovid, EBSCOhost, EMBASE, and ProQuest, were examined from 1 January 1998 to 30 June 2020. A total of 180 articles were discovered, of which 60 were finally employed in the study. Two reviewers extracted the data, while two other reviewers validated it. The search produced 684 articles, which were subsequently narrowed down to 60 by eliminating duplicates based on title, abstract, and full-text examination. The majority of the studies were conducted in the United States and the United Kingdom. Submissions from Canada, Australia, New Zealand, Korea, Japan, Greece, France, Saudi Arabia, and Egypt were limited in number. Identifying, quantifying, and evaluating drug errors require an active methodology rather than a passive strategy. Initiatives must be implemented to promote the reporting of pharmaceutical errors, encompassing the education of personnel on improvement areas and the identification of root causes. The taxonomy established by the National Coordinating Council for Medication Error Reporting and Prevention functions as a classification system for elucidating and examining the specifics of individual medication error occurrences. Conclusion: An efficient medication mistake reporting program must guarantee reporter safety, offer constructive ideas and enhancements for all stakeholders, and be inclusive, supported by enough resources. Health organizations must provide an efficient reporting framework for the medication utilization process to improve dependability in practice.
Keywords: medical errors, medication error, improve, medication error reporting program, health care professional, patients, health organizations

1. Introduction

Medical errors are inadvertent mistakes arising from either action or inaction. Medical errors can be categorized as execution errors or planning errors, which are characterized by the ineffective execution of deliberate acts or the use of an unsuitable strategy to achieve a goal, possibly jeopardizing the patient by straying from the care protocol [1]. In 2008, the US Department of

Health and Human Services Office stated that 180,000 hospitalized individuals died due to medical errors. Medication errors represent a significant portion of medical errors, impacting around 1.5 million persons annually [2]. A medication error, according to the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP), is "any preventable event that may lead to improper medication use or patient harm while the medication is managed by a healthcare professional, patient, or consumer." Procedures, medical supplies, professional practice, and systems related to prescription, order communication, dispensing, monitoring, product labeling, distribution, compounding, administration, nomenclature, packaging, education, and use are all interconnected with these events. These events pertain to healthcare products, practices, and professional standards, including systems that began with nomenclature and packaging, advanced through drug administration and monitoring, and concluded with prescribing, transcribing, documenting, reviewing, preparing (or compounding), product labeling, education, and dispensing [3]. Medication errors significantly impact the welfare of individuals, organizations, and healthcare systems. Prescription errors constitute the sixth leading cause of mortality in the United States, with 5-10% of recorded prescription errors resulting in harm, according to an NCCMERP report [3]. In recent years, pharmaceutical errors have escalated, presenting a problem for healthcare systems and directly associated with hospital mortality and morbidity rates [4]. Medication errors particularly endanger hospitalized patients and erode public confidence in the healthcare system and the quality of services rendered [5]. Additionally, pharmaceutical errors negatively affect clinical outcomes, including length of stay (LOS), and result in significant costs of around USD 2000–2500 per patient [2,6]. The heightened prevalence of underreporting medication errors is estimated to be between 50 and 60 percent inside healthcare facilities. This is due to the lack of medical recording systems at several hospitals. As a result, various preventative programs were established to track errors, targeting the underlying causes and contributing factors of pharmaceutical errors using carefully crafted organization-wide reporting systems to identify the likely sources of these errors. The documenting of prescription errors provides essential insights for improving patient safety; nevertheless, advancements in this domain are impeded by a well acknowledged absence of systematic reporting [12]. Diverse institutional and regulatory standards are necessary for the establishment of an effective medication mistake reporting system [12]. Altering drug error reporting systems is crucial to avert easily preventable mistakes and their frequently grave repercussions [12]. Thus, improved patient care may be achieved in the future by understanding the obstacles to reporting [12]. Numerous studies have examined the causes [7,8,9,10], incidence of prescription errors, and adverse effects [13,14,15], although none have researched the fundamental causes. The attributes of effective reporting systems for drug errors have not been sufficiently analyzed.

2. Material and Methods

2.1. Aims and Objectives

In order to provide basic information about the culture of reporting medication errors, incidence reporting systems, efficient reporting techniques, analysis of medication error reports, and suggestions for improving medication error reporting systems, we conducted a review of the body of existing literature.

2.2. Search Strategy

The following subject headings and keywords were used to conduct a systematic search for articles in five electronic databases (PubMed, Ovid, EBSCOhost, Embase.com, and ProQuest): characteristics, effective, error, improve, medicine, report, reporting, successful, and system. In

order to find new papers, we also looked at citations from pertinent journals. Only English-language journals published between January 1998 and June 2020 were included in the search.

.2.3. Inclusion and Exclusion Criteria

Included were easily accessible, peer-reviewed, full-text, English-language primary research publications of any design (both quantitative and qualitative, including observational cohort or case-control studies, clinical trials, cross-sectional studies, and systematic reviews). We looked into research that addressed the culture of reporting medication errors, incident reporting systems, the analysis of medication error reports, the creation of efficient reporting procedures, and suggestions for improving reporting systems. The search yielded studies that were carefully assessed for their applicability to this subject. A small number of papers discussing nursing practice errors and medical errors (as opposed to medication errors) were also included. Excluded were case studies, organizational reports, opinion pieces, letters to the editor, conference papers, and opinion editorials.

2.4. Data Extraction and Analysis

Two reviewers (AA and SA) carefully examined titles with abstracts, and any ambiguities were subsequently examined in depth. A third reviewer (AS) and a fourth reviewer in consensus (ARZ) settled disagreements between two reviewers after a thorough text evaluation. Finding pertinent information about medication error reporting systems, reporting culture, creating an efficient reporting process, analyzing medication error reports, and suggestions for enhancing medication error reporting systems was part of the data extraction process, which involved going through each chosen article. Because of the variety of tools and data offered, a narrative synthesis was employed to assess the literature. The literary technique that effectively communicates the findings drawn from the chosen literature is what distinguishes a narrative synthesis [16]. The qualifying studies were evaluated using critical assessment tools. Ten items make up the evaluation, which evaluates a study's methodology and determines how well it mitigates potential bias in its planning, implementation, and analysis. The appraisal's findings have been carefully taken into account in the synthesis and interpretation of the recommendations.

3. Results and Discussion

We looked through five literature databases and found 684 articles in total. Duplicate articles were eliminated from the review in total. Three hundred papers' abstracts and titles were evaluated for possible inclusion. Out of 180 articles that completed full-text evaluation, 60 publications were chosen to make up the narrative review (Figure 1). The following criteria were used to exclude about 120 articles after thorough text screening: conference papers, editorials, letters to the editor, organizational reports, opinion pieces, and case reports (80); focus on errors associated with particular medications or medical conditions (14); lack of comparative data (9); or irrelevance to hospital settings (17). Articles were published between 1998 and 2020, and a conference of papers took place between 2006 and 2014. The United States and the United Kingdom dominated the publications, with fewer studies from Canada, Australia, New Zealand, Korea, Japan, Greece, France, Saudi Arabia, and Egypt.

3.1. Reporting Culture

Potential future medical error occurrences can be identified with the help of a medical error reporting system [17, 18]. In order to tackle future healthcare issues, patient safety must advance more quickly. Medical errors were rarely reported in the past, but today it is unethical and subject to legal consequences for hospitals to fail to reveal errors [17,20]. Are medical errors reported by

all practitioners? It is controversial for a healthcare professional to disclose a medical blunder. Four factors—provider, patient, error, and institutional culture—have been found by Fein and colleagues to have a major impact on the decision to disclose a medical error [17, 18, 19, 20, 21]. In the medical field, there is a dearth of reporting on medical errors, and numerous countries have looked at the factors influencing the motivation to reveal such errors. 16–20% of nurses [22,23,24,25] choose not to report situations because they are worried about their job security. Because of inadequate management feedback [22,25,26], unsupportive coworkers [26], time restrictions [25], and a lack of competence [27], some healthcare workers choose not to report an incident. To make success in this area, cultural changes are required; two important elements that might enhance patient safety are a willingness to learn from past mistakes and a sense of security in reporting medical errors [19, 28]. Among reporting systems, the question of whether reports should be required or optional is a challenging one. Mandatory reporting may result in legal action and damage the doctor-patient relationship, forcing doctors to practice "defensive medicine." It is unethical and unprofessional for healthcare workers to be required to report medical errors. In addition to improving medical education, voluntary reporting fosters a culture of safety. The importance of participating in the documentation of medical errors has been demonstrated by mandatory reporting. For example, Denmark has a 50% voluntary reporting rate, whereas Australia has a 1% rate [19]. In England, reporting errors is now required rather than optional; the medical trust could be fined £4,000 for not reporting an error. In order to guarantee organizational accountability, improve patient safety, and fortify preventive actions, the papers "To Err is Human" and "An Organization with a Memory" both argued for the establishment of an obligatory reporting system for bad situations.3.2

Incidence Reporting Systems

While Incidence Reporting Systems (IRSs) are known to reduce aviation accidents, it is conceivable that they could also reduce medical errors in healthcare systems [31]. These days, medical error reporting systems are widely used. The national organization in charge of keeping an eye on adverse drug reactions in New Zealand is the New Zealand Pharmacovigilance Centre (NZPhvC), which works with the Centre for Adverse Reactions Monitoring (CARM). Australia implemented the Advanced Incident Monitoring System (AIMS) in 2005, whereas the United Kingdom has been using the National Reporting and Learning System (NRLS) since 2003. Ireland has been using the National Adverse Event Management System (NAEMS), formerly known as the STARS online IRS, since 2004. The United States Pharmacopeia's MEDMARX Reporting System and the Medical Event Reporting System for Transfusion Medicine (MERS-TM) were first used in the US a few years ago. The United States' various approaches demonstrate a high level of reporting mechanism proficiency [33, 34]. Reporting systems fall into two categories: required and optional. The primary techniques are based on the Federal Aviation Administration's voluntary, anonymous Aviation Safety Report System (ASRS) program. Voluntary systems based on the Aviation Safety Report System (ASRS) include the Veterans Administration's Patient Safety Reporting System (PSRS), the Institute for Safe Medical Practice (ISMP) for reporting medical errors, and the US Food and Drug Administration's (US FDA) Data Watch for recording adverse events from drugs and medical devices. The Canadian drug Incident Reporting and Prevention System (CMIRPS) was developed by Health Canada, ISMP Canada, and the Canadian Institute for Health Information (CIHI) to track and record avoidable drug errors on a national level [39]. Additionally, the Egyptian neonatal Safety Training Network (ENSTN) is used by Egypt's neonatal intensive care units (NICUs) to enable private and anonymous reporting of medical errors [40]. The National Pharmacovigilance Center (NPC) was founded by the Saudi

Food and Drug Authority (SFDA) to manage medication safety surveillance, which is crucial for detecting, assessing, and averting adverse drug reactions (ADRs). Similar systems have been implemented in many countries, including Greece [42], Korea [43], Japan [44], and France [45], and have demonstrated significant benefits.

.3.3. Creating an Effective Reporting Method

To determine the baseline rates of prescription errors, a successful multi-phase reporting strategy needs to be put in place. This can make it easier to identify common drug errors and help reduce risk by putting various prevention measures into place [50]. Pre-intervention, intervention, and post-intervention phases may all be included in an effective plan to treat and identify drug-related issues [51]. During the pre-intervention phase, emphasis is placed on healthcare professionals' voluntary use of standardized forms to document prescription errors. Reports need to be continuously tracked, examined, and recorded throughout the pre-intervention stage [51]. Pre-intervention activities include reviewing patient information, keeping track of medication management phases, and documenting all actions. The type and number of pharmaceutical errors that occurred at the medical facility will be determined. Both quantitative and qualitative evaluations of the gathered reports must be carried out during the intervention period [50,51]. Numerous quantitative and qualitative investigations, such as qualitative content analysis and quantitative root-cause analysis, may be used in light of the available data. Therefore, it is possible to identify the underlying causes of prescription errors that have negatively impacted patients or have the potential to do so [50]. Since it must include educational opportunities for the chosen healthcare workers, the intervention phase is an essential corrective stage [51]. Training programs must focus on identifying pharmaceutical errors, their causes, the harm they cause, and the value of effective communication in order to raise patient safety standards inside the healthcare facility. The post-intervention phase must include ongoing monitoring after the intervention's corrective phase [51]. It is important to emphasize the importance of gathering new data and comparing it to the pre-intervention data. The staff's preparedness to report medication-related incidents is assessed in this phase. The event is then spread around the country via the organization's system or an electronic form that can be accessed online.

4. Analysis of Medication Error Reports

To help healthcare professionals and organizations systematically characterize, trace, and analyze medication errors, NCCMERP has created a medication error taxonomy tool. The taxonomy facilitates the creation of a database for pharmaceutical errors as well as a tool for data gathering or mistake reporting. Systems and procedures must be put in place by healthcare institutions to gather the necessary information for the prompt investigation and reporting of medication errors, ideally including all of the components listed in the taxonomy. A crucial part of the taxonomy is the NCCMERP medicine index, which uses a scale from A to I to classify errors according to the seriousness of the outcome [52]. The index takes into account things including the patient's knowledge of the mistake, how much it affected them, and how much of an influence it had. The NCCMERP pharmaceutical error index should be used in all healthcare delivery settings [52].

5. Recommendations to Improve Medication Errors Reporting Systems

Every medical facility should make an effort to implement measures that prevent patients from being put in danger as a result of medication mistakes. To prevent recurrence, healthcare organizations need to examine both previous and likely future errors. By identifying disparities in

medication use reporting, this method helps to reduce the risks to patients' health. Pharmaceutical safety must be regularly monitored and assessed using a systematic methodology. Promoting the reporting, observation, and open discussion of drug-related incidents is essential to creating a culture of safety. The accuracy of the system will be improved by more data entries, which could include known flaws, previously overlooked inconsistencies, or even irrelevant inaccuracies. Numerous researchers have determined that the following list (Table 1) outlines important factors that need to 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

A system needs to be non-punitive and able to identify and fix errors in order to produce accurate and useful data [53]. To ensure that people who make mistakes or annotate them are not held accountable, a procedure must be set up. Preventative and corrective measures should take precedence over assigning blame to specific persons in an efficient medication mistake reporting system. Corrective actions can reduce prescription errors, stop incidents from happening again, and improve patients' long-term health, all of which raise the standard of treatment they get [54].

5.2. Anonymity

The reporting system must also take anonymity in the incident data into account in order to protect the privacy of the reporter when they report the drug error [54]. People can better understand by following Australian and British practices in "open disclosure" and "transparency," since most of these events are unintentional and can then be clearly understood [55].

5.3. Responsive and Productive

Internal reporting in a healthcare organization is significantly improved by an efficient drug mistake reporting system [56]. In particular, results that are judged more critical or urgent need to be examined as away. People who are able to take the necessary action must have easy access to these reports. For the healthcare system to be transformed, the solution needs to be understandable, practical, and beneficial [56].

5.4. Encourage Involvement

Ensuring patient safety is the responsibility of every employee in the healthcare company. Including important stakeholders will increase support for priorities and ensure that improvement initiatives are carried out successfully [57]. The head of the Pharmacy and Therapeutics (P&T) Committee, the director of pharmacy or chief pharmacy officer, the chief executive officer, the chief nursing officer, the chief operational officer, the chief medical officer, and others are examples of important stakeholders. Thus, it is clear that it is crucial to incorporate patient education into many programs, both medical and non-medical.

5.5. Accountability

Interaction with senior leadership is crucial to establishing formal or informal authority to guarantee the investigation and timely correction of detrimental actions [57]. Establishing a framework for accountability through committees or senior leadership is essential to the effectiveness of pharmaceutical safety measures. Through adequate teaching and continuing guidance, patients will learn how to prevent medication errors and support the experts and system that are there to help them [57].

5.6. Create an Environment That Supports Reporting

To further reduce prescription errors, data analysis is essential given the development of contemporary infrastructure and technology. Due in large part to the interplay and mutual reinforcement of computerized physician inputs and barcoded pharmaceutical distribution, this is now more feasible than ever [58]. According to research, hospitals may lower complications and death rates by using tools like assisted journal entries and a suitable decision-support system, which would save operating costs [59,60]. An organizational reporting system should be accessible and usable by all employees, students, and non-employee teaching staff [58]. Modifications to the system design must be taken into account in order to offer clear and meaningful reporting. For instance, reporting may necessitate fewer screens or paper pages, usability and the need for depth may need to be balanced, and checkboxes or drop-down options may be used [59]. When all users are familiar with the operational and structural design of the system, these strategies will work best [59].

5.7. Review Summary on a Regular Basis

Enhancing a pharmaceutical mistake reporting program requires focusing on reporting and analyzing occurrences that did not compromise patient safety in order to reduce adverse events [60]. It may be harmful to place too much focus on trends and numerical data in monthly statistics reports at the expense of root cause analysis, which can result in corrective measures and process improvements [60]. Refocusing safety improvement efforts and identifying organizational areas with underreporting issues are frequently facilitated by a periodic examination of summary data, which can be conducted quarterly, semi-annually, or yearly [61].

5.8. System-Oriented

To enable thorough system improvement and preserve its progressive state, people must believe that there is a lack of responsibility. They ought to be motivated to enhance the various components of the system [61]. As a result, a culture of safety will be established, which can be promoted

individually [61]. This will support the idea that an error resulting from a single human error can eventually be repeated because of flaws in the reporting system [61].

5.9. Expertise

The therapeutic needs of a given situation and the underlying system architecture that made this possible must be carefully assessed by experts [50]. Professionals with technical expertise are necessary for the best possible use of a reporting system.

5.10. Psychological Safety

Psychological safety must be guaranteed by healthcare organizations. It means "possessing the assurance to showcase oneself and participate in employment without apprehension regarding negative impacts on one's self-image, status, or career." [62] By putting these fundamental principles into practice, employers may create an environment where workers are respected and trusted [62]. By doing this, the reporting system will be more effective at providing and receiving feedback and detecting errors [62].

5.11. Enough Resources

Implementing reporting systems is ineffective when there is insufficient funding [63]. It is important to concentrate on the analysis and understanding of the fundamental causes of different problems because improvements could depend on small margins [63].

5.12. Physical Wellbeing

Healthcare workers must be physically fit and focused during emergencies [64]. Healthcare professionals' deteriorating awareness or memory coordination may lead to mistakes in the prescription and administration of medications [65]. Previous studies have shown a correlation between medical errors and medical personnel' sleep deprivation [66]. There is evidence that healthcare workers who work nights have lower-quality sleep and shorter sleep duration than their day shift counterparts, which leads to a higher rate of medical errors [67]. Therefore, offering shortened night shifts and cutting back on working hours may result in better sleep and fewer prescription errors.

Limitations

Like all reviews, this one is subject to limits. The assessment's main focus was on the various reporting methods and suggestions for enhancing procedures for reporting pharmaceutical errors. Because of its broad nature, a narrative approach was used rather than a thorough literature assessment. This preference was beneficial because it made it possible to include evidence, but it also increased the possibility of bias in the studies chosen and made it more difficult for us to assess the caliber of the evidence offered. To improve understanding of the wide range of topics covered in this study and the extensive body of current literature on the issue, we advise more academic research. In order to gain a thorough understanding that can then be put into practice, these medication errors and the mechanisms that enable their spread may be further investigated. The selection of just English-language publications may have limited the comprehensiveness of the data included in this review.

6. Conclusions

Medication errors are common, place a heavy burden on healthcare systems, and are frequently preventable with good preventive measures. An important consideration when evaluating a reporting system's effectiveness is how well the data collected is used to improve patient safety. Safety for the reporter, the supply of practical suggestions and implementable changes, inclusive involvement, and enough resource support are the hallmarks of an effective medication error reporting program. Establishing an efficient reporting environment is essential for firms looking

to improve the safety of the pharmaceutical consumption process. In order to guarantee that medication is administered within a safer framework, the organization must give its users a methodical and ongoing reporting environment.

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