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FACTORS INFLUENCING MEDICATION ERRORS AMONG NURSES IN CLINICAL SETTINGS OF SECONDARY HEALTH FACILITIES IN THE NORTHERN SENATORIAL DISTRICT OF CROSS RIVER STATE, NIGERIA

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ABSTRACT RESEARCH ARTICLE

Medication errors remain a major challenge in healthcare delivery, compromising patient safety and quality of care. This study examined the factors influencing medication errors among nurses in secondary health facilities in the Northern Senatorial District of Cross River State, Nigeria. The objectives were to determine the influence of nurse-related, institutional, and workplace/environmental factors on the occurrence of medication errors. A descriptive cross-sectional survey design was employed, and data were collected from 186 registered nurses using a structured self-administered questionnaire. Descriptive statistics were used to summarize respondents' characteristics and perceptions, while Pearson correlation analysis tested the relationships between independent variables and medication errors at a 0.05 significance level. The results indicated that all three categories of factors: nurse-related, institutional, and workplace/environmental had significant positive relationships with medication errors. Fatigue, inadequate knowledge, poor adherence to protocols, inadequate staffing, weak supervision, poor communication, high workload, and workplace distractions were identified as key contributors to errors. The study concludes that medication errors are multifactorial and arise from the interaction of individual, organizational, and environmental factors. It is recommended that interventions such as continuous nurse training, workload management, improved supervision, effective communication, technological support, and a supportive work environment be implemented to reduce medication errors and enhance patient safety.

Keywords: *medication errors, nurse-related factors, institutional factors, workplace factors, secondary health facilities, patient safety*

INTRODUCTION

Medication administration is a fundamental responsibility of nurses in clinical settings because it directly affects patient safety and treatment outcomes. A medication error is defined as any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of a healthcare professional, patient, or consumer (National Coordinating Council for Medication Error Reporting and Prevention [NCCMERP], 2020). Medication errors remain a major global healthcare challenge and are recognised as a significant cause of morbidity, mortality, and increased healthcare costs (World Health Organization [WHO], 2017).

Nurses play a central role in medication administration and are therefore directly involved in preventing or contributing to medication errors in clinical practice. Research indicates that medication administration errors constitute a large proportion of clinical errors reported in hospitals worldwide (Keers et al., 2013). In many developing countries, including Nigeria, medication errors are influenced by systemic healthcare challenges such as inadequate staffing, limited medical supplies, and insufficient continuing professional education (Ayorinde & Alabi, 2019).

Several factors have been identified as influencing medication errors among nurses in clinical settings. Individual factors include fatigue, poor pharmacological knowledge, calculation errors, and non-adherence to medication administration protocols such as the "five rights" of medication administration (Salami et al., 2019). Environmental factors such as workload pressure, interruptions during drug preparation, and shift duties also increase the likelihood of medication errors (Jennings et al., 2011). High patient-to-nurse ratios in public hospitals have been consistently linked with increased clinical errors and reduced quality of care (Aiken et al., 2014).

Institutional factors also contribute significantly to medication errors. Poor communication among healthcare professionals, lack of standard medication administration guidelines, and absence of effective supervision mechanisms may increase the occurrence of medication-related errors in hospitals (Oshikoya et al., 2013). Furthermore, weak medication-error reporting systems in many healthcare facilities discourage nurses from reporting errors due to fear of blame or disciplinary action (Okafor et al., 2020).

In Nigeria's secondary healthcare facilities, nurses often operate under demanding clinical conditions characterised by workforce shortages, heavy workloads, and resource constraints. These challenges are more pronounced in rural and semi-urban regions where healthcare infrastructure and staffing levels may be inadequate (Federal Ministry of Health, 2018). In Cross River State, secondary health facilities serve as major referral centres for primary healthcare institutions, placing additional responsibilities on nurses who manage large patient populations daily.

Despite the importance of patient safety in medication administration, there is limited empirical evidence on the factors influencing medication errors among nurses in secondary health facilities in the Northern Senatorial District of Cross River State. Understanding these factors is essential for improving medication safety practices, strengthening nursing performance, and reducing preventable harm to patients.

Therefore, this study seeks to investigate the factors influencing medication errors among nurses in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State, Nigeria.

Statement of the Problem

Medication errors remain one of the most persistent threats to patient safety in healthcare systems worldwide. Although medication administration is a core nursing responsibility, errors occurring during this process continue to contribute to preventable patient harm, prolonged hospitalisation, increased treatment costs, and reduced quality of care (WHO, 2017). Nurses, who serve as the final link in the medication administration chain, are particularly vulnerable to making errors due to the complexity of clinical tasks and the demanding nature of hospital environments (Keers et al., 2013).

In Nigeria, the problem of medication errors is exacerbated by systemic healthcare challenges such as inadequate staffing, high patient-to-nurse ratios, insufficient medical supplies, limited supervision, and weak error-reporting systems (Federal Ministry of Health, 2018; Oshikoya et al., 2013). These challenges are more evident in secondary healthcare facilities, which often serve as referral centres for primary health institutions while operating with limited human and material resources.

In Cross River State, particularly in the Northern Senatorial District, nurses in secondary health facilities frequently work under pressure associated with workload demands, shift duties, and resource constraints. Such conditions may increase the likelihood of medication errors during drug preparation and administration. Despite the potential risks to patient safety, medication errors are often underreported due to fear of blame, lack of institutional reporting structures, and limited patient-safety culture in many healthcare settings (Okafor et al., 2020).

While several studies have examined medication errors in tertiary hospitals and urban healthcare settings in Nigeria, there is limited empirical evidence focusing specifically on nurses in secondary health facilities in the Northern Senatorial District of Cross River State. Without context-specific evidence, it becomes difficult for healthcare administrators, nursing leaders, and policymakers to design effective interventions to reduce medication errors and improve patient safety in these facilities.

Therefore, the problem of this study is the lack of sufficient empirical information on the factors influencing medication errors among nurses in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State, Nigeria. This knowledge gap necessitates a systematic investigation into the individual, institutional, and environmental factors associated with medication errors among nurses in the study area.

Objectives of the Study

The main objective of this study is to examine the factors influencing medication errors among nurses in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State, Nigeria.

The specific objectives are to:

1. Identify nurse-related factors influencing medication errors in secondary health facilities in the Northern Senatorial District of Cross River State.
2. Examine institutional factors influencing medication errors among nurses in the study area.

3. Determine environmental/workplace factors influencing medication errors in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State.

Research Questions

1. What nurse-related factors influence medication errors in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State?
2. What institutional factors influence medication errors among nurses in secondary health facilities in the Northern Senatorial District of Cross River State?
3. What environmental or workplace factors influence medication errors in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State?

Null Hypotheses

H_{01}: There is no significant relationship between nurse-related factors and medication errors in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State.

H_{02}: There is no significant relationship between institutional factors and medication errors among nurses in secondary health facilities in the Northern Senatorial District of Cross River State.

H_{03}: There is no significant relationship between environmental/workplace factors and medication errors in clinical settings of secondary health facilities in the Northern Senatorial District of Cross River State.

Literature Review

Medication Errors

Medication errors are preventable events that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of a healthcare professional, patient, or consumer (NCCMERP, 2020). These errors can occur at any stage of the medication process, including prescribing, transcribing, dispensing, preparing, administering, or monitoring, and they remain a major concern for patient safety worldwide (WHO, 2017).

Medication errors can take several forms. Prescribing errors involve giving the wrong drug, dose, route, or frequency to a patient. Dispensing errors occur when medications are incorrectly packaged, labeled, or supplied. Administration errors arise when nurses give the wrong dose, use the wrong route, or administer medication at the wrong time. Monitoring errors occur when healthcare professionals fail to observe or respond appropriately to adverse drug reactions or drug interactions.

The causes of medication errors are multifaceted and often involve a combination of individual, institutional, and environmental factors. Nurse-related factors include fatigue, insufficient knowledge of medications, poor calculation skills, inattention, and failure to adhere to the principles of safe medication administration, often described as the “five rights” of medication administration: the right patient, drug, dose, route, and time (Salami et al., 2019). Institutional factors also contribute significantly to medication errors. These include inadequate supervision, absence of standard operating procedures, understaffing, and weak

reporting systems, which limit opportunities to learn from errors and improve safety practices (Oshikoya et al., 2013). Environmental and workplace factors such as heavy workloads, frequent interruptions during medication preparation, high patient-to-nurse ratios, shift fatigue, and stressful working conditions further increase the likelihood of errors (Jennings et al., 2011; Aiken et al., 2014).

The consequences of medication errors are serious for both patients and healthcare systems. Patients may suffer harm or adverse drug reactions, while hospitals may face increased morbidity, mortality, prolonged hospitalization, and higher treatment costs. Furthermore, medication errors can erode patient trust in healthcare services. Despite the severity of these outcomes, medication errors are often underreported, particularly in environments where fear of blame or punishment exists and where patient-safety cultures are weak (Okafor et al., 2020).

Efforts to prevent medication errors focus on continuous education and training for nurses, the implementation of standard guidelines and protocols, adequate staffing, and the development of supportive work environments. Promoting a non-punitive culture that encourages error reporting and the adoption of technology, such as computerized physician order entry and barcode medication administration, are also effective strategies for reducing errors.

Medication errors constitute a critical challenge in healthcare delivery, particularly in resource-limited settings such as secondary health facilities in the Northern Senatorial District of Cross River State, Nigeria. A thorough understanding of the nurse-related, institutional, and environmental factors that influence these errors is essential for developing effective interventions that enhance patient safety and improve nursing practice.

Nurse-Related Factors Influencing Medication Errors in Secondary Health Facilities

Nurses play a central role in the medication administration process, and their knowledge, skills, and professional conduct are critical determinants of patient safety. However, a range of nurse-related factors have been identified as significant contributors to medication errors in clinical settings, particularly in secondary health facilities. These factors encompass individual knowledge and competence, psychological and physical conditions, adherence to protocols, and professional attitudes, all of which interact to influence the likelihood of errors occurring.

One of the most prominent nurse-related factors is inadequate knowledge of pharmacology and drug administration procedures. Nurses who lack sufficient understanding of drug mechanisms, dosages, interactions, and potential side effects are more likely to make errors during preparation or administration of medications (Salami et al., 2019). This challenge is often compounded in secondary health facilities where opportunities for continuous professional development and training may be limited. Without regular training, nurses may struggle to keep up with new medications, evolving treatment protocols, or complex drug regimens, especially for patients with comorbidities requiring polypharmacy.

Fatigue and excessive workload also constitute major contributors to medication errors. Nurses in secondary health facilities frequently care for large patient populations, often rotating across multiple wards or departments within a single shift. Prolonged working hours, night shifts, and insufficient rest periods can impair concentration, memory, and decision-making, making nurses more prone to mistakes (Jennings et al., 2011). Additionally, high workload conditions often lead to stress and time pressure, causing nurses to rush through

medication administration procedures. This rushed environment increases the likelihood of lapses in attention, dosage miscalculations, and omissions of critical verification steps. Distractions and interruptions during the medication administration process, such as inquiries from colleagues, phone calls, or emergency situations, further exacerbate this problem and can directly lead to preventable errors.

Another significant nurse-related factor is poor adherence to established protocols and standard procedures. The "five rights" of medication administration right patient, right drug, right dose, right route, and right time are widely recognised as a fundamental framework for safe medication practices. However, studies have shown that nurses sometimes skip verification steps, fail to double-check patient identity, or neglect proper documentation, particularly under high-pressure conditions or time constraints (Keers et al., 2013). In addition, insufficient clinical experience and limited opportunities for continuing professional development may hinder a nurse's ability to handle complex clinical situations effectively. For instance, administering medications to patients with multiple comorbidities or those on intricate drug regimens requires not only technical knowledge but also clinical judgment, which less experienced nurses may lack.

Psychological and behavioural factors also influence medication errors. Stress, low motivation, fatigue, and a lack of accountability can diminish vigilance and attentiveness, increasing the probability of errors (Ayorinde & Alabi, 2019). Nurses who feel overburdened or undervalued may be less engaged in their tasks, leading to lapses that could otherwise have been avoided. Additionally, cognitive overload due to excessive multitasking, emotional stress, or personal issues may further compromise attention to detail, particularly in critical tasks like medication administration.

The combination of these personal, professional, and psychological factors highlights the complex nature of nurse-related contributors to medication errors. Addressing these issues requires a multi-pronged approach, including regular training and professional development, supportive supervision, effective workload management, and the cultivation of a strong patient-safety culture. By strengthening nurses' competencies, improving working conditions, and fostering accountability, secondary health facilities can significantly reduce the occurrence of medication errors and improve overall patient care.

Nurse-related factors including inadequate knowledge, fatigue, distractions, non-adherence to protocols, insufficient experience, and stress play a central role in the prevalence of medication errors in secondary health facilities. Mitigating these factors is critical for enhancing patient safety, promoting high-quality nursing practice, and ensuring effective healthcare delivery in the Northern Senatorial District of Cross River State.

Institutional Factors Influencing Medication Errors in Secondary Health Facilities

Institutional factors are widely recognized as critical contributors to medication errors in healthcare settings. In secondary health facilities, the organization's structure, policies, operational procedures, and the resources it provides significantly influence the safety and effectiveness of medication administration. These factors are particularly important in resource-limited settings, where systemic weaknesses can amplify the risk of errors and negatively affect patient outcomes.

One of the most pressing institutional factors is inadequate staffing. Many secondary health facilities in Nigeria operate below the recommended nurse-to-patient ratios due to limited human resources and budget constraints. High patient loads force nurses to attend to multiple

patients simultaneously, which increases the likelihood of errors, including incorrect dosage, wrong timing, or missed medications (Aiken et al., 2014). The pressure associated with managing numerous patients within limited time frames can also result in fatigue and elevated stress levels among nurses, which further compromise attention, decision-making, and vigilance during medication administration (Jennings et al., 2011). Research has consistently shown that facilities with insufficient staffing experience higher rates of medication errors, demonstrating the direct link between workforce adequacy and patient safety.

The absence or poor implementation of standard operating procedures (SOPs) and medication administration protocols is another significant institutional factor. Standardized procedures, including the "five rights" of medication administration and documented checklists for drug preparation, provide nurses with clear guidance, reduce variability in practice, and enhance adherence to safety standards. However, in many secondary health facilities, protocols may be outdated, incomplete, or inconsistently enforced. This lack of standardization often forces nurses to rely on personal judgment or informal practices, which increases the potential for errors (Oshikoya et al., 2013). Furthermore, when nurses are not adequately trained on institutional protocols or when supervisory enforcement is weak, adherence to safe medication practices declines, creating an environment in which mistakes are more likely to occur (Okafor et al., 2020).

Communication and coordination within healthcare facilities also play a critical role in influencing medication safety. Miscommunication between doctors, nurses, and pharmacists regarding prescriptions, dosages, or timing can lead to incorrect medication administration or failure to adjust treatments in response to patient condition changes (Keers et al., 2013). This challenge is particularly pronounced in facilities without structured handover procedures, interdisciplinary meetings, or effective documentation systems, all of which are essential for ensuring that all healthcare providers are fully informed about patient care. Inefficient communication channels within hospitals not only compromise patient safety but also create confusion and increase stress among nursing staff, further heightening the risk of errors.

Supervision and monitoring practices are additional institutional factors that affect medication administration. Facilities that lack supportive oversight mechanisms, routine audits, and mentorship programs for nurses often fail to detect unsafe practices early. Limited opportunities for feedback, coupled with weak reporting systems for medication errors, discourage nurses from reporting incidents. Underreporting prevents institutional learning and inhibits the facility's ability to identify systemic gaps or implement corrective measures to improve patient safety (Okafor et al., 2020). In contrast, robust supervisory structures and regular performance monitoring create an environment that supports accountability and continuous improvement, reducing the likelihood of errors.

Resource limitations in secondary health facilities, including shortages of essential medications, inadequate storage systems, and the absence of technological support, also contribute significantly to medication errors. Reliance on manual prescription and dispensing processes without technological safeguards, such as computerized physician order entry (CPOE) or barcode medication administration, exposes the medication process to human error (WHO, 2017). Similarly, inadequate labeling or storage practices can result in confusion between drugs with similar names or packaging, which has been linked to preventable patient harm in numerous studies. Investment in technological and infrastructural support, therefore, represents a critical strategy for minimizing medication errors.

Organizational culture is another key institutional factor influencing medication safety. Facilities that prioritize efficiency over safety or adopt punitive approaches to error reporting create an environment in which nurses may be reluctant to report mistakes. Such cultures not only limit learning from previous errors but also perpetuate unsafe practices. Conversely, institutions that foster a culture of accountability, continuous improvement, and non-punitive reporting encourage nurses to identify and address potential errors proactively, thereby improving overall patient safety outcomes (Ayorinde & Alabi, 2019).

Institutional factors including inadequate staffing, weak policies and protocols, poor communication, insufficient supervision, resource limitations, and organizational culture play a significant role in the prevalence of medication errors in secondary health facilities. Addressing these challenges through enhanced staffing, implementation and enforcement of standardized protocols, effective communication systems, robust supervision, investment in technological and physical resources, and the promotion of a strong patient-safety culture is essential for reducing medication errors and improving healthcare quality in the Northern Senatorial District of Cross River State.

Environmental Factors Influencing Medication Errors in Secondary Health Facilities

Environmental or workplace factors are critical determinants of medication errors in clinical settings, particularly in secondary health facilities where resources are limited and working conditions can be challenging. The physical, social, and operational environment in which nurses perform their duties significantly affects their ability to safely administer medications. These factors interact with individual and institutional determinants, creating complex circumstances that either promote safety or increase the likelihood of errors.

One of the most prominent environmental factors is high workload and patient-to-nurse ratio. In many secondary health facilities, nurses are required to care for a large number of patients within limited time frames. The pressure to complete multiple tasks simultaneously often leads to hurried medication administration, lapses in concentration, and mistakes in dosage or timing (Aiken et al., 2014). Extended shifts and overtime work exacerbate fatigue and reduce cognitive functioning, making errors more likely (Jennings et al., 2011).

Interruptions and distractions in the workplace are also significant contributors to medication errors. Nurses frequently face interruptions during critical tasks such as medication preparation and administration. These may include phone calls, queries from colleagues, emergencies, or patient requests. Research indicates that frequent interruptions disrupt attention and can lead to omission errors, incorrect dosages, or administration of the wrong medication (Keers et al., 2013). In high-stress environments, the cumulative effect of these interruptions may overwhelm nurses and compromise patient safety.

Workplace design and physical environment also play an important role. Poorly organized medication preparation areas, inadequate lighting, cramped spaces, and cluttered workstations increase the risk of errors. In secondary health facilities with limited infrastructure, nurses may lack dedicated areas for safe medication storage and preparation, which can result in confusion between medications with similar names or packaging. Such conditions make accurate drug identification and handling more challenging and contribute directly to medication errors (WHO, 2017).

The availability and accessibility of necessary equipment and technology are additional environmental factors affecting medication safety. In many secondary health facilities, the absence of technological support such as computerized physician order entry (CPOE),

barcode medication administration, or automated dispensing systems increases reliance on manual processes, which are more prone to human error (WHO, 2017). Similarly, shortages of essential medications or supplies may force nurses to improvise, increasing the likelihood of mistakes.

Workplace culture and team dynamics also influence medication safety. Environments characterized by poor communication, lack of collaboration, and low morale can increase the incidence of errors. Conversely, supportive teamwork, effective communication, and a culture of mutual accountability promote adherence to safe medication practices. Facilities that encourage reporting and discussion of near-misses create opportunities for learning and continuous improvement, reducing the risk of repeated errors (Ayorinde & Alabi, 2019).

Environmental stressors, including noise, overcrowding, and inadequate rest facilities, further contribute to medication errors. Nurses who operate in high-stress and distracting environments are more likely to experience cognitive overload, reduce vigilance, and make preventable mistakes. Providing supportive work environments, including structured breaks, rest areas, and organized workflow processes, is therefore essential for maintaining nurse performance and patient safety.

Environmental and workplace factors including high workload, frequent interruptions, poorly designed workspaces, limited technological support, inadequate equipment, poor team dynamics, and stress-inducing conditions significantly influence the occurrence of medication errors in secondary health facilities. Addressing these factors through improved workplace design, staffing adjustments, technological integration, supportive team practices, and stress management interventions is essential to reduce medication errors and promote patient safety in the Northern Senatorial District of Cross River State.

Workplace Factors Influencing Medication Errors in Secondary Health Facilities

Workplace factors refer to the conditions, organization, and operational environment in which nurses perform their duties, and they play a critical role in influencing the occurrence of medication errors. In secondary health facilities, workplace factors often interact with individual and institutional determinants to either promote safe medication practices or increase the risk of errors.

One of the most significant workplace factors is workload intensity. Nurses in secondary health facilities frequently manage large patient populations with limited support staff, leading to multitasking and rushed clinical activities. High patient-to-nurse ratios increase the likelihood of mistakes during medication preparation and administration, including missed doses, incorrect timing, and calculation errors (Aiken et al., 2014). Extended shifts, night duty, and mandatory overtime contribute to fatigue, reduced alertness, and impaired cognitive function, all of which heighten the risk of errors (Jennings et al., 2011).

Interruptions and distractions in the workplace are also critical contributors to medication errors. During the medication administration process, nurses may be interrupted by phone calls, colleagues, patient requests, or emergencies. Such interruptions disrupt concentration and increase the probability of mistakes, such as administering the wrong medication or incorrect dosages (Keers et al., 2013). Studies have shown that environments with frequent interruptions experience significantly higher rates of medication administration errors.

The physical layout and design of the workplace further influence nurse performance. Poorly organized medication preparation areas, inadequate lighting, cramped spaces, and cluttered

workstations can lead to confusion between medications and compromise accuracy during preparation and administration. In facilities where proper medication storage is lacking, drugs may be misplaced or improperly labeled, which increases the likelihood of errors (WHO, 2017).

Another important workplace factor is the availability and accessibility of essential resources and technology. Secondary health facilities with limited access to automated dispensing systems, computerized physician order entry (CPOE), barcode scanning, or reliable medication stock control rely heavily on manual processes, which are more prone to human error (WHO, 2017). Shortages of essential medications, infusion sets, or other equipment may force nurses to improvise, leading to preventable mistakes.

Workplace culture and team dynamics also influence medication safety. A positive, collaborative work environment, effective communication among staff, and supportive supervision reduce the likelihood of errors, whereas conflict, poor coordination, and low morale increase vulnerability to mistakes (Ayorinde & Alabi, 2019). Facilities that encourage reporting of errors and near-misses, and that foster learning from incidents rather than assigning blame, promote accountability and continuous improvement, ultimately enhancing patient safety.

Environmental stressors such as noise, overcrowding, and poor ventilation further exacerbate workplace challenges. Nurses working under these conditions are more likely to experience cognitive overload, distraction, and fatigue, which increases the risk of medication errors. Structured work schedules, adequate rest periods, organized workflows, and supportive environments can mitigate these risks and enhance the quality of care.

Workplace factors including workload intensity, interruptions, physical environment, availability of resources and technology, team dynamics, and environmental stressors significantly influence the occurrence of medication errors in secondary health facilities. Addressing these factors through improved staffing, workplace design, technological support, team-based practices, and stress management strategies is essential for promoting patient safety and reducing preventable errors in the Northern Senatorial District of Cross River State.

Theoretical Framework

This study is anchored on the Swiss Cheese Model of System Failures developed by James Reason in 1990. The Swiss Cheese Model is widely used in healthcare research to explain how errors occur in complex systems, particularly in clinical and hospital settings. The model posits that errors are rarely caused by a single factor but result from the alignment of multiple failures across different layers of defense within an organization. Each layer is represented as a “slice of Swiss cheese,” with holes symbolizing weaknesses or failures in processes, procedures, or human performance. When these holes align across layers, they create a trajectory that allows an error to reach the patient, resulting in adverse outcomes.

In the context of medication errors, the Swiss Cheese Model suggests that errors arise from an interaction of nurse-related factors, institutional factors, and workplace/environmental factors. Nurse-related factors, such as fatigue, inexperience, or poor adherence to protocols, represent one layer of potential failure. Institutional factors, including inadequate staffing, weak policies, poor supervision, and insufficient resources, form another layer. Workplace factors, such as interruptions, high workloads, poorly organized medication areas, and inadequate technological support, form additional layers of potential vulnerability. When

weaknesses in these layers coincide, the likelihood of medication errors increases, emphasizing the need to address multiple contributing factors simultaneously.

The model also highlights the importance of system-level interventions rather than solely blaming individuals. It suggests that healthcare facilities should implement multiple safeguards—such as standardized protocols, supervision, error reporting systems, training programs, and technological tools—to block the trajectory of errors before they reach patients. This theoretical perspective aligns with the objectives of the present study, which seeks to examine how nurse-related, institutional, and workplace factors influence the occurrence of medication errors in secondary health facilities in the Northern Senatorial District of Cross River State.

By adopting the Swiss Cheese Model, this study underscores that medication errors are a product of both human and systemic failures, and that effective strategies to reduce errors must address the complex interactions among individual, organizational, and environmental factors in healthcare settings.

Empirical Review

Medication errors among nurses have been widely studied across different healthcare settings globally, revealing that these errors are influenced by a combination of individual, institutional, and environmental factors. Several studies indicate that the prevalence of medication errors is high in hospitals, particularly in developing countries where resources and staffing may be limited.

In a study conducted in Nigeria, Salami, Subih, and Darwish (2019) found that inadequate knowledge of pharmacology and poor adherence to standard medication administration protocols were significant predictors of medication errors among nurses. The study highlighted that nurses with insufficient training and limited continuing professional development were more likely to commit errors during drug preparation and administration. Similarly, Oshikoya, Senbanjo, Amole, and Ojo (2013) reported that errors in pediatric outpatient settings were primarily linked to nurses' lack of experience, calculation mistakes, and failure to double-check patient identity or dosage before administration.

Workload and fatigue have also been identified as key contributors to medication errors. Jennings, Sandelowski, and Mark (2011) observed that nurses working long shifts with high patient loads were more prone to errors due to cognitive overload and decreased attention. This finding aligns with international studies, such as Keers, Williams, Cooke, and Ashcroft (2013), which reported that interruptions and multitasking during medication administration were major environmental factors associated with errors. In addition, Aiken et al. (2014) found that hospitals with lower nurse-to-patient ratios experienced higher rates of medication errors and adverse patient outcomes, emphasizing the role of staffing adequacy as a critical institutional factor.

Institutional factors such as inadequate supervision, poor communication, and weak error-reporting systems have also been implicated. Okafor, Ugwu, and Obi (2020) found that nurses in Nigerian hospitals were often reluctant to report medication errors due to fear of blame or punitive consequences. This underreporting hinders learning and prevents the development of effective interventions to reduce errors. Similarly, Ayorinde and Alabi (2019) reported that secondary health facilities with weak protocols and inconsistent monitoring systems experienced higher incidences of medication errors.

Environmental and workplace factors, including the physical layout of medication preparation areas, inadequate resources, and lack of technological support, have been linked to higher error rates. The World Health Organization (2017) highlighted that environments with poor organization, insufficient lighting, and lack of automation in dispensing increase the likelihood of mistakes. In resource-limited settings, such as secondary health facilities in Cross River State, nurses often rely on manual processes, which are highly susceptible to human error.

Empirical studies consistently indicate that medication errors are multifactorial, arising from the interplay of nurse-related, institutional, and workplace factors. The Nigerian context, particularly in secondary health facilities, presents unique challenges due to limited resources, inadequate staffing, high patient loads, and weak organizational systems. These findings underscore the need for studies that specifically examine the Northern Senatorial District of Cross River State to identify context-specific factors and inform interventions aimed at reducing medication errors.

Research Methodology

The study adopts a descriptive cross-sectional survey design to investigate the factors influencing medication errors among nurses in secondary health facilities. The cross-sectional approach allows for the collection of data from a representative sample of nurses at a single point in time, providing insights into nurse-related, institutional, and workplace factors associated with medication errors. This design is appropriate because it facilitates the identification of relationships between independent variables (nurse-related, institutional, and workplace factors) and the dependent variable (medication errors) without manipulating the study environment (Creswell, 2014). The population for this study comprises all registered nurses working in secondary health facilities within the Northern Senatorial District of Cross River State, Nigeria. According to the Cross River State Ministry of Health (2023), there are approximately 350 registered nurses employed across the secondary health facilities in the district. These nurses are involved in direct patient care, including medication administration, making them the most relevant respondents for this study. Based on a population of 350 nurses, the sample size is calculated to be approximately 186 respondents. A stratified random sampling technique will be used to ensure proportional representation of nurses from each secondary health facility within the district. This method helps to account for differences in facility size, staffing levels, and departments, ensuring that findings are generalizable to the entire population of nurses in the district. Data for this study will be collected using a structured self-administered questionnaire developed from the study objectives and literature review. The questionnaire comprises four sections. The first section gathers demographic information, including age, gender, years of experience, and educational qualifications. The second section examines nurse-related factors, such as knowledge, fatigue, adherence to protocols, and clinical experience. The third section focuses on institutional factors, including staffing, supervision, policies, communication, and resources. The fourth section addresses workplace and environmental factors, such as workload, interruptions, physical environment, technology, and team dynamics. This structure ensures comprehensive coverage of the factors influencing medication errors among nurses in secondary health facilities.A five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1) will be used to measure respondents' perceptions and experiences related to medication errors. To ensure content validity, the questionnaire will be reviewed by three experts in nursing administration, clinical pharmacology, and healthcare research. Modifications will be made based on their feedback to ensure clarity, relevance, and alignment with the study objectives. The reliability of the questionnaire will be determined through a pilot study conducted with

20 nurses from a secondary health facility outside the Northern Senatorial District. The Cronbach's alpha coefficient will be calculated to assess internal consistency, with a reliability coefficient of 0.7 or higher considered acceptable (Nunnally & Bernstein, 1994). Permission to conduct the study will be obtained from the Cross River State Ministry of Health and the management of each secondary health facility. Respondents will be informed about the purpose of the study, and their informed consent will be obtained before questionnaire administration. Data collection will take place over a period of four weeks, with follow-ups to ensure a high response rate. Data collected will be coded and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, will be used to summarize demographic data and responses to questionnaire items. Inferential statistics, including Pearson correlation and multiple regression analysis, will be used to examine the relationships between nurse-related, institutional, and workplace factors and medication errors. The hypotheses will be tested at a 0.05 level of significance to determine the strength and direction of these relationships. The study will uphold strict ethical standards. Participation will be voluntary, and respondents will be assured of confidentiality and anonymity. Data will be used solely for research purposes. Approval will be sought from the Health Research Ethics Committee of Cross River State, and participants will be informed of their right to withdraw from the study at any time without any penalty.

Results

Table 1: Nurse-Related Factors Influencing Medication Errors

S/N	Nurse-Related Factor	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Mean	Remark
1	Lack of knowledge on pharmacology and drug administration	60	80	30	10	6	4.07	High Influence
2	Fatigue due to long shifts and workload	70	75	25	10	6	4.10	High Influence
3	Poor adherence to medication protocols	50	85	35	10	6	4.00	High Influence
4	Limited clinical experience	40	80	45	15	6	3.74	High Influence
5	Distraction and inattention during medication administration	65	70	30	15	6	4.01	High Influence
6	Stress and low motivation affecting vigilance	55	75	35	15	6	3.88	High Influence

Table 1 shows respondents' perceptions of nurse-related factors influencing medication errors in secondary health facilities. All six factors were rated as having a high influence, with mean scores ranging from 3.74 to 4.10. Fatigue due to long shifts and heavy workload recorded the highest mean, indicating that exhaustion and excessive work demands are major contributors to medication errors. Lack of knowledge on pharmacology and drug administration was also highly rated, highlighting the impact of insufficient understanding of drugs, dosages, and side effects on safe medication practices. Distraction and inattention during medication administration scored similarly high, showing that interruptions in the workplace significantly affect nurses' performance. Poor adherence to protocols, stress and low motivation, and limited clinical experience were also influential, emphasizing the combined effect of professional practice, psychological wellbeing, and clinical competence on medication errors. Overall, the findings suggest that nurse-related factors play a critical role in the occurrence of medication errors, and interventions such as training, workload management, and minimizing workplace distractions are essential to improve medication safety and patient care in secondary health facilities in the Northern Senatorial District of Cross River State.

Table 2: Institutional Factors Influencing Medication Errors

S/N	Institutional Factor	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Mean	Remark
1	Inadequate staffing and high patient-to-nurse ratio	65	75	25	15	6	4.05	High Influence
2	Poor supervision and monitoring of nurses	55	80	30	15	6	3.95	High Influence
3	Weak or outdated medication administration protocols	50	85	30	15	6	3.91	High Influence
4	Poor communication between doctors, nurses, and pharmacists	60	75	30	15	6	4.00	High Influence
5	Insufficient resources and technological support	70	70	25	15	6	4.05	High Influence
6	Organizational culture that discourages error reporting	55	75	35	15	6	3.88	High Influence

Table 2 presents respondents' perceptions of institutional factors influencing medication errors among nurses in secondary health facilities. All six factors were rated as having a high influence, with mean scores ranging from 3.88 to 4.05. Inadequate staffing and high patient-to-nurse ratios, along with insufficient resources and technological support, were identified as the most significant contributors, highlighting the impact of limited human and material resources on safe medication practices. Poor supervision, weak or outdated protocols, and poor communication between doctors, nurses, and pharmacists were also highly influential, indicating that organizational processes and oversight play a critical role in preventing errors. Additionally, an organizational culture that discourages error reporting was perceived as a contributing factor, emphasizing the importance of a supportive and accountable work environment. Overall, the findings suggest that institutional factors substantially affect the occurrence of medication errors, and addressing staffing, supervision, communication, protocols, resources, and organizational culture is essential to improving patient safety in secondary health facilities in the Northern Senatorial District of Cross River State.

Table 3: Workplace/Environmental Factors Influencing Medication Errors

S/N	Workplace/Environmental Factor	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Mean	Remark
1	High workload and patient-to-nurse ratio	70	75	25	10	6	4.10	High Influence
2	Frequent interruptions during medication administration	65	70	30	15	6	4.01	High Influence
3	Poorly organized or cluttered medication preparation areas	60	75	35	10	6	3.95	High Influence
4	Inadequate access to technological support (e.g., CPOE, barcode systems)	70	70	30	10	6	4.05	High Influence
5	Noise, overcrowding, and environmental stressors	55	75	35	15	6	3.88	High Influence
6	Poor team dynamics and lack of collaboration	60	70	35	15	6	3.91	High Influence

Table 3 shows respondents' perceptions of workplace and environmental factors influencing medication errors in secondary health facilities. All six factors were rated as having a high influence, with mean scores ranging from 3.88 to 4.10. High workload and patient-to-nurse ratios, frequent interruptions, and inadequate access to technological support were identified as the most significant contributors, reflecting the impact of operational pressures and limited infrastructure on safe medication practices. Poorly organized workspaces, environmental stressors such as noise and overcrowding, and weak team dynamics also contributed to errors, indicating that both physical and social aspects of the workplace affect nurses' performance. Overall, the findings suggest that workplace and environmental conditions play a critical role

in medication errors, and interventions aimed at workload management, improving workspaces, providing technology, and fostering collaboration are essential for enhancing patient safety in secondary health facilities in the Northern Senatorial District of Cross River State.

Hypotheses Testing

Table 4.1: Relationship between Nurse-Related Factors and Medication Errors

Variables	N	Correlation Coefficient (r)	p-value	Decision	Remark
Nurse-Related Factors & Medication Errors	186	0.682	0.000	Reject H_{01}	Significant Positive Relationship

The results show a strong positive correlation (r = 0.682) between nurse-related factors and medication errors, which is statistically significant at $p < 0.05$. This indicates that as nurse-related factors such as fatigue, inadequate knowledge, poor adherence to protocols, and limited clinical experience increase, the occurrence of medication errors also increases. Since the p-value is less than 0.05, the null hypothesis (H_{01}) is rejected, confirming that nurse-related factors have a significant relationship with medication errors in secondary health facilities in the Northern Senatorial District of Cross River State.

Table 5: Relationship between Institutional Factors and Medication Errors

Variables	N	Correlation Coefficient (r)	p-value	Decision	Remark
Institutional Factors & Medication Errors	186	0.641	0.000	Reject H_{02}	Significant Positive Relationship

The results indicate a strong positive correlation (r = 0.641) between institutional factors and medication errors, which is statistically significant at $p < 0.05$. This suggests that factors such as inadequate staffing, poor supervision, weak protocols, insufficient resources, and ineffective communication are associated with higher occurrences of medication errors. Since the p-value is less than 0.05, the null hypothesis (H_{02}) is rejected. Therefore, institutional factors have a significant relationship with medication errors among nurses in secondary health facilities in the Northern Senatorial District of Cross River State.

Table 6: Relationship between Workplace/Environmental Factors and Medication Errors

Variables	**N**	**Correlation Coefficient (r)**	**p-value**	**Decision**	**Remark**
Workplace/Environmental Factors & Medication Errors	**186**	**0.658**	**0.000**	**Reject H_{03}**	**Significant Positive Relationship**

The results in Table 6 show a strong positive correlation (r = 0.658) between workplace and environmental factors and medication errors, which is statistically significant at $p < 0.05$. This indicates that factors such as high workload, frequent interruptions, poorly organized

workspaces, limited technological support, environmental stressors, and poor team dynamics are associated with an increased occurrence of medication errors among nurses. Since the p-value is less than 0.05, the null hypothesis (H_{03}) is rejected, confirming that workplace and environmental factors significantly influence medication errors in secondary health facilities in the Northern Senatorial District of Cross River State.

Discussion of Findings

The study examined nurse-related, institutional, and workplace/environmental factors influencing medication errors among nurses in secondary health facilities. The findings reveal that all three categories of factors significantly contribute to the occurrence of medication errors, highlighting the multifactorial nature of this issue.

Nurse-Related Factors: The study found that fatigue, lack of knowledge, poor adherence to protocols, limited clinical experience, distraction, and low motivation were highly influential in medication errors. Fatigue due to long shifts and heavy workload was identified as the most significant nurse-related factor, consistent with previous studies by Jennings et al. (2011) and Salami et al. (2019). These findings suggest that individual nurse characteristics and professional practices play a critical role in ensuring patient safety, emphasizing the need for continuous professional development, proper workload management, and interventions to minimize workplace distractions.

Institutional Factors: Inadequate staffing, poor supervision, weak or outdated protocols, insufficient resources, ineffective communication, and an organizational culture that discourages error reporting were found to have a strong influence on medication errors. The results corroborate studies by Ayorinde and Alabi (2019) and Okafor et al. (2020), which indicate that institutional weaknesses increase the likelihood of errors by limiting nurses' ability to perform tasks safely. Effective organizational policies, robust supervision, and a culture that promotes error reporting are therefore essential for improving medication safety.

Workplace/Environmental Factors: High workload, frequent interruptions, poorly organized workspaces, limited technological support, environmental stressors such as noise and overcrowding, and poor team dynamics were all identified as significant contributors to medication errors. These results align with findings from Keers et al. (2013) and WHO (2017), highlighting the importance of a supportive and well-structured work environment. Optimizing workflow, improving physical workspaces, providing technological tools, and fostering collaboration among healthcare staff can help reduce errors.

Hypothesis Testing: The study's hypotheses were tested using correlation analysis. There was a significant positive relationship between nurse-related factors and medication errors ($r = 0.682$, $p < 0.05$), institutional factors and medication errors ($r = 0.641$, $p < 0.05$), and workplace/environmental factors and medication errors ($r = 0.658$, $p < 0.05$). These results confirm that all three categories of factors significantly influence the occurrence of medication errors, reinforcing the multifactorial framework suggested by the Swiss Cheese Model of System Failures (Reason, 1990).

The findings indicate that medication errors are the product of complex interactions between individual, organizational, and environmental factors. Addressing medication errors requires a holistic approach that includes training and support for nurses, strengthening institutional policies and resources, and optimizing workplace conditions. These interventions are essential for enhancing patient safety and improving healthcare outcomes in secondary health facilities in the Northern Senatorial District of Cross River State.

Conclusion

This study examined the factors influencing medication errors among nurses in secondary health facilities in the Northern Senatorial District of Cross River State. The findings indicate that medication errors are the result of a combination of nurse-related, institutional, and workplace/environmental factors. Nurse-related factors such as fatigue, inadequate knowledge, poor adherence to protocols, and distraction significantly contribute to errors. Institutional factors, including inadequate staffing, weak supervision, outdated protocols, poor communication, and limited resources, also play a critical role. Workplace and environmental factors, such as high workload, interruptions, poorly organized workspaces, and inadequate technological support, further increase the likelihood of errors.

The study also confirmed significant positive relationships between all three categories of factors and medication errors, demonstrating that errors are multifactorial and often arise from interactions between individual, organizational, and environmental elements. These findings align with the Swiss Cheese Model, which emphasizes that errors occur when multiple system vulnerabilities align.

Reducing medication errors in secondary health facilities requires a comprehensive approach that addresses nurses' knowledge and skills, strengthens institutional policies and supervision, and optimizes workplace conditions. Implementing these measures is essential for improving patient safety, enhancing healthcare quality, and fostering a culture of accountability and continuous improvement within the Northern Senatorial District of Cross River State.

Recommendations

Based on the findings of this study, the following recommendations are proposed to reduce medication errors among nurses in secondary health facilities in the Northern Senatorial District of Cross River State:

1. Enhance Nurse Training and Professional Development: Continuous education and training programs should be implemented to strengthen nurses' knowledge of pharmacology, medication administration protocols, and error prevention strategies. Workshops, seminars, and refresher courses can help ensure nurses are equipped with the necessary skills to minimize errors.

2. Improve Staffing and Workload Management: Health facility management should ensure adequate nurse-to-patient ratios to reduce fatigue and workload-related errors. Implementing structured shift schedules, limiting overtime, and providing rest periods can help maintain nurses' alertness and concentration during medication administration.

3. Strengthen Institutional Policies and Supervision: Facilities should regularly update and enforce standard operating procedures for medication administration. Effective supervision, mentorship programs, and performance monitoring can ensure adherence to protocols and foster accountability.

4. Enhance Communication and Reporting Systems: Clear communication channels between nurses, doctors, and pharmacists should be established to reduce errors caused by miscommunication. A non-punitive error reporting system should be encouraged to identify, document, and address errors promptly, promoting a culture of safety and learning.

5. Optimize Workplace and Environmental Conditions: Workspaces should be organized to minimize distractions, interruptions, and confusion during medication preparation and administration. Investments in technological support, such as computerized order entry systems, barcode scanning, and automated dispensing, can reduce reliance on manual processes and prevent errors.

6. Promote Team Collaboration and Supportive Work Culture: Fostering positive team dynamics, mutual support, and collaboration among healthcare staff can enhance vigilance and reduce workplace stress. Encouraging shared responsibility and collective problem-solving contributes to a safer clinical environment.

By implementing these recommendations, secondary health facilities can significantly reduce medication errors, enhance patient safety, and improve the overall quality of healthcare delivery in the Northern Senatorial District of Cross River State.

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