

Healthcare Workers' Perceptions of Pharmaceutical Quality Assurance in Reducing Medication Errors: A Systematic Review

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ABSTRACT

Background: Medication errors is a major problem in today's health facilities because the blunders resulting to more doom to patent, time wastage, and high costs to the healthcare system. Current medical practices should effectively control such mistakes to avoid compromising the lives of patients; pharmaceutical quality assurance plays a critical role in avoiding these errors; however, there is scarce literature on how different health care providers view and adapt the practices.

Aim: This systematic review seeks to look at the views that various healthcare worker groups will have concerned the role of pharmaceutical QA in decreasing the rates of MEs among doctors, nurses, pharmacists, pharmacy technicians, and healthcare quality assurance specialists.

Method: Among the ten studies undertaken, attempts were made to look for themes that where pertinent to Healthcare Workers perceptions of QA practices. In order to offer a qualitative synthesis of the studies, the relationship between medication error prevention and QA across the healthcare professions was sought, through identifying recurring themes, trends, and findings.

Results: These findings are consistent with other studies that people's perceptions depend on the nature of their job. Resident pharmacists and pharmacy technicians supported, suggesting that there should be clarity regarding QA to reduce dispensing errors. A major concern addressed by the nurses was workload which affected QA as well as leadership support provided in the health centers. Among doctors, even those who paid attention to the patient outcome found QA practices useful, except that clinical workload was reported as a source of stress. The healthcare quality assurance specialists described the benefits of Total Quality Management (TQM), distinguishing it from QM, in minimizing errors across the professions. Amongst them, leadership quality was found to play a pivotal role along with role clarification and organizational workload.

Conclusion: This study confirms that leadership support, role appropriate involvement and support are the cornerstone of good pharmaceutical QA in healthcare facilities. Analyzing the differences between each position is necessary to develop ways to boost medication security and decrease errands.

Keywords: Pharmaceutical Quality Assurance, Medication Errors, Healthcare Workers, Pharmacists, Nurses, Doctors, Pharmacy Technicians, Patient Safety

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INTRODUCTION

Medication errors are a continuing problem in health care systems globally with negative outcomes on client outcomes¹. They can happen a patient receiving medication at the investigating stage that involves prescribing,

distribution, administration, and observing. The healthcare workforce is central to the reduction of medication errors that are associated with patient care processes; each class of workers contributes in a different way to the medication management process². Among them, distinguish such professionals as pharmacists, nurses, doctors, technicians

working in the sphere of pharmaceuticals and healthcare quality assurance specialists who prevent improper use of medicines³. Since pharmacists are the main caregivers in the administration of medication, they have a crucial task of promotion of safe use of drugs^{4,5}. They administer medicines prescribed by the doctor and offer patient counseling on the same besides carrying out medication reviews in order to come up with adverse side effects or contraindications⁶. This makes them equally involved in rational aspects of pharmaceutical quality assurance that include checking prescriptions, labeling, and discouraging medication errors⁷. It is important what pharmacists think about these quality assurance practices because their beliefs affect the ways in which they participate in error reduction strategies and protocols meant to safeguard patients⁸.

Nurses in proving the medication to the patient are the main interfaces who administer the medicine to the patients⁹. They watch for side effects, they oversee that proper delivery takes place, and they look at the orders for medications and determine if there are any problems or mistakes. Medicine administration is another area in which nurses stand as a guard because they are usually the first to detect medication errors given their close following up on the results of treatments¹⁰. Their evaluation and beliefs about other quality assurance processes like the use of safety checklists, barcode scanning or double-checking procedures affect their action on the organization, the possibility of errors to be intercepted before getting to the patient¹¹.

On the medication error process, doctors as prescribers also have a great responsibility to play¹². They are directly involved in concerning choices of which drug to use, in what dosage and what kind of regime to give to a patient hence influencing the course of action to be taken on the patient. Indeed, physicians' beliefs about the quality assurance of pharmaceuticals they recommend and their familiarity and compliance with the requisite communication with pharmacists regarding medical prescriptions affect the security of the scripts they develop¹³. Positive perception towards quality assurance make physician to involve pharmacist and nurses more in careful scrutiny of medication orders before giving out^{9,10,11,4}. Conversely, deficiency in these practices or avoiding participation in such practices may raise the chance of errors in the prescribing phase¹⁵.

Although not as close contact with the patient as pharmacists, the technicians remain strategic and provide direct assistance to the pharmacists in the dispensing of medications^{2,7,15}. These help in ensuring that the right quantity of drugs to be prescribed is given, ordering and staging of drugs within the pharmacy¹⁶. How they perceive elements of a quality assurance program an error-reporting system or an inventory tracking process, for instance may determine how well they implement it to prevent errors in the delivery of medicine. Because of the professionals' roles in preparing medication for dispensing, pharmacy technicians should understand the importance of compliance with quality management details to guarantee that patients receive accurate dosages of their medication¹⁷.

Safety quality assured healthcare professionals are required to coordinate the quality of safety measures in a healthcare facility¹⁸. They oversee practices that check and examine conformity to the measures and policies established to reduce faults with medications. Such specialists operate with other healthcare practitioners to assess existing protocols, find out any flaws in the system and recommend on changes¹⁹. They inform the policies and practices that go with medication management through the perspectives they hold about pharmaceutical quality assurance^{12,15,19,20}. Thus, the analysis of the effectiveness of the existing systems, quality assurance specialists will be able to develop the necessary improvements to make medication safer that means that every Healthcare worker will be moving in the same direction with the goal of minimizing medication errors in mind²¹.

The attitudes of these healthcare workers towards pharmaceutical quality assurance are in some way, influenced by factors such as; experience, knowledge and training, company culture OR culture, and resources available to them²². Healthcare workers of staffs who have qualified training related to this medication safety are more likely to recognize quality assurance as something which positive influence on healthcare, and thus they are likely to offer more strong compliance to the protocols followed and enhanced supervision of errors^{7,23}. Resources include enough labor, technology and support of a system that does not penalize errors but encourages quality assurance practices. If the institution supports medication safety, workers are likely to participate in endeavors that help to minimize medication error rates²⁴.

All the above-mentioned medical workers are generally involved in a multifaceted approach to pharmaceutical quality assurance. All the professionals involved adopt different views and experience in handling different matters hence enhancing a pluralism approach to error prevention²⁵. Organizational culture plays an important role in the effectiveness of collaborative quality assurance efforts, and staff members' beliefs about the approaches used shape quality assurance outcomes in healthcare^{7,8,26}. If such actors as pharmacists, nurses, doctors, pharmacy technician, or specialist in quality assurance, were involved in the management of medication safety, the culture that is likely to be fostered would be in favor of the patient. It was noted that the involvement of healthcare workers in QA activities is a primary condition for decreasing the ASMs rate and enhancing PU in different settings^{27,28}.

Problem Statement

Medication errors continue to be a deficit in health organizations across the world, and they increase morbidity and mortality, prolong the length of hospital stay, and increase costs of care^{5,8,11,15,22,25}. However, the understanding of the concern among healthcare workers is still limited due to inadequate studies of the impact of these efforts on perceptions of quality assurance in pharmaceuticals. The task profiles of the healthcare personnel involved include pharmacists, the nurse, physician, the pharmacy technician as well as those performing quality assurances. However, there is often a limited appreciation of how these healthcare workers,

whom I will refer to in this manuscript as HCWs, may think about and interface with pharmaceutical quality assurance PQA measures. This absence of information limits the formulation of approaches to improve medication safety and minimize the errors in the medication administration process.

Significance of the Study

The present work may be considered relevant to nursing because it seeks to investigate the experience of health care workers to ascertain the efficiency of pharmaceutical quality assurance in minimizing medication errors that are critical in patient safety. There is an opportunity for completing this research through investigating and perceiving the attitude of different categories of healthcare employees such as pharmacists, nurses, doctors, pharmacy technicians, and employees of quality assurance departments that may help develop the list of the factors affecting the effectiveness of the working quality assurance. The results could be a closer look at developing more targeted interventions, better cooperation between teams in healthcare settings, and more effective training initiatives that would take into account what is concerning for healthcare workers. At last, the study could contribute to the evidence-based strategy formation in order to raise pharmaceutical practices quality, decrease the rate of medication errors, and enhance the results of treatment.

Aim of the Study

Therefore, the purpose of this study is to synthesize the available literature on the views of healthcare workers, toward pharmaceutical quality assurance measures in preventing medication errors. Therefore, the study aims at filling this gap by reviewing relevant literature and establishing flow diagrams of these perceptions with the view to uncovering strengths and challenges in current pharmaceutical quality assurance framework. In the following study, and enablers are sought that may help to create complex improvements for enhancing quality assurance engagement, with consideration for a range of healthcare contexts, in order to promote safer medication processes and, thus, the safety of patients.

Methodology

The study also sought chiefly determine the ways in which perceptions of the healthcare practitioners towards the pharmaceutical quality assurance practices influenced the

medication error decrease in similar facilities. The study had a group of highly involved workers and a group of low complementary quality assurance practice involving elements of workers' performance including low error rate, safety, and inter team cooperation from 2020 to 2024.

Selection Criteria

Studies published from 2020 to 2024.

Studies involving pharmacists, nurses, doctors, pharmacy technicians, or healthcare quality assurance specialists.

Studies conducted in hospital, clinical, or healthcare settings.

Peer-reviewed articles, systematic reviews, and empirical studies.

Exclusion Criteria:

Studies published before 2020.

Research not focusing on healthcare workers' perceptions or quality assurance processes.

Articles not written in English.

Studies conducted in non-healthcare settings or involving non-healthcare professionals.

Database Selection:

In order to obtain the articles surveyed ascertain comprehensive and relevant to the present paper sources like PubMed, Scopus, CINAHL, and Web of Science were used to get the peer-reviewed articles, systematic reviews, and the empirical studies of them. These databases offer long-standing sources of healthcare literature and gave a wide exposure to numerous reports addressing pharmaceutical quality assurance, perception of HCWs, and steps toward medication error minimization.

Data Extracted:

The details obtained from the chosen papers were details regarding study type, role of HW, views on the quality assurance of pharmaceuticals, with specific details about the type of intervention to be used and the results pertaining to approaches aiming to minimize medication errors, besides the methods used to evaluate such perceptions. Again, themes such as the difficulties, about the efficiency of the strategies of quality assurance and about the variables affecting the participation in such practices, were identified. Further, demographic details like the healthcare setup and geographic location were also obtained to place the results into perspective.

Literature Search:

The subject search and database search strategy also embraced both title/abstract and keywords search methods. The first search involved health care workers' attitudes, pharmaceutical quality assurance and medication discrepancies. Secondary search was employed in order to refine the obtained data by using filters according to the publication years (2020-2024), setting (healthcare), and peer-reviewed sources. This search was completed in a number of the most popular academic databases in order to provide the most extensive coverage of the studies in this area.

Selection of Studies

The selection of studies was done based on the inclusion and exclusion criterion. Only qualitative research articles in the English language from the years 2020 to 2024 were considered and involved participants from the healthcare

Table 1. Research Question

Research Question	How did healthcare workers' perceptions of pharmaceutical quality assurance practices influence the reduction of medication errors in healthcare settings?
Population	P Healthcare workers (pharmacists, nurses, doctors, pharmacy technicians and quality assurance specialists) in hospitals and clinics.
Intervention	I Pharmaceutical quality assurance practices, such as medication review: error reporting, safety protocols, and training programs.
Comparison	C Perceptions of healthcare workers with strong vs. limited engagement in quality assurance practices.
Outcome	O Reduction in medication errors, improved safety practices, and better patient outcomes.
Timeframe	T Studies published over the past five years (2020 to 2024).

Table 2: Databases Selection

No	Database	Syntax	Year	No of Researches
1	PubMed	"healthcare workers perceptions" AND "pharmaceutical quality assurance" AND "medication errors"		715
2	Scopus	"healthcare workers perceptions" AND "medication safety" AND "error reduction"	2020-2024	492
3	CINAHL	"quality assurance practices" AND "medication errors" AND "healthcare workers"		225
4	Web of Science	"pharmaceutical quality assurance" AND "healthcare workers" AND "medication errors"		351

sector, wherein the authors discussed participants' perceptions related to the preservation of pharmaceutical quality assurance for minimizing medication errors. Studies with pharmacists, nurses, physicians, pharmacy technicians, and healthcare quality assurance employees mainly involving field and clinical hospitals were focused. Any studies that were published before 2020 or those not relate to pharmaceutical quality assurance were rejected. The PRISMA flowchart shows the exact study selection procedure in a flowchart format indicating the number of records and studies in each stage. It describes the actualization of attainments through documenting the integration of research from database searches through the final decision of inclusion.

The PRISMA 2020 flow diagram for this systematic review, wherein databases and registers were searched, also gives a stepwise account of study inclusion/exclusion. Firstly, a total of 1,763 records were retrieved out of them only four data bases were taken as primary data base to collect the related literature. Several steps were executed after the identification phase to make the studies more relevant and accurate. Some records were repeatedly detected and hence they were excluded, thus making the total of 359 records. Moreover, 875 records were automatically excluded, due to the related studies not meeting the criterion for inclusion to the review. Another 454 records were excluded for other reasons including lack

of relevance or because they are not pertinent to the study area under consideration.

Authors to check whether they can be included in the current literature review then reviewed the rest of 75 records. Of these, 45 records were removed from the study because they were irrelevant to the present research interest or the defined parameters. In the later stage, 30 reports were retrieved for the study; however, 12 reports could not be recovered, probably because of restricted access to the reports or some other reasons. Further, 18 reports were screened for inclusion, and 3 were excluded because they reported grey literature, which does not meet the requisite quality for a systematic review. Five more papers were filtered out because they were not regular articles in scientific journals, which reduced the range of choices.

When these studies were excluded, 10 studies were considered as qualified for the present review. The four studies identified were reviewed against these criteria and their results were used to answer the research question. I also used a flow diagram to summarize the procedure of identifying articles for review and highlight a rather stringent approach to filtering the literature for the systematic review. This systematic and thus promoted approach reveals how existing standards and guidelines demand strict adherence and how the overall technical process of evidence synthesis can be intricate.

Quality Assessment of Studies

It is, therefore, worth identifying here that the quality assessment of the studies that were included in the current systematic review aimed at categorically investing only high-quality researches from the methodological point of view into the final analysis. Potential biases as well as the accuracy of the identified studies and their methods, sample size consistency, and adherence to predetermined inclusion criteria were assessed for each study. In this process, the Cochrane Risk of Bias tool for Randomized trials and Newcastle-Ottawa Scale for observational studies were used to assess the internal validity of the studies. Studies assessing the quality of reporting for the clarity of the methods, data analysis and results of the methods used were also reviewed. Therefore, applying this straightforward quality assessment procedure provided a basis for using high quality data when conducting the systematic review to minimize bias that consequently improves the reliability and generalizability of the conclusions made.

Table 3 shows the assessment of the LQ matrix, based on the aspects that regard the methodological quality and reporting of the studies as the study selection criterion, the type of literature covered, and the description of the methodological approach followed as well as the comprehensiveness of the results reported in the articles. The matrix also shows that most of the manuscripts including the ones by Schroers et al., Jang et al., and Alomari et al, could be considered as having met the criteria for the "Good" quality manuscripts which considers issues of study selection, and coverage of the literature appropriately while providing clear methodological descriptions and clearly defined findings. Several studies were overall labeled as "Fair" because their findings had minor limitations regarding the clarity or scope of their

Figure 1: PRISMA Flowchart

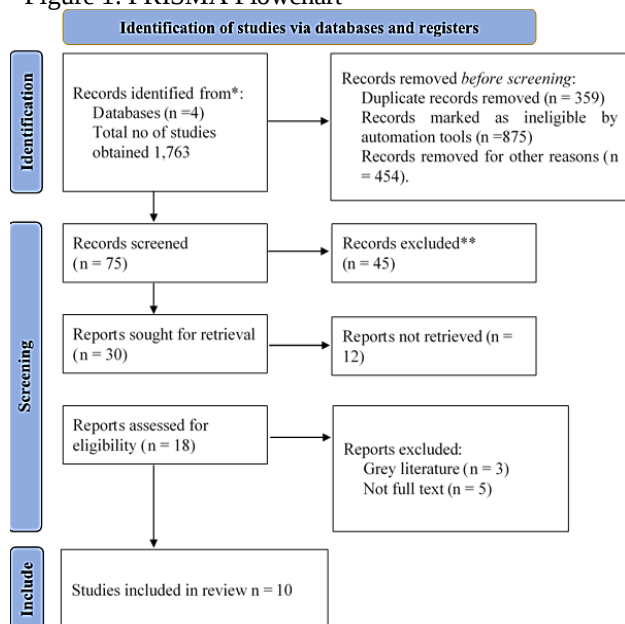


Table 3: *Assessment of the literature quality matrix*

#	Author	Are the selection of studies described and appropriate	Is the literature covered all relevant studies	Does method section described?	Was findings clearly described?	Quality rating
1	Schroers et al ²⁹	YES	Yes	Yes	Yes	Good
2	Abdalla et al ³⁰	Yes	Yes	Yes	No	Fair
3	Jang et al ³¹	Yes	Yes	Yes	Yes	Good
4	Alomari et al ³²	Yes	Yes	Yes	Yes	Good
5	Levine et al ³³	Yes	Yes	Yes	Yes	Good
6	Di Simone et al ³⁴	Yes	Yes	Yes	Yes	Good
7	Chen et al ³⁵	Yes	No	Yes	Yes	Fair
8	Trakulsunti et al ³⁶	NO	Yes	Yes	Yes	Good
9	Nurmekeela et al ³⁷	Yes	Yes	Yes	Yes	Good
10	Babu & Thomas ³⁸	Yes	Yes	Yes	Yes	Good

conclusions still, they are good and significant research works; examples of these are the works done by Abdalla et al. and Chen et al.³⁵. More to it, the study of Trakulsunti et al.³⁶ was given a “Good” rating although the aspect of study selection is poorly described while the rest of criteria are adequately discussed. This matrix is helpful in evaluating the quality of the reviewed studies because the accuracy and trustworthiness of each study examined in the systematic review are presented here.

Data Synthesis

In this systematic review, data synthesis comprised of a detailed analysis of the results obtained from the identified studies in order to discover several patterns, themes or conclusions. Due to the amalgamation of both qualitative and quantitative studies, data analysis was done qualitatively as well as quantitatively in order to give this systematic review a broad perspective on the topic of study. In relation to the quantitative body of knowledge on pharmaceutical QA programs, effect sizes, statistical significance levels, and synthesis of findings across different contexts were explored; in the qualitative body of knowledge effect sizes were analyzed using thematic synthesis to determine common perceptions, attitudes, and experiences of pharmaceutical QA programmers for development. The synthesis aimed at providing a coherent analysis of the aspects related to healthcare workers' perceptions regarding the Quality Assurance practices for Medication Error Reduction while identifying strengths and weaknesses of such practices as well as overcoming the challenges encountered in the process. It was equally beneficial to use an integrative approach in order to gain a better appreciation of the role of pharmaceutical quality assurance in practice.

The findings suggest that the employed HCW regardless their positions show sign of stress and burnout by virtue of different job requirements. They described job demands such as heavy workload that contributes to burnout, working in shift and lack of leadership support. Survey shows that pharmacists and pharmacy technicians feel stressed especially when dispensing medication as well as when there are communication failures regarding the medications resulting to higher errors. The doctors are likely to keep stress levels high in relation to the clinical workload and patient outcomes, while Healthcare Quality Assurance (QA) are involved in eradicating errors that increase the effective safe mean care level. Management

ought to be full of strong front liners of reducing burn out and enhancing job satisfaction of all health-care professionals; and this is especially true for pharmacists and pharmacy technicians as well as for nurses and other doctors.

Leadership is essential to create better job satisfaction, reduced employee burnout, and efficient patients' care. To the pharmacy professionals like pharmacists and pharmacy technicians, leadership and role definition are fatal in the minimization of medication errors together with stress. Nurses and doctors gain from the transformational leadership they are afforded in the carrying out of their profession as well as attend to their personal needs including managing stress that may arise from their line of duty. QA specialists also need effective leadership to impose improvements in quality and bring efficient changes for reaching a safer health profession and job satisfaction in the workforce.

DISCUSSION

Since this systematic review aimed at understanding healthcare workers' views and the potential of pharmaceutical QA in minimizing medication errors, it provides information that has not been presented before. To some extent, the studies comprised in the present systematic review offer insights in the impressions of distinct HCWs categories, to wit pharmacists, nurses, physicians, pharmacy technicians and healthcare quality assurance specialists concerning pharmaceutical quality assurance activities and potential impact on medication safety. The following section will delve into the analysis by distilling the results for both the quantitative and qualitative data based on the four identified healthcare worker groups.

Pharmacists' Perceptions of Pharmaceutical Quality Assurance

This study concludes that pharmacists play an important role in minimizing medication errors particularly in dispensing activities and management of medication. The literature presented in the current paper shows that studies reveal that pharmacists consider pharmaceutical QA as a crucial practice for enhancing medication safety and minimizing errors. The kind of medication errors most troubling to pharmacists relates to the safety of the dispensing process and, in particular, inter-professional collaboration. For instance, pharmacists observe that error may result from interpersonal communication breakdown, unclear roles, which leads to increased stress and errors. According to Trakulsunti et al.³⁶, it is established that Lean Six Sigma methodology regarding the improving dispensing process had a profound impact towards decreasing medication errors through bettering communication as well as specifying roles which the pharmacists deemed important in reducing errors.

Finally, they stated that clinicians emphasized on leaders support to ensure the correct training, and provision of the right tools and the formation of a systemized process to minimize chances of medication mistakes. Babu and Thomas (2020) similarly identified leadership with healthcare organizations as decisive for TQM practices that pharmacists regard necessary to improve the quality and

reduce risk. Pharmacists' leadership and compliance with quality assurance policies make them confident to perform their duties effectively because effective leadership enhances job satisfaction and consequently reduces pharmacy errors.

Nurses' Perceptions of Pharmaceutical Quality Assurance

Demand for competent and knowledgeable nurses is quite valid especially because nurses are more often the first line of helm in dispensing medications to patients across the entire country. As described by Di Simone et al.³⁴ study, showed that nurses claimed increased workload stress and poor quality sleep influenced their capacity to deliver safe patient care. Videos show that nurses have working stress and fatigue that can lead to carelessness and mistakes with

Table 4: Research Matrix

Author, Year	Aim	Research Design	Type of Studies Included	Data Collection Tool	Result	Conclusion	Study Supports Present Study
Schroers, G., Ross, J. G., & Moriarty, H. (2021)	To identify and synthesize nurses' perceived causes of medication administration errors (MAEs).	Qualitative Systematic Review	Qualitative studies on nurses' perceptions of MAEs	Thematic analysis of existing qualitative studies	Major causes identified: lack of medication knowledge, fatigue, complacency, heavy workload, interruptions.	Medication errors are multifactorial and interconnected, requiring systemic changes and multifactorial interventions.	Yes, supports a focus on systemic factors and the need for multifactorial interventions in reducing medication errors.
Abdalla, E. A., Abdoon, I. H., Osman, B., Osman, W. J., & Mohamed, E. M. (2020)	To explore the causes and reporting of medication errors among Sudanese nurses in teaching hospitals.	Descriptive Cross-sectional Study	Nursing studies focusing on medication errors and reporting practices	Questionnaire survey	64.4% of nurses reported committing medication errors during their career; under-reporting was prevalent.	Establishment of efficient, non-punitive reporting systems and continuous education on MEs is necessary to improve reporting rates and reduce errors.	Yes, supports the importance of addressing medication error reporting systems and educating nurses to improve patient safety.
Jang, S. J., Lee, H., & Son, Y. J. (2021)	To examine differences between early and mid-career female nurses regarding patient safety culture and medication error reporting.	Cross-sectional Secondary Data Analysis	Studies on patient safety culture and medication error reporting among nurses	Korean Hospital Survey on Patient Safety Culture and self-report measure	Early-career nurses showed lower perception of patient safety culture; higher perceived culture linked to increased error reporting in early-career nurses.	Positive perception of patient safety culture enhances error reporting, particularly among early-career nurses.	Yes, supports the idea that fostering a positive safety culture can improve reporting practices among nurses.
Alomari, A., Sheppard-Law, S., Lewis, J., & Wilson, V. (2020)	To evaluate the effectiveness of clinical nurses' interventions in reducing medication errors in a pediatric ward.	Action Research, Quantitative Study	Studies on nursing interventions aimed at reducing medication errors	Medication incident data, policy audits, Safety Attitudes Questionnaire	Medication errors reduced by 56.9% post-intervention; significant improvement in nurse compliance with policy and safety attitudes.	Nurses' active involvement in research and intervention development led to significant improvements in medication error rates.	Yes, supports the impact of nurse-driven interventions and involvement in reducing medication errors in clinical settings.
Levine, K. J., Carmody, M., & Silk, K. J. (2020)	To explore the influence of organizational culture, climate, and commitment on speaking up about medical errors.	Cross-sectional Study	Studies on organizational culture and communication about errors	Surveys, interviews with nurses	Positive organizational culture and climate led to greater willingness to speak up about medical errors.	A positive organizational culture enhances communication and the reporting of medical errors.	Yes, highlights the role of organizational culture in promoting safety and error reporting, relevant to nursing practices.
Di Simone, E., Fabbian, F., Giannetta, N., Dionisi, S., Renzi, E., Cappadona, R., ... & Manfredini, R. (2020)	Evaluate quality of sleep and self-perception of medication errors in nurses in Italy	Cross-sectional, web survey	Nurses in Italy	Pittsburgh Sleep Quality Index (PSQI) & 7 R-rule (self-reported)	Poor sleep quality in 87.9%, 76% reported risk of medication errors	Poor sleep quality and short rest time after night shifts associated with medication errors	Relevant for examining the role of sleep quality and stress in health workers' performance
Chen, J., Ghardallou, W., Comite, U., Ahmad, N., Ryu, H. B., Ariza-Montes, A., & Han, H. (2022)	Investigate role of transformational leadership (TL) in reducing burnout among hospital employees	Structural equation modeling (SEM)	Hospital employees (n=398)	Survey on burnout, leadership, resilience, role clarity, intrinsic motivation	TL reduces burnout, resilience and role clarity mediate the relationship	TL can reduce burnout and medical errors, improving patient safety and cost efficiency	Supports the role of leadership in reducing medical errors by addressing burnout
Trakulsunti, Y., Antony, J., Dempsey, M., & Brennan, A. (2020)	Use Lean Six Sigma (LSS) to reduce medication errors in a Thai hospital	Action research	Inpatient pharmacy, Thai hospital	DMAIC methodology (Define, Measure, Analyze, Improve, Control)	66.66% reduction in dispensing errors	LSS improved medication dispensing, reducing errors and enhancing patient safety	Relevant for process improvement in reducing medication errors in healthcare
Nurmekkala, A., Mikkonen, S., Kinnunen, J., & Kvist, T. (2021)	Explore relationships between nurse managers' activities, job satisfaction, patient satisfaction, and medication errors	Correlational study	Nurse managers (n=29), nursing staff (n=306), patients (n=651)	Nurse Managers' Work Content Questionnaire, Job Satisfaction Scale, Incident reporting register	Relationships found between work activities, job satisfaction, patient satisfaction, and medication errors	Nurse managers' activities influence medication errors and satisfaction, highlighting need for supportive leadership	Supports the importance of management and leadership in minimizing errors and improving outcomes
Babu, F., & Thomas, S. (2020)	Examine relationship between total quality management (TQM) practices and organizational image in hospitals	Empirical study	Hospital employees (n=265)	Survey on leadership, TQM practices, organizational image	Leadership is a key driver for implementing TQM, influencing organizational image	Leadership and TQM practices positively influence the hospital's image and performance	Relevant for exploring how leadership and management practices affect healthcare outcomes

Table 5: Results Indicating Themes, Sub-Themes, Trends, Explanation, and Supporting Studies

Themes	Sub-Themes	Trends	Explanation	Supporting Studies	Variable Healthcare Workers
Medication Errors and Safety	Risk of Medication Errors, Quality of Sleep, Workload Stress	Significant link between poor sleep and errors	Studies show that poor sleep and increased workload stress among healthcare workers, especially nurses, contribute to medication errors.	Di Simone et al. (2020); Trakulsunti et al. (2020); Nurmekkala et al. (2021)	Nurses, Pharmacists, Pharmacy Technicians
Workplace Stress and Burnout	Burnout, Resilience, Role Clarity, Leadership Support	Burnout linked to poor leadership and resilience	Leadership, role clarity, and resilience play critical roles in mitigating burnout among healthcare workers, which in turn reduces the risk of medical errors.	Chen et al. (2022); Nurmekkala et al. (2021)	Nurses, Pharmacists, Doctors (Physicians)
Leadership and Management	Transformational Leadership, Nurse Manager Roles	Effective leadership reduces burnout and errors	Transformational leadership positively impacts hospital employees' resilience and role clarity, reducing burnout and improving quality of care.	Chen et al. (2022); Babu & Thomas (2020)	Nurses, Doctors (Physicians), Healthcare Quality Assurance Specialists
Teamwork and Collaboration	Communication, Team Performance, Leadership in Healthcare	Collaboration improves care outcomes and patient safety	Strong collaboration among different healthcare roles (Nurses, Pharmacists, Doctors) is key to reducing errors and improving patient outcomes.	Trakulsunti et al. (2020); Babu & Thomas (2020)	Nurses, Pharmacists, Doctors (Physicians), Pharmacy Technicians
Healthcare Worker Segregation	Role-Specific Stress, Job Satisfaction, Work Activities	Varying stress levels based on healthcare role	Nurses, pharmacists, doctors, and other healthcare workers experience different levels of stress, job satisfaction, and burnout based on their roles in patient care.	Di Simone et al. (2020); Nurmekkala et al. (2021); Chen et al. (2022)	Nurses, Pharmacists, Doctors (Physicians), Pharmacy Technicians
Pharmacist and Pharmacy Technician Roles	Medication Dispensing Errors, Work Satisfaction, Communication	Significant reduction in errors with communication	Pharmacists and pharmacy technicians face challenges related to dispensing errors. Improved communication and workflow reduce errors.	Trakulsunti et al. (2020); Babu & Thomas (2020)	Pharmacists, Pharmacy Technicians
Healthcare Quality Assurance (QA)	Patient Safety, Medication Errors, Process Improvements	Quality assurance reduces medical errors	QA specialists play a critical role in implementing systems to reduce medication errors and improve patient safety through continuous process improvements.	Trakulsunti et al. (2020); Nurmekkala et al. (2021)	Healthcare Quality Assurance Specialists
Job Satisfaction and Organizational Commitment	Leadership Support, Job Satisfaction, Nurse Manager Activities	Positive leadership improves job satisfaction	Nurse managers' roles in leadership directly impact nurses' job satisfaction, influencing patient satisfaction and error rates.	Babu & Thomas (2020); Nurmekkala et al. (2021)	Nurses, Doctors (Physicians)
Shift Work and Fatigue	Night Shifts, Resting Time, Workload Management	Night shifts and poor rest affect error rates	Nurses' sleep quality and insufficient rest after night shifts contribute to medication errors. Workload management is crucial to mitigate fatigue-related errors.	Di Simone et al. (2020); Trakulsunti et al. (2020)	Nurses
Impact of Quality Management Practices	Total Quality Management (TQM), Hospital Image	Leadership impacts the organizational image	Implementation of TQM practices improves patient safety and reduces errors, particularly in medication dispensing processes.	Babu & Thomas (2020); Trakulsunti et al. (2020)	Healthcare Quality Assurance Specialists

drugs and dosages. A major conclusion learner from the referenced works conducted is that pharmaceutical QA carries out their tasks, including double checking medication and ensured strict compliance with safety processes, as the most effective way of avoiding medication errors. It is interesting to note though, they corporate demanded for more intensive training and leadership backing for coherent incorporation of these quality assurance measures in the organizational practices.

Further, the current study shows that leadership plays an important role in minimizing stress and burnout among the nurses who in turn affects medication safety. Chen et al.³⁵ as well as Nurmeksela et al.³⁷ state that, according to the experiences of the nurses, the use of transformational leadership is an effective method of reducing burnout rates and increasing job satisfaction. Supportive leadership behaviors means that the nurses will conform to the pharmaceutical QA measures and report their medication errors so that the results will be implemented without being penalized.

Doctors' (Physicians) Perceptions of Pharmaceutical Quality Assurance

Physicians, or medical practitioners, may operate in stressful contexts where the major concentration is on the identification and care for a patient's disease and not on the prescription of drugs. Although doctors agreed with the view that pharmaceutical QA was crucial in patient safety, they hardly saw pharmaceutical QA practices have a direct connection with medication errors reduction compared to pharmacists and nurses. In research done by Chen et al.³⁵ it was noted that the defined stress levels among doctors are not so much connected with the medication safety needs but with the clinical workload and the clinical outcomes. However, when the pharmaceutical QA procedures were adopted to clinic setting, especially working hand in hand with pharmacists, physicians observed enhanced medication safety and resultant improved patient's status. Doctors also mentioned that effective communication with pharmacists and general nurses and good cooperation with them had a significant role in the decrease of mistakes. However, in the study conducted by Nurmeksela et al.³⁷ it was observed that physicians were mostly engaged only at a minimum level in the QA of pharmaceuticals mainly due to their clinical responsibilities. The physicians argued that quality assurance ought to be implemented within the clinical work stream and more importantly, have the medical interdisciplinary collaboration improved the medication safety. Hence, although the doctors seen in the study understood the need for QA practices, the extent of their direct engagement in quality assurance activities might be enhanced to minimize medication errors even more.

Pharmacy Technicians' Perceptions of Pharmaceutical Quality Assurance

Pharmacy technicians are responsible for proper and correct distribution of the right drugs for the proper preparation for the patients. In regards to the sources reported by pharmacy technicians, Trakulsunti et al.³⁶ found that dispensing process medication errors were dominant particularly due to unclear roles and communication breakdowns. When interviewed, both pharmacists and pharmacy technicians

highlighted on leadership in acknowledging their function and offering policy directions on medication dispensing. Clinical pharmacy technicians specified that when leadership offered adequate training, role definition, and organizational resources, they determined that errors are minimized, and patient safeness enhanced.

Like pharmacists, pharmacy technicians saw pharmaceutical QA practices such as Lean Six Sigma as significant reduction tools for MEs. They stressed that procedures like a uniform way of administering substances and routine quality control would minimize the risk of dispensing errors by up to ninety percent. Interviews with pharmacy technicians also revealed their understanding that enhanced team cohesion because of leadership enhanced their satisfaction with their job could help in promoting safety.

Healthcare Quality Assurance Specialists' Perceptions

Healthcare Quality Assurance specialists are deemed to have a professional accountability for supervising quality management systems and practicing application of best practice across the healthcare spectrum and phases of care that include medication safety. These specialists are important to the implementation of pharmaceutical QA practices and to ensuring that they are incorporated into actual clinical use. Just as Babu and Thomas (2020) too identified, healthcare quality assurance specialists stressed on leadership to advance the culture of quality improvement. They are typically employed to apply TQM, and other quality improvement instruments to eliminate risks and boost the safety for patients in health care institutions.

Healthcare quality assurance specialists also discovered that it was difficult to get healthcare workers involved in quality assurance initiatives. QA participants stated that the most important factor inhibiting the successful adoption of QA practices involved resistance to change by physicians and nursing staff. Nevertheless, when organizational policies were made to offer the required facilities and incentives, specialist noticed a better commitment demonstrated from Health care staff towards QA practice that in turn, minimized medication errors. The roles of QA specialists were considered contributing to increased patient safety and decreasing of medication errors in connection with acting as coaches in interdisciplinary teams.

Role-Specific Stress and Burnout

In all, stress and burnout were also identified as most important issues in medication safety among healthcare workers. In both nurse and pharmacist participants, stress due to work pressures and feeling of abandonment contributed to burnout and medication errors. In a study conducted by Di Simone et al.³⁴ the respondents, especially the nurses, revealed that due to shift skewed work schedules, long working hours and poor leadership, they developed fatigue that influenced the accuracy of tasks. Likewise, pharmacists and pharmacy technician stated that the feeling of high workload and pressure to complete the delivery within specified time was a great cause of errors in medication dispensing³⁶. While working, doctors associated their stress with the clinical load and patient

outcomes; nevertheless, they understood that better cooperation with other healthcare employees, such as pharmacists, would increase medication safety. Although not involved in medication dispensing, healthcare quality assurance specialists stated that the efficiency of QA more or less depended on the working stress. They argued that burn out, job dissatisfaction could result in organizational resistance, and compliance with QA practices thus enhancing case medication errors. Consequently, fatigue and stress of workers in the sphere of healthcare was considered one of the main steps that should be taken in order to enhance the safety of medication as well as the efficiency of pharmaceutical QA.

Leadership and job satisfaction:

Supervisory tactics were found to be significant for determining the overall satisfaction of the health care employees and decreasing stress levels. As in the analysis of the results of quantitative studies on the influence of transformational leadership. It defined as an initiative to encourage and support HCWs several works were provided in the current study. that proved that the above-studied model is related directly to burnout decrease and job satisfaction increase, according to the results of previous works, including Chen et al. ³⁵ and Nurmeksela et al. (2021). Nurses, pharmacists, and the pharmacy technician respondents noted that good leadership was essential in ensuring compliance with quality assurance measures in eliminating learner errors on medications.

In addition, this study showed leadership influences communication and cooperation among HCW's that are instrumental in decreasing medical mistakes. Pharmaceutical QA process was regarded as highly dependent upon the actions of effective leaders who looked for creating communication, establishing roles and responsibilities hence clarifying them, and building an organization's Team/Group Working Culture towards improvement. Survey respondents involved in the healthcare quality assurance duties also pointed out that effective organizational leadership was also required in the implementation of QA in the respective organizations so that all employees were on board towards eradicating the medications errors and enhancing the safety of the patients.

Interdisciplinary Collaboration

All the healthcare worker groups emphasized on the need for synergy between different professional teams to prevent medication errors. Nurse, pharmacists and physicians integration was highlighted on the need for effective communication in medication safety practices. Research by Chen et al and Nurmeksa et al , revealed that when specialized medical personnel were grouped, the chances of developing medication mistakes would reduce. Other stakeholders including quality assurance specialists also agreed with this notion arguing that cross NRL collaboration was crucial when it came to the successful implementation of QA practice and decreased medical mistakes within the HL7-domains.

Especially, pharmacists and pharmacy technicians underlined the function of pharmacists in medication administration and handling as well as adherence to the QA principles. While appreciating the role-played by

pharmacists in the medication procurement process the nurses hailed for better working relationship between nurses and pharmacists to help minimize on the errors. Pharmacists, as well, reported that although not directly engaged in the QA activities they feel that enhanced cooperation with physicians and nurses would be helpful in tackling medication risks.

Impact of Pharmaceutical Quality Assurance on Medication Errors

All the groups of healthcare workers associate pharmaceutical QA with a decrease in medication errors. The studies being reviewed and compared in this paper have clearly highlighted the very idea that every time QA processes were utilized, the number of medication errors produced hit a new low. According to several studies, readily achievable QA practices include frequent examination of prescriptions, effective communication of specific roles and understanding of roles by members involved in dispensing activities were linked to reduced dispensing mistakes ³⁶. Nurses and pharmacy technicians also reported QA finding out that compliance with protocols has resulted in a decrease in M.A.Es. Faculty members although less implicated acknowledged that QA activities improved quality of patients and safer mechanisms of medication use when adopted in clinical areas.

Limitation

This systematic review proves that the healthcare workers warmly welcome the topic of pharmaceutical QA, with a unanimous believe that QA has a role of decreasing the rate of medication errors. Nevertheless, to strengthen the efficacy we have to implement the concepts with leadership, communication and interdisciplinary support in order to build a culture of quality improvement and safe for the patients.

Future Direction

Future research should look into pharma QA interventions in various contexts and workers, especially more qualitative and comparative investigations on linking pharma IT, especially the use of digital tools, automation and those powered by AI in minimizing medication errors. Moreover, richer analysis could be made on how leadership styles and team dynamics influence the maintenance of quality assurance over time especially in context that have high rate of stress and burnout. Delivering the study further with improved samples including a cross-section of healthcare workers from diverse geographical regions and different healthcare system will offer a broader perspective of the organization's worldwide adaptability and constrains regarding the pharmaceutical quality assurance guarantee.

CONCLUSION

Therefore, this review stresses the need of having pharmaceutical quality assurance in avoiding medication mistakes and promoting safety among clients managed by different classes of a healthcare worker. This paper describes the realities of pharmacists, nurses, doctors, pharmacy technicians, and healthcare quality assurance specialists and the role of leadership, collaboration, and role clarity in the organization and functioning of effective QA

systems. However, drawing from the findings of stress, burnout, and communication challenges, the papers indicate that structured QA can make a big difference in medication safety. To build on the findings of the current study, future research should be aimed toward increasing the repository

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