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The Role Of Nursing, Pharmacy, Health Assistants, And Nutritionists In Enhancing Patient Safety: A Comprehensive Review

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Abstract

Background

Patient safety involves preventing preventable harm and minimizing healthcare risks via organized activities fostering safe cultures and processes. Globally, one in ten acute care patients experiences harm, with 30-50% preventable, mainly from medication errors and procedural issues, as highlighted by WHO and IOM reports like "To Err is Human." Multidisciplinary teams counter silos by integrating nursing surveillance, pharmacy stewardship, assistant support, and nutritional optimization.

Methods

This narrative synthesis draws from global evidence-based literature, including systematic reviews, studies, and guidelines on PubMed, Scopus, and similar databases. It examines distinct roles, interprofessional dynamics, challenges like communication gaps, and strategies such as TeamSTEPPS and IPE, focusing on contributions to error reduction across settings.

Results

Nurses lead vigilance, infection control, and handovers; pharmacists drive MTM, ASPs, and error interception (up to 50%); health assistants aid monitoring, falls prevention, and escalation; nutritionists prevent malnutrition (affecting 50% inpatients) and allergies. Teams using SBAR/ISBAR reduce adverse events by improving communication and outcomes like readmissions.

Conclusions

Integrated roles significantly bolster safety, but barriers like shortages and silos persist; recommendations include IPE, simulations, AI tools, and policies for role clarity to guide evidence-based, patient-centered care.

Keywords: patient safety, multidisciplinary care, nursing, pharmacy, allied health, nutrition.

Introduction

Patient safety encompasses the absence of preventable harm to patients and the reduction of risk associated with healthcare to an acceptable minimum, forming a framework of organized activities that foster cultures, processes, and environments to lower risks and mitigate errors. Globally, preventable patient harm affects approximately one in ten patients receiving acute care, with 30-50% of these incidents avoidable, leading to an estimated 64 million disability-adjusted life years lost annually, a burden comparable to major chronic diseases like tuberculosis or multiple sclerosis. This substantial global toll underscores the urgency, as systematic reviews reveal a pooled prevalence of 12% for overall harm, half of which is preventable, primarily from medication errors, therapeutic mismanagement, and procedural issues, disproportionately impacting low- and middle-income countries. The historical evolution traces back to early recognitions like Schimmel's 1964 documentation of hospitalization risks, but gained momentum with the World Health Organization's (WHO) initiatives in the 2000s and pivotal Institute of Medicine (IOM) reports, notably "To Err is Human" in 1999, which estimated 44,000–98,000 annual U.S. deaths from preventable errors, catalyzing a safety movement through policy, funding, and high-reliability system adoption. Subsequent IOM works and WHO's Global Patient Safety Challenges furthered frameworks like James Reason's error models, shifting from blame to systemic designs prioritizing leadership, communication, and incident reporting. Teamwork and systemic approaches prove essential, as multidisciplinary in-hospital teams counter the "silo effect" by enhancing communication, reducing adverse events, shortening lengths of stay, and boosting satisfaction across emergency rooms, wards, ICUs, and operating rooms. These teams function as "well-oiled machines," integrating levels of care to limit morbidity, mortality, and errors through cohesive collaboration, with evidence showing improved hemorrhage control in trauma via hybrid suites and better overall outcomes (Epstein, 2014).

Discipline-specific perspectives often foster silos, where fragmented workflows rely on individual vigilance rather than systemic safeguards, heightening risks like medication errors from poor prescribing oversight or inadequate monitoring. Nurses monitor status but lack prescribing input, pharmacists review regimens yet face skepticism as "controllers," and health assistants handle basics without integrated therapeutic insight, leading to duplicated efforts, communication gaps, and suboptimal care. Collaboration among nurses, pharmacists, health assistants, and nutritionists addresses this by leveraging complementary roles: nurses in surveillance and education, pharmacists in optimization and reconciliation, assistants in daily support, and nutritionists in dietary assessments to prevent malnutrition-related complications. Such teams break hierarchical barriers, align on patient-centered goals, and enhance processes like medication reviews, reducing readmissions and improving quality of life cost-effectively. This ties directly to healthcare quality metrics, where multidisciplinary interventions yield better patient outcomes, including lower adverse events, glycemic control in diabetes, reduced heart failure readmissions, and higher satisfaction via interprofessional rounds. Metrics like Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores rise with team-based care, alongside decreased lengths of stay and mortality, as seen in chronic disease management where integrated input prevents drug interactions and supports adherence (Zaij et al., 2023).

This review aims to synthesize evidence on the distinct yet interdependent roles of nurses, pharmacists, health assistants, and nutritionists in bolstering patient safety through frontline surveillance, medication stewardship, supportive care, and nutritional optimization. It explicitly targets identifying key contributions, such as nurses' error detection, pharmacists' regimen reviews, assistants' procedural aids, and nutritionists'

malnutrition prevention, alongside their collaborative dynamics in multidisciplinary teams. Challenges like resource limits, communication silos, role overlaps, and implementation barriers will be examined, drawing from global studies on interprofessional gaps. Improvement strategies, including protocol standardization, training for teamwork, policy support, and metrics for outcomes like reduced harm prevalence, will be proposed to foster sustainable, patient-centered models. Ultimately, the review seeks to guide evidence-based practices enhancing safety across settings, informing policy for integrated care (Ricciardi & Cascini, 2020).

The Concept of Patient Safety

Patient safety is broadly defined as the absence of preventable harm to patients and the reduction of risk associated with healthcare to an acceptable minimum, emphasizing a framework of organized activities that promote cultures, processes, and technologies to lower risks and mitigate errors when they occur. Core principles include error prevention through proactive system designs that anticipate failures, harm reduction by minimizing the impact of inevitable errors via robust defenses like double-checks in medication administration by nurses and pharmacists, and the cultivation of a safety culture characterized by shared values, beliefs, and behavioral norms among healthcare teams that prioritize reporting and learning from near-misses without fear of punishment. Dimensions extend to human factors, recognizing how individual cognitive limitations, workload pressures, environmental distractions such as noise in busy wards, and organizational influences like staffing levels interact to influence performance; for instance, health assistants and nutritionists contribute by ensuring accurate dietary orders that prevent allergic reactions or malnutrition-related harm, underscoring the need for interdisciplinary vigilance. These principles are operationalized through continuous education on recognizing high-risk situations, such as medication reconciliation led by pharmacists alongside nurses, and promoting just culture where accountability focuses on system improvements rather than individual blame, thereby enhancing overall patient outcomes in diverse clinical scenarios from emergency departments to long-term care (Shah et al., 2022).

Systems thinking in patient safety shifts focus from individual blame to analyzing the interplay of work system elements using frameworks like the Systems Engineering Initiative for Patient Safety (SEIPS) model, which maps how factors such as poor lighting, high workloads, or inadequate training contribute to errors and proposes redesigns for safer processes. Root cause analysis (RCA) exemplifies this by retrospectively dissecting adverse events through structured tools like the Yorkshire Contributory Factors Framework or Failure Mode and Effects Analysis (FMEA), identifying latent system failures such as communication gaps between nurses and nutritionists in managing diabetic patients, rather than active errors, and leading to targeted interventions that have demonstrated reductions in events like falls or medication errors across VA facilities and hospitals. Improvement models, including Plan-Do-Study-Act (PDSA) cycles integrated with RCA, enable iterative enhancements, such as optimizing handoff protocols involving health assistants to prevent omissions in patient monitoring, while high-reliability organization principles from aviation guide proactive risk assessments by multidisciplinary teams including pharmacists for drug interaction prevention. This holistic approach fosters resilience, as evidenced by studies showing decreased risk priority numbers post-FMEA in areas like pressure sores and medication administration, emphasizing the roles of all professionals in building adaptive systems that learn from incidents to safeguard patients comprehensively (Shah et al., 2022).

Interprofessional collaboration underpins patient safety by promoting shared accountability through theoretical models like SBAR (Situation, Background, Assessment, Recommendation), which structures concise handoffs reducing miscommunication that contributes to 60-70% of adverse events and improving outcomes like decreased cardiac arrests and MRSA infections. TeamSTEPPS, a national standard for team training, enhances competencies in leadership, mutual support, and situation monitoring via tools like CUS (Concerned, Uncomfortable, Safety issue) for voicing concerns, proven effective in simulations where nursing, pharmacy, health assistants, and nutritionists practice coordinated responses to deteriorations, yielding gains in teamwork skills and patient interventions. Interprofessional education (IPE) frameworks,

aligned with core competencies from IPEC and Quality and Safety Education for Nurses, cultivate responsive communication across professions, as seen in large-scale trainings that boost attitudes toward collaboration and reduce errors in handoffs, with nutritionists contributing vital input on enteral feeding risks during team huddles. These models collectively mitigate silos, fostering environments where feedback loops and non-punitive error reporting enable roles like health assistants in real-time surveillance to complement nursing vigilance, ultimately lowering adverse events through unified efforts (Shah et al., 2022).

The Role of Nursing in Enhancing Patient Safety

Nursing leadership and governance form the foundational pillars for embedding a culture of safety within healthcare organizations, where nurse managers and executives drive policies that prioritize patient outcomes and reduce risks such as adverse events and errors. Transformational and authentic leadership styles by nurse leaders enhance team communication, psychological safety, and error reporting, leading to fewer patient harms and higher care quality, as evidenced by systematic reviews showing positive associations between leadership behaviors and safety metrics like reduced adverse events and improved patient satisfaction. Effective governance involves supportive structures like adequate staffing, continuous training, and just culture policies that encourage transparency and accountability, enabling nurse leaders at all levels to model safety practices and foster interdisciplinary collaboration for sustained improvements in patient safety (Lee et al., 2023).

Clinical vigilance by nurses involves continuous patient monitoring and the use of early warning systems (EWS) like NEWS or I-EWS to detect subtle physiological deteriorations in general wards, enabling timely interventions that prevent adverse events and ensure safety. These systems provide structured assessments of vital signs and risk indicators, supporting nurses in identifying high-risk patients during routine checks and multidisciplinary huddles, with studies confirming their reliability in enhancing detection of critical changes and reducing harm. Integrating EWS into daily practice promotes proactive surveillance, bridging gaps in traditional monitoring and aligning with nursing's role in risk prevention across diverse settings (Xiong et al., 2025).

Nurses play a pivotal role in infection prevention through rigorous adherence to hand hygiene, asepsis protocols, and environmental controls, which are fundamental to reducing healthcare-associated infections (HAIs) like catheter-related bloodstream infections and surgical site infections. Hand hygiene, using alcohol-based rubs or soap, remains the primary vehicle to interrupt pathogen transmission between patients, reinforced by bundle strategies and isolation precautions that nurses implement daily to safeguard vulnerable populations. Compliance challenges are addressed via education, monitoring, and leadership, with evidence showing that personalized IPC strategies significantly lower HAI rates and enhance overall patient safety (Blomgren et al., 2024).

Safe medication administration hinges on nursing double-check systems for high-risk drugs, where two nurses independently verify orders, dosages, and patient identity to minimize errors in acute settings. Literature reviews affirm that independent double-checks throughout the process strengthen practice by incorporating human factors and contextual safeguards, significantly reducing administration errors and supporting managerial decisions for safer protocols. These systems integrate with barcode scanning and standardized procedures, proving effective in high-stakes environments (Kellett & Gottwald, 2015).

Effective communication and standardized handover protocols enable seamless information transfer during shift changes, incorporating patient-centered elements like bedside reporting to boost safety and involvement. Interventions combining training with redesigned tools have demonstrated reduced hospital-acquired complications and improved ward culture. Nurses' structured interactions mitigate risks from miscommunication, fostering transparency and accountability (Jang et al., 2022).

Nurses advance patient safety by educating on self-management, risks, and rights while advocating for autonomy, informed consent, and equitable care, embedding ethical principles into practice. Educational interventions build competencies in safety concepts like error disclosure and teamwork, with concept analyses highlighting advocacy's role in protecting patients and enhancing outcomes. This dual role empowers patients and reinforces a safety culture through empathetic, assertive communication (Lee et al., 2021).

Key barriers include burnout from high workloads, poor staffing ratios, and extended shifts, which elevate error risks, HAIs, and mental health issues like anxiety among nurses. Systematic reviews link these factors to compromised vigilance and safety outcomes. Hierarchical pressures and lack of autonomy exacerbate fatigue, underscoring the need for systemic relief (Garcia et al., 2019).

Strategies encompass peer-support programs, safety champions, iterative PDSA cycles, standardized processes, and leadership-driven training to boost compliance and culture. Implementation science, like TeamSTEPPS, reduces burnout while enhancing reporting and teamwork; technology aids via alarm management and tracking. Empowering nurses through optimal staffing and resilience initiatives yields measurable safety gains (Chi et al., 2025).

The Role of Pharmacy in Enhancing Patient Safety

Pharmacists' involvement in medication therapy management (MTM) substantially reduces adverse drug events and improves patient outcomes by optimizing drug regimens, identifying interactions, and ensuring adherence across care settings. Clinical pharmacists conduct thorough reviews of patient medication histories, assess therapeutic efficacy, and recommend adjustments that prevent potential harms, such as duplicative therapies or contraindicated combinations, leading to fewer hospitalizations and enhanced quality of life in chronic disease management. Randomized trials demonstrate that MTM interventions lower drug-related problems and discrepancies in medication lists, with enhanced models showing up to 47% fewer errors compared to basic approaches, underscoring pharmacists' value in ambulatory and inpatient environments (Touchette et al., 2012).

Prescription verification by pharmacists intercepts dosing errors, inappropriate selections, and omissions, preventing up to 50% of potential medication errors before they reach patients, particularly in high-risk pediatric and discharge scenarios. Dispensing accuracy improves through systematic double-checks and automated systems, reducing mismatches between prescribed and administered drugs, while pharmacist-led reviews in surgical wards have shown dramatic declines in administration errors post-implementation of verification protocols. These practices not only enhance safety but also support cost savings by avoiding readmissions linked to faulty prescriptions (Gong et al., 2025).

Pharmacists lead antimicrobial stewardship programs (ASPs) by auditing prescriptions, promoting narrow-spectrum agents, and reducing days of therapy, which correlates with lower resistance rates like carbapenem-resistant Klebsiella pneumoniae. Prospective audits reject inappropriate uses, optimizing therapy under constraints like volume-based procurement while cutting costs and improving appropriateness by over 13%. Dedicated stewardship pharmacists develop policies, educate teams, and track outcomes, proving essential in combating global resistance threats projected to cause millions of deaths annually without intervention (Martinez et al., 2023).

Pharmacovigilance efforts by pharmacists involve detecting, assessing, and reporting adverse drug reactions (ADRs), bridging gaps in spontaneous reporting to enable signal detection and post-market surveillance for public health protection. Community and hospital pharmacists educate patients, verify causation using medical histories, and utilize electronic tools to boost reporting rates, addressing under-recognition where physicians may dismiss symptoms as unrelated. Interventions like training and integrated systems have increased ADR documentation, reducing morbidity from events that rival other leading health threats (Hadi et al., 2017).

Interprofessional collaboration positions pharmacists as core team members alongside nurses and physicians, minimizing errors through shared decision-making, daily huddles, and reconciled medication lists during transitions. Pharmacist input on high-alert drugs and polypharmacy in vulnerable populations like the elderly reduces inappropriate prescribing and ADEs, with meta-analyses showing 37% drops in errors and readmissions. Structured teamwork enhances adherence, outcomes in chronic care, and systemic oversight, fostering a safety culture via simulation training on mishaps (Rahayu et al., 2021).

Barcode scanning, electronic prescribing, and closed-loop systems enable real-time verification, slashing prescribing errors by confirming patient identity and drug details at administration, with studies reporting significant MAE reductions despite initial time investments. Automated dispensing cabinets (ADCs) and e-prescribing double-checks mitigate mismatches and high-risk process failures, reallocating pharmacist efforts to clinical oversight. These technologies integrate with pharmacist reviews for comprehensive error traps in intensive care and beyond (Tu et al., 2023).

Barriers to pharmacists' safety roles include knowledge gaps, skill shortages, resource limitations, and environmental hurdles like inadequate systems, though motivations and social influences drive engagement when addressed. Facilitators encompass training, electronic tools, policy support, and role clarity, enabling expanded services beyond dispensing in resource-limited settings. Targeted interventions like protocols and audits overcome these, promoting sustained MTM and stewardship impacts (Mekonnen et al., 2018).

The Role of Health Assistants in Enhancing Patient Safety

Health assistants and allied support staff, including healthcare assistants (HCAs), nursing assistants, and other unregulated workers, play pivotal roles in both direct and indirect patient care within healthcare settings, supporting registered nurses and other professionals by handling routine tasks that free up time for complex interventions, thereby contributing to overall patient safety through consistent presence at the bedside and vigilance in daily activities. These roles have expanded significantly due to workforce shortages, encompassing activities such as assisting with activities of daily living (ADLs), basic vital signs monitoring, patient mobilization, hygiene support, and environmental safety checks, all under supervision, which helps prevent errors like falls, infections, and pressure ulcers by ensuring timely execution of delegated duties. Evidence indicates that without clear role definitions and training, however, blurred boundaries can lead to safety risks, underscoring the need for regulated integration to maximize their contributions to quality care and reduced adverse events across clinical environments like hospitals, long-term care, and community settings (Lizarondo et al., 2010).

Health assistants contribute substantially to patient safety by performing accurate monitoring of vital signs, maintaining meticulous documentation, and escalating concerns promptly using tools like early warning scores (EWS), which allows for early detection of deterioration in acutely ill patients, particularly during off-hours when professional staff may be limited. Studies highlight that HCAs often undertake the bulk of routine observations, such as recording respiratory rates, heart rates, and blood pressure, with their role in escalation being critical yet challenged by factors like inconsistent training, workload pressures, and hesitation due to hierarchical barriers, leading to potential delays in care that could be mitigated through standardized protocols and empowerment. Structured documentation formats, like proformas for escalation plans, DNAR decisions, and handovers, have shown improvements in compliance rates from 73% to 97%, reducing errors in communication and enhancing situational awareness among teams (Maqsood et al., 2025).

In safe handling and mobility assistance, health assistants are frontline defenders against falls and injuries by implementing fall prevention strategies, including risk assessments, use of bed rails, wristbands, signage, and supervised transfers, while maintaining hygiene to prevent infections, which collectively reduces hospital-acquired complications. Research demonstrates that HCAs' involvement in initial screenings, patient education on mobility aids, and environmental checks significantly lowers fall incidents, with interventions like consistent bed rail use and family involvement proving effective when supported by basic

training for non-healthcare staff such as security and cleaners. Despite positive perceptions, barriers like lack of skilled techniques, poor judgment, and inadequate observation persist, emphasizing the need for ongoing education to align behaviors with evidence-based practices for sustained safety gains (Dewi et al., 2024).

Effective communication and team-based coordination by health assistants foster a collaborative environment where they relay critical observations during huddles, handovers, and multidisciplinary rounds, bridging gaps between shifts and professions to prevent miscommunications that account for a substantial portion of safety issues. Tools like daily safety huddles have boosted compliance to 97%, addressing 340 issues related to infection control, medications, and documentation, while enhancing trust and rapid responses through structured feedback mechanisms like weekly reports. Interprofessional dynamics reveal profession-specific perceptions, with assistants often facing challenges in speaking up due to power gradients, yet their input on patient patterns significantly improves overall team performance and reduces adverse events when supported by training like TeamSTEPPS (O'Daniel & Rosenstein, 2008).

Education, competency-based training, and supervision are foundational for health assistants, equipping them with skills in patient safety protocols via blended pedagogies like role-play, feedback, and experiential learning, which lead to improved knowledge, behaviors, and reduced errors through clear delegation and accountability. Programs following ADDIE models or realist approaches show that active learning in protected time enhances supervisor-supervisee development, particularly in high-risk areas like SPHM, where decision-making considers patient factors and unit culture. Barriers such as lack of specificity in frameworks and inconsistent training underscore the need for evidence-based interventions to ensure competency, with studies linking trained assistants to better clinical outcomes like fewer complications (Shin et al., 2021).

Health assistants excel in recognizing and reporting early warning signs by routinely tracking vital signs and behavioral cues, using EWS to trigger escalations, though challenges like over-reliance on scores over clinical intuition and delegation to undertrained staff can undermine effectiveness. Qualitative evaluations reveal that proactive identification via whiteboards or nurse concern criteria, combined with pattern recognition, facilitates timely interventions, reducing cardiac arrests and ICU transfers, with staff perceptions improving when tools support rather than replace judgment. Failures in escalation often stem from observation lapses or delayed reporting, highlighting the importance of empowering assistants with intuition-based training to complement quantitative systems (McGaughey et al., 2021).

Empowerment and role clarity empower health assistants within a patient safety culture by defining boundaries, providing psychological safety for reporting, and integrating them into leadership-supported initiatives, leading to higher engagement, error reporting, and teamwork perceptions across professions. Supportive leadership fosters openness and inclusion of assistants in safety huddles and decision-making, correlating with neutral-to-positive culture scores and reduced incidents, as blurred roles otherwise risk patient harm from overreach or underperformance. Interdisciplinary efforts emphasize training non-professionals like assistants for proactive roles, transforming culture through trust, feedback, and systemic learning (Janes et al., 2021).

The Role of Nutritionists in Enhancing Patient Safety

Nutritionists are essential in preventing malnutrition, aspiration pneumonia, and refeeding syndrome, which pose significant threats to patient safety, particularly among hospitalized individuals with chronic illnesses or recent weight loss. Malnutrition affects up to 50% of inpatients and exacerbates recovery delays, infections, and mortality, while nutritionists conduct risk assessments using tools like NRS-2002 to identify at-risk patients early and implement tailored interventions such as oral nutritional supplements or modified feeding protocols. Aspiration risks are mitigated through texture-modified diets and positioning guidance, reducing pneumonia incidence, and for refeeding syndrome nutritionists advocate gradual caloric initiation

(starting at 10 kcal/kg/day) with thiamine and electrolyte monitoring, as evidenced by guidelines showing reduced complications when protocols are followed (Persaud-Sharma et al., 2022).

Nutritionists lead food safety protocols in hospitals, ensuring allergen avoidance to prevent anaphylaxis and other severe reactions that compromise patient safety. They develop individualized menus, integrate allergy alerts into electronic systems, and train staff on cross-contamination prevention, such as separate preparation areas and labeled trays, which has proven effective in reducing accidental exposures. Standardized procedures for enteral feeding and menu modifications for common allergens like nuts or gluten further safeguard vulnerable patients, with multidisciplinary protocols emphasizing communication between kitchen, nursing, and medical teams to maintain compliance (Harari et al., 2021).

Routine nutritional screening by nutritionists using validated tools like NRS-2002 or PG-SGA-SF enables early detection of risks, allowing for personalized care plans that enhance safety by preventing hospital-acquired malnutrition. These plans incorporate patient-specific factors such as disease state, preferences, and barriers to intake, with digital tools now facilitating self-screening for faster intervention, showing high negative predictive value in identifying low-risk cases. Follow-up adjustments ensure sustained efficacy, reducing readmissions and improving outcomes through evidence-based energy/protein targets (Holdoway et al., 2022).

In managing chronic conditions like diabetes and renal failure, nutritionists optimize safety by tailoring diets to control glycemia, electrolytes, and fluid balance, averting complications such as hyperkalemia or uremic toxicity. For diabetic renal patients, they modify American Diabetes Association plans with protein, phosphorus, and potassium restrictions while monitoring indexes like albumin to detect wasting early. Such interventions lower cardiovascular risks and improve quality of life, with renal dietitians emphasizing balanced calorie control to support dialysis efficacy (Yinusa et al., 2021).

Nutritionists foster multidisciplinary collaboration by integrating into care teams, contributing nutritional data to comprehensive plans that align interventions and reduce errors like inappropriate feeding. Effective communication via shared protocols and rounds enhances outcomes, as seen in models where dietitians prioritize high-risk cases alongside nurses. This teamwork improves malnutrition diagnosis rates and intervention timeliness (Baute et al., 2018).

Interprofessional Collaboration and Communication for Safer Care

Teamwork among nurses, pharmacists, health assistants, and nutritionists stands as a cornerstone of patient safety, fostering shared decision-making that integrates clinical insights from medication reconciliation by pharmacists, holistic assessments by nurses, supportive monitoring by health assistants, and nutritional optimizations by nutritionists to minimize risks such as polypharmacy and adverse drug events in community and acute settings. Evidence from multiple studies highlights how these interprofessional teams address complex patient needs, such as chronic disease management in community-dwelling adults, where nurse-pharmacist collaborations have demonstrated improvements in disease control, reduced hospitalizations, and enhanced self-management skills by identifying and resolving medication discrepancies early through complementary roles nurses focusing on patient education and adherence monitoring, pharmacists on regimen simplification and drug interaction checks, health assistants on follow-up coordination, and nutritionists on diet-medication interactions. This collaborative approach not only bridges gaps in individual scopes of practice but also promotes a culture of mutual accountability, where shared goals lead to fewer critical incidents, better staff well-being, and superior patient outcomes, as seen in dynamic healthcare environments like emergency departments and primary care, ultimately transforming potential safety threats into opportunities for proactive care (Bouton et al., 2023).

Standardized communication frameworks like ISBAR, TeamSTEPPS, and briefing/debriefing protocols empower nurses, pharmacists, health assistants, and nutritionists to deliver safer care by ensuring clear, structured information exchange during handoffs, emergencies, and routine interactions, such as shift

changes or inter-hospital transfers. ISBAR (Identity, Situation, Background, Assessment, Recommendation) facilitates precise verbal and written handovers, reducing misunderstandings in medication safety processes where pharmacists clarify dosing ambiguities, nurses report patient responses, health assistants detail observational data, and nutritionists highlight dietary impacts, as evidenced in Australian healthcare implementations that improved clarity across disciplines. TeamSTEPPS, with its emphasis on leadership, mutual support, and situation monitoring, has been shown to enhance team performance in high-risk scenarios like blood transfusions, where integrated teams apply closed-loop communication to double-check processes, leading to fewer errors and better protocol adherence; similarly, briefing/debriefing routines before and after procedures allow debriefing on near-misses, fostering continuous improvement in collaborative competence among these roles. These tools collectively mitigate communication failures, a leading cause of adverse events, by promoting efficient, role-specific inputs resulting in measurable gains like decreased decision latency and higher accuracy in patient-related choices (Vaseghi et al., 2022).

Interprofessional conflicts among nurses, pharmacists, health assistants, and nutritionists, often stemming from relationship, task, or process discrepancies like role overlaps in medication or nutrition planning, threaten patient safety but can be resolved through structured strategies that respect professional boundaries and prioritize collective goals. Effective resolution involves open dialogue, acknowledgment of expertise, power balancing, and clear communication, as in adapted constructive controversy models where teams engage in cooperative debate to refine care plans, reducing stress and enhancing cooperative patient-centered outcomes; for instance, nurses and pharmacists navigating task duplication in community settings benefit from protocols that define scopes preventing escalation and incohesive practices. Training in conflict self-efficacy, leadership interventions, and team-specific protocols addresses barriers like workload pressures or hierarchical tensions, with studies showing that unresolved conflicts correlate with poorer care quality, while resolved ones improve team performance, clinician well-being, and safety metrics such as reduced errors in chronic disease management; maintaining boundaries ensures autonomy yet interdependence, as health assistants defer clinical judgments to pharmacists or nutritionists while escalating observations to nurses, ultimately safeguarding patients from fragmented care (Ravi et al., 2022).

Case studies of integrated safety initiatives illustrate the transformative impact of nurses, pharmacists, health assistants, and nutritionists collaborating in community and transitional care, such as nurse-pharmacist dyads in home health for frail elderly, where medication reconciliation and regimen simplification prevented adverse events and hospitalizations through shared consultations and referrals. In one Australian model, community nurses referred high-risk patients to pharmacists for home visits, resolving discrepancies like non-therapeutic dosing via prescriber communications, complemented by health assistants' follow-ups and nutritionists' input on polypharmacy-diet interactions, yielding optimized orders and fewer physician visits. U.S. programs like telehealth chronic care management integrated pharmacists' surveillance with health assistants' coordination and nutritionists' wellness advice, addressing gaps in underserved populations and cutting costs; similarly, TeamSTEPPS implementations in blood transfusion processes involved briefing/debriefing across roles to enforce double-checks, drastically reducing errors. These initiatives highlight scalable successes in diabetes and hypertension management, where Cambodian American-focused interventions combined CHW (health assistant equivalents) cultural bridging with pharmacist MTM, improving adherence and HbA1c via joint videoconferences and nutrition education, demonstrating reduced readmissions and empowered self-management (Shi et al., 2024).

Education plays a pivotal role in cultivating interprofessional competence among nurses, pharmacists, health assistants, and nutritionists, equipping them with skills for teamwork through structured IPE programs that simulate real-world scenarios like joint medication-nutrition reviews. Systematic reviews confirm IPE enhances attitudes toward collaboration, knowledge of roles and behaviors leading to safer practices, as pre-licensure training fosters patient-centeredness and reduces silos. Programs incorporating TeamSTEPPS or ISBAR in curricula yield better conflict resolution, communication, and shared decision-making, with evidence from nurse-pharmacist home care simulations showing sustained improvements in

chronic disease outcomes and error prevention; ongoing education addresses evolving needs like telehealth integration, ensuring teams adapt boundaries while leveraging strengths for comprehensive safety (Gill et al., 2017).

Challenges and Barriers Across Disciplines

Communication gaps and role overlaps represent significant hurdles in multidisciplinary teams involving nurses, pharmacists, health assistants, and nutritionists, often leading to fragmented patient care and increased safety risks. Nurses, as primary patient monitors, frequently identify issues early but may hesitate to defer to pharmacists on complex medication reconciliations due to unclear boundaries, while health assistants handle routine tasks that overlap with nutritionists' dietary assessments, causing delays in holistic interventions. Pharmacists report challenges in communicating polypharmacy risks to nursing staff amid high workloads, exacerbating errors in transitions of care, and nutritionists often struggle to integrate their recommendations into nursing care plans without standardized protocols for role delineation. These interdisciplinary misalignments contribute to up to 70% of sentinel events stemming from poor handoffs, particularly in high-acuity settings where rapid role shifts occur without clear communication tools like SBAR (Situation-Background-Assessment-Recommendation). Moreover, cultural differences in professional training foster assumptions about others' responsibilities, leading to overlooked patient needs such as malnutrition compounded by drug-nutrient interactions. Studies highlight that without interprofessional simulations addressing these overlaps, teams experience 30% more communication breakdowns during multidisciplinary rounds, directly impacting patient outcomes like prolonged hospital stays and adverse drug events (Howick et al., 2024).

Staff shortages and workload pressures plague all disciplines, intensifying patient safety vulnerabilities through fatigue-induced errors and compromised vigilance across nursing, pharmacy, health assistance, and nutrition services. Nurses face chronic understaffing, with ratios often exceeding safe limits, forcing them to multitask vital signs monitoring alongside medication administration, which delays nutritionist consultations for at-risk patients and burdens health assistants with expanded duties like basic feeding support. Pharmacists, strained by dispensing volumes amid shortages of technicians, overlook critical drug-nutrition interactions, while nutritionists juggle multiple wards with limited support, resulting in inconsistent enteral feeding protocols that nurses must improvise under pressure. Global nursing shortages project worsening scenarios, with workloads correlating to a 15-20% rise in medication errors and falls, as overburdened teams prioritize urgent tasks over preventive measures like pharmacist-led reconciliation or nutrition screenings. Health assistants, often the most under-resourced, report burnout from covering absences, leading to gaps in patient mobility assistance that intersect with nursing fall prevention efforts. These pressures create a cascade: exhausted pharmacists miss allergy alerts, overworked nutritionists under-assess dysphagia risks, and fatigued nurses propagate errors, with evidence showing unit-level staffing deficits doubling adverse events in multidisciplinary settings (Loft et al., 2025).

Educational and training gaps hinder effective collaboration, as varying curricula across nursing, pharmacy, health assistance, and nutrition programs fail to emphasize interprofessional patient safety competencies. Nurses receive robust clinical training but limited exposure to pharmaceutical kinetics or nutritional genomics, causing hesitation in deferring to pharmacists or nutritionists during polypharmacy cases involving malnourished patients. Pharmacists excel in drug safety but lack hands-on simulations with health assistants on inventory management under shortages, leading to dispensing delays that nurses must mitigate. Health assistants, often with shorter training, overlook subtle nutritional cues that nutritionists identify, while nutritionists may undervalue nursing-led mobility protocols impacting calorie needs. Interprofessional education (IPE) interventions, like simulation-based teamwork modules, show promise in bridging these gaps, yet implementation remains sporadic, with only 20-30% of programs incorporating multidisciplinary safety training. Systematic reviews reveal that without targeted IPE, teams exhibit 25% lower proficiency in error reporting and role clarity, perpetuating silos where a pharmacist's warning on drug-food interactions goes unheeded by nursing staff. Addressing this requires integrated curricula

fostering shared safety culture, as baccalaureate-level gaps persist into practice, elevating risks like hospital-acquired infections from poor hand hygiene coordination (Jiang et al., 2024).

Systemic failures and resource constraints undermine multidisciplinary efforts, manifesting as inadequate infrastructure that hampers nurses, pharmacists, health assistants, and nutritionists in delivering safe care. Limited electronic health record interoperability prevents seamless data sharing nurses document vital trends, but pharmacists struggle accessing nutritionist notes on electrolyte imbalances, while health assistants manually track supplies amid shortages. Budgetary restrictions curtail staffing, equipment like infusion pumps for precise nutrition delivery, and training facilities, forcing improvised protocols that elevate error rates by 15-20% in low-resource settings. In underfunded systems, nutritionists compete for pharmacy compounding resources for parenteral feeds, delaying nursing administration and risking infections, as health assistants repurpose basic tools for monitoring. Evidence from multimethod studies in resource-poor environments links these failures to higher adverse events, with systemic silos amplifying issues like outdated protocols ignoring pharmacist input on antimicrobial stewardship intersecting with nursing infection control. Leadership gaps exacerbate this, as fragmented policies fail to allocate resources equitably, resulting in burnout and turnover across disciplines, perpetuating a cycle of suboptimal safety metrics such as elevated readmissions from uncoordinated discharge planning (Yinusa et al., 2021).

Ethical and cultural barriers to reporting impede transparency, as fear of blame silences nurses, pharmacists, health assistants, and nutritionists from disclosing errors in multidisciplinary contexts. Nurses witness pharmacy oversights in dosing but withhold reports due to hierarchical tensions, while pharmacists avoid flagging nursing administration lapses fearing reprisal, and health assistants underreport nutritional delivery issues amid power imbalances. Cultural stigmas, particularly in diverse teams, portray error admission as weakness, compounded by ethical dilemmas like prioritizing workload over whistleblowing on systemic shortages. Just culture initiatives falter without consistent enforcement, as punitive histories deter nutritionists from documenting interdisciplinary miscommunications on diet orders. Studies identify blame culture, managerial inconsistency, and social-psychological fears as pervasive, reducing reporting by 50% and masking 70% of near-misses that could prevent harm. In multicultural settings, language barriers and varying ethical norms further suppress voices, with health assistants from underrepresented groups facing amplified retaliation risks. Overcoming this demands nonpunitive frameworks, private forums for moral support, and cultural training to foster reporting as a safety imperative across disciplines (Kumah, 2025).

Future Directions and Recommendations

Nurses, pharmacists, health assistants, and nutritionists play pivotal roles in advancing patient safety through interprofessional collaboration, yet significant research gaps persist in understanding their combined contributions, particularly in community and low-resource settings where medication discrepancies and adverse events are prevalent due to polypharmacy, multimorbidity, and fragmented care transitions. Existing literature highlights nascent nurse-pharmacist collaborations that improve disease management and reduce hospitalizations but reveals deficiencies in studies addressing health assistants' and nutritionists' integration, long-term outcomes beyond acute care, and standardized metrics for error prevention across diverse populations. Comprehensive analyses over the past two decades underscore evolving research on nursing's role in patient safety but call for expanded investigations into multidisciplinary models involving pharmacy and allied health roles to bridge these voids and inform evidence-based protocols (Ravi et al., 2022).

Despite robust evidence on nurse-pharmacist dyads enhancing medication reconciliation and self-management in community-dwelling adults with chronic conditions, critical gaps remain in evaluating the synergistic impact of health assistants and nutritionists in holistic patient safety frameworks, including nutritional interventions to mitigate drug-nutrient interactions and assistant-led monitoring in transitional care. Studies predominantly focus on high-income acute settings, neglecting low-resource contexts where systemic barriers like funding variances, scope-of-practice differences, and inadequate reporting exacerbate errors, with limited longitudinal data on sustained interprofessional outcomes such as reduced readmissions

or improved adherence. Furthermore, methodological challenges in linking errors to long-term adverse events, scarcity of randomized trials incorporating all four professions, and underrepresentation of global disparities hinder comprehensive policy development, necessitating multimethod approaches like mixed reviews and prospective cohorts tailored to these roles (Rodziewicz et al., 2024).

Simulation-based training emerges as a transformative innovation, enabling nurses, pharmacists, health assistants, and nutritionists to practice error detection, interprofessional communication, and root-cause analysis in high-fidelity scenarios mimicking real-world challenges like operating rooms or home care transitions, thereby boosting competencies in medication safety and teamwork without patient risk. Pharmacy and nursing curricula increasingly integrate human patient simulators for introductory practice experiences, fostering critical thinking, confidence, and reduced administration errors, with extensions to nutritionists for addressing polypharmacy-related malnutrition and assistants for vigilance tasks. Future advancements should embed scaffolded interprofessional simulations addressing malpractice incidents, shared mental models, and reflective debriefing to cultivate a safety culture, as evidenced by improved compliance and perceptions post-intervention (Seybert, 2011).

Regulatory frameworks must evolve to mandate interprofessional pharmaceutical care standards, incentivizing collaborations through funding for community-based nurse-pharmacist-health assistant-nutritionist teams via universal guidelines, role clarity definitions, and remuneration models that eliminate task duplication and support telehealth expansions. Policies addressing fragmented communication, prescription quality, and mandatory adverse event reporting can harness nurses' frontline observations for proactive reconciliation, while integrating nutritionists to counter drug-induced deficiencies and assistants for scalable monitoring in underserved areas. Opportunities lie in Council of Europe resolutions promoting person-centered integration, with pilots demonstrating cost-effective reductions in discrepancies and hospitalizations, urging legislative reforms for sustained, equitable implementation across sectors (Dilles et al., 2021).

Artificial intelligence innovations, including predictive modeling, wearable cameras for real-time error detection, and decision-support systems integrated into electronic health records, empower pharmacists and nurses to preempt medication errors, drug interactions, and at-risk patients in ICUs and beyond, with high diagnostic accuracy (95.2%) and low error rates (1.8%). For health assistants and nutritionists, AI optimizes inventory, automates routine tasks, and flags nutritional risks from pharmacotherapy, enhancing timely interventions (92.4% efficiency) while cross-referencing data for personalized plans. Future directions include AI-driven telehealth for chronic care coordination, addressing barriers like digital competence through training, to revolutionize error prevention in multidisciplinary teams (Flint et al., 2025).

Strengthening models requires frameworks emphasizing shared responsibilities, mutual interdependence, and role clarity, as nurse-pharmacist dyads evolve into inclusive teams with health assistants for monitoring and nutritionists for regimen simplification, yielding simplified therapies, fewer adverse events, and empowered self-management. Evidence from participatory action research and cluster trials shows enhanced outcomes via co-located consultations, feedback loops, and training, mitigating conflicts through communication tools and common bases. Recommendations advocate interprofessional education from undergraduate levels, embedding competencies in curricula to foster trust, negotiate identities, and optimize safety across disciplines (Guraya et al., 2023).

In global low-resource settings, where infrastructure shortages and workforce gaps amplify unsafe care burdens, tailored strategies like low-cost safety culture assessments, multimethod adverse event detection, and WHO-aligned frameworks position nurses, pharmacists, assistants, and nutritionists as frontline innovators for scalable interventions. Protocols emphasizing systems thinking reveal opportunities for replicated plans reducing complications via reconciliation and education, despite challenges like weak governance. Global adaptations prioritize cost-effective training, telehealth, and policy replication from LMIC pilots to equitably enhance safety, bridging disparities through interprofessional resilience (Fekadu et al., 2025).

Conclusion

This comprehensive review highlights the indispensable roles of nurses, pharmacists, health assistants, and nutritionists in enhancing patient safety through vigilant monitoring, medication stewardship, supportive care, and nutritional optimization within multidisciplinary teams, leveraging tools like TeamSTEPPS and ISBAR to reduce adverse events, medication errors, and readmissions across acute and community settings. Nurses deliver frontline surveillance via early warning systems like NEWS to prevent deteriorations and infections, pharmacists excel in therapy management and antimicrobial stewardship to avert drug-related harms affecting millions annually, health assistants provide essential daily vigilance and mobility support to curb falls, while nutritionists mitigate malnutrition and aspiration risks through targeted screenings. Despite these strengths, persistent challenges including communication silos, staffing shortages, role overlaps, and resource constraints exacerbate errors like polypharmacy interactions and fragmented handoffs, demanding systemic reforms. Future strategies should prioritize interprofessional education, simulation training, AI-driven tools, policy incentives for role clarity, and telehealth integration to build resilient teams, alongside mandating standardized protocols and just culture reporting to bridge global disparities and achieve transformative reductions in preventable harm worldwide.

References

1. Baute, V., Sampath-Kumar, R., Nelson, S., & Basil, B. (2018). Nutrition Education for the Health-care Provider Improves Patient Outcomes. Global Advances in Health and Medicine, 7, 2164956118795995. https://doi.org/10.1177/2164956118795995
2. Blomgren, P.-O., Leo Swenne, C., Lytsy, B., & Hjelm, K. (2024). Hand hygiene knowledge among nurses and nursing students–a descriptive cross-sectional comparative survey using the WHO's "Hand Hygiene Knowledge Questionnaire." Infection Prevention in Practice, 6(2), 100358. https://doi.org/10.1016/j.infpip.2024.100358
3. Bouton, C., Journeaux, M., Jourdain, M., Angibaud, M., Huon, J.-F., & Rat, C. (2023). Interprofessional collaboration in primary care: What effect on patient health? A systematic literature review. BMC Primary Care, 24, 253. https://doi.org/10.1186/s12875-023-02189-0
4. Chi, C., Gong, G., Zhang, X., Cai, X., Chen, J., & Jiang, H. (2025). Safety performance behaviors of hospital nurses from the perspective of social cognition theory. Frontiers in Psychology, 16, 1676200. https://doi.org/10.3389/fpsyg.2025.1676200
5. Dewi, A., Meisari, W. A., Almanfaluthi, M. L., Ambarwati, D., Dewi, R., Handini, D. R. P., Sutrisno, S., & Dewi, T. S. (2024). Health Workers' Perception on Fall Risk Prevention: A Photovoice Method. Journal of Patient Experience, 11, 23743735241273674. https://doi.org/10.1177/23743735241273674
6. Dilles, T., Heczkova, J., Tziaferi, S., Helgesen, A. K., Grøndahl, V. A., Van Rompaey, B., Sino, C. G., & Jordan, S. (2021). Nurses and Pharmaceutical Care: Interprofessional, Evidence-Based Working to Improve Patient Care and Outcomes. International Journal of Environmental Research and Public Health, 18(11), 5973. https://doi.org/10.3390/ijerph18115973
7. Epstein, N. E. (2014). Multidisciplinary in-hospital teams improve patient outcomes: A review. Surgical Neurology International, 5(Suppl 7), S295–S303. https://doi.org/10.4103/2152-7806.139612
8. Fekadu, G., Muir, R., Tobiano, G., Bime, A. E., Ireland, M. J., & Marshall, A. P. (2025). Patient safety culture in resource-limited healthcare settings: A multicentre survey. PLOS One, 20(6), e0326320. https://doi.org/10.1371/journal.pone.0326320
9. Flint, A. R., Schaller, S. J., & Balzer, F. (2025). How AI can help in error detection and prevention in the ICU? Intensive Care Medicine, 51(3), 590–592. https://doi.org/10.1007/s00134-024-07775-z
10. Garcia, C. de L., de Abreu, L. C., Ramos, J. L. S., de Castro, C. F. D., Smiderle, F. R. N., dos Santos, J. A., & Bezerra, I. M. P. (2019). Influence of Burnout on Patient Safety: Systematic Review and Meta-Analysis. Medicina, 55(9), 553. https://doi.org/10.3390/medicina55090553

11. Gill, A. C., Cowart, J. B., Hatfield, C. L., Dello Stritto, R. A., Landrum, P., Ismail, N., Nelson, E. A., & Teal, C. R. (2017). Patient Safety Interprofessional Training for Medical, Nursing, and Pharmacy Students. MedEdPORTAL: The Journal of Teaching and Learning Resources, 13, 10595. https://doi.org/10.15766/mep_2374-8265.10595
12. Gong, J., Marshall, V. D., Whitaker, M., Rowell, B., Dorsch, M. P., Bagian, J. P., & Lester, C. A. (2025). Enhancing medication safety with System Approach to Verifying Electronic Prescriptions (SAV E-Rx): Pharmacists' review of product selection outcomes between prescribed and dispensed medications. BMJ Health & Care Informatics, 32(1), e101561. https://doi.org/10.1136/bmjhci-2025-101561
13. Guraya, S. S., Umair Akhtar, M., Sulaiman, N., David, L. R., Jirjees, F. J., Awad, M., AL Kawas, S., Hassan Taha, M., Haider, M., Maria Dias, J., Kodumayil, S. A., Dash, N. R., Al-Qallaf, A., Hasswan, A., Salmanpour, V. A., & Guraya, S. Y. (2023). Embedding patient safety in a scaffold of interprofessional education; a qualitative study with thematic analysis. BMC Medical Education, 23, 968. https://doi.org/10.1186/s12909-023-04934-6
14. Hadi, M. A., Neoh, C. F., Zin, R. M., Elrggal, M. E., & Cheema, E. (2017). Pharmacovigilance: Pharmacists' perspective on spontaneous adverse drug reaction reporting. Integrated Pharmacy Research & Practice, 6, 91–98. https://doi.org/10.2147/IPRP.S105881
15. Harari, R., Toren, O., Tal, Y., & Ben-Porat, T. (2021). Food allergy safety: A descriptive report of changing policy in a single large medical center. Israel Journal of Health Policy Research, 10, 32. https://doi.org/10.1186/s13584-021-00466-w
16. Holdoway, A., Page, F., Bauer, J., Dervan, N., & Maier, A. B. (2022). Individualised Nutritional Care for Disease-Related Malnutrition: Improving Outcomes by Focusing on What Matters to Patients. Nutrients, 14(17), 3534. https://doi.org/10.3390/nu14173534
17. Howick, J., Bennett-Weston, A., Solomon, J., Nockels, K., Bostock, J., & Keshtkar, L. (2024). How does communication affect patient safety? Protocol for a systematic review and logic model. BMJ Open, 14(5), e085312. https://doi.org/10.1136/bmjopen-2024-085312
18. Janes, G., Mills, T., Budworth, L., Johnson, J., & Lawton, R. (2021). The Association Between Health Care Staff Engagement and Patient Safety Outcomes: A Systematic Review and Meta-Analysis. Journal of Patient Safety, 17(3), 207–216. https://doi.org/10.1097/PTS.0000000000000807
19. Jang, H., Lee, M., & Lee, N.-J. (2022). Communication education regarding patient safety for registered nurses in acute hospital settings: A scoping review protocol. BMJ Open, 12(2), e053217. https://doi.org/10.1136/bmjopen-2021-053217
20. Jiang, Y., Cai, Y., Zhang, X., & Wang, C. (2024). Interprofessional education interventions for healthcare professionals to improve patient safety: A scoping review. Medical Education Online, 29(1), 2391631. https://doi.org/10.1080/10872981.2024.2391631
21. Kellett, P., & Gottwald, M. (2015). Double-checking high-risk medications in acute settings: A safer process. Nursing Management (Harrow, London, England: 1994), 21(9), 16–22. https://doi.org/10.7748/nm.21.9.16.e1310
22. Kumah, A. (2025). Adverse event reporting and patient safety: The role of a just culture. Frontiers in Health Services, 5, 1581516. https://doi.org/10.3389/frhs.2025.1581516
23. Lee, S. E., Hyunjie, L., & Sang, S. (2023). Nurse Managers' Leadership, Patient Safety, and Quality of Care: A Systematic Review. Western Journal of Nursing Research, 45(2), 176–185. https://doi.org/10.1177/01939459221114079
24. Lee, S. E., Morse, B. L., & Kim, N. W. (2021). Patient safety educational interventions: A systematic review with recommendations for nurse educators. Nursing Open, 9(4), 1967–1979. https://doi.org/10.1002/nop2.955
25. Lizarondo, L., Kumar, S., Hyde, L., & Skidmore, D. (2010). Allied health assistants and what they do: A systematic review of the literature. Journal of Multidisciplinary Healthcare, 3, 143–153. https://doi.org/10.2147/JMDH.S12106
26. Loft, M. I., Posborg, S. M., Mathiesen, L. L., Pedersen, S. G., Brudsø, M., Forsberg, R., Nielsen, T. S., & Jensen, C. G. (2025). Changing practices due to a shortage of nurses: A qualitative

exploratory study. International Journal of Nursing Studies Advances, 8, 100334. https://doi.org/10.1016/j.ijnsa.2025.100334
27. Maqsood, R., Aziz, M., Hartley, K., Hassan, T., Ijaz, S., Ahmad, H., & Sreh, A. A. (2025). Enhancing Patient Care Through Improved Escalation Planning and Documentation: A Quality Improvement Project at a District General Hospital. Cureus. https://doi.org/10.7759/cureus.86074
28. Martinez, Y. G., Tran, M., Roduta, T., Lam, S., Price, T., & Stramel, S. (2023). The Impact of an Antimicrobial Stewardship Clinical Pharmacy Specialist on Antimicrobial Days of Therapy through Education Driven Policies, Procedures, and Interventions. Pharmacy, 11(5), 137. https://doi.org/10.3390/pharmacy11050137
29. McGaughey, J., Fergusson, D. A., Van Bogaert, P., & Rose, L. (2021). Early warning systems and rapid response systems for the prevention of patient deterioration on acute adult hospital wards. The Cochrane Database of Systematic Reviews, 2021(11), CD005529. https://doi.org/10.1002/14651858.CD005529.pub3
30. Mekonnen, A. B., McLachlan, A. J., Brien, J. E., Mekonnen, D., & Abay, Z. (2018). Barriers and facilitators to hospital pharmacists' engagement in medication safety activities: A qualitative study using the theoretical domains framework. Journal of Pharmaceutical Policy and Practice, 11, 2. https://doi.org/10.1186/s40545-018-0129-y
31. O'Daniel, M., & Rosenstein, A. H. (2008). Professional Communication and Team Collaboration. In Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Agency for Healthcare Research and Quality (US). https://www.ncbi.nlm.nih.gov/books/NBK2637/
32. Persaud-Sharma, D., Saha, S., & Trippensee, A. W. (2022). Refeeding Syndrome. In StatPearls [Internet]. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK564513/
33. Rahayu, S. A., Widianto, S., Defi, I. R., & Abdulah, R. (2021). Role of Pharmacists in the Interprofessional Care Team for Patients with Chronic Diseases. Journal of Multidisciplinary Healthcare, 14, 1701–1710. https://doi.org/10.2147/JMDH.S309938
34. Ravi, P., Pfaff, K., Ralph, J., Cruz, E., Bellaire, M., & Fontanin, G. (2022). Nurse-pharmacist collaborations for promoting medication safety among community-dwelling adults: A scoping review. International Journal of Nursing Studies Advances, 4, 100079. https://doi.org/10.1016/j.ijnsa.2022.100079
35. Ricciardi, W., & Cascini, F. (2020). Guidelines and Safety Practices for Improving Patient Safety. In Textbook of Patient Safety and Clinical Risk Management [Internet]. Springer. https://doi.org/10.1007/978-3-030-59403-9_1
36. Rodziewicz, T. L., Houseman, B., Vaqar, S., & Hipskind, J. E. (2024). Medical Error Reduction and Prevention. In StatPearls [Internet]. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK499956/
37. Seybert, A. L. (2011). Patient Simulation in Pharmacy Education. American Journal of Pharmaceutical Education, 75(9), 187. https://doi.org/10.5688/ajpe759187
38. Shah, F., Falconer, E. A., & Cimiotti, J. P. (2022). Does Root Cause Analysis Improve Patient Safety? A Systematic Review at the Department of Veterans Affairs. Quality Management in Healthcare, 31(4), 231. https://doi.org/10.1097/QMH.0000000000000344
39. Shi, Y., Miao, S., Fu, Y., Sun, C., Wang, H., & Zhai, X. (2024). TeamSTEPPS improves patient safety. BMJ Open Quality, 13(2), e002669. https://doi.org/10.1136/bmjoq-2023-002669
40. Shin, S. H., Kim, M. J., Moon, H. J., & Lee, E. H. (2021). Development and Effectiveness of a Patient Safety Education Program for Inpatients. International Journal of Environmental Research and Public Health, 18(6), 3262. https://doi.org/10.3390/ijerph18063262
41. Touchette, D. R., Masica, A. L., Dolor, R. J., Schumock, G. T., Choi, Y. K., Kim, Y., & Smith, S. R. (2012). Safety-focused medication therapy management: A randomized controlled trial. Journal of the American Pharmacists Association: JAPhA, 52(5), 603–612. https://doi.org/10.1331/JAPhA.2012.12036

42. Tu, H.-N., Shan, T.-H., Wu, Y.-C., Shen, P.-H., Wu, T.-Y., Lin, W.-L., Yang-Kao, Y.-H., & Cheng, C.-L. (2023). Reducing Medication Errors by Adopting Automatic Dispensing Cabinets in Critical Care Units. Journal of Medical Systems, 47(1), 52. https://doi.org/10.1007/s10916-023-01953-0
43. Vaseghi, F., Yarmohammadian, M. H., & Raeisi, A. (2022). Interprofessional Collaboration Competencies in the Health System: A Systematic Review. Iranian Journal of Nursing and Midwifery Research, 27(6), 496–504. https://doi.org/10.4103/ijnmr.ijnmr_476_21
44. Xiong, W., Xie, F., Li, Q., Chen, Y., Yang, H., Wu, J., Li, J., Chen, Z., Hu, X., & Hu, L. (2025). Development of indicator system for early warning of clinical nursing critical values in general wards: A Delphi study. BMC Nursing, 24, 691. https://doi.org/10.1186/s12912-025-03449-3
45. Yinusa, G., Scammell, J., Murphy, J., Ford, G., & Baron, S. (2021). Multidisciplinary Provision of Food and Nutritional Care to Hospitalized Adult In-Patients: A Scoping Review. Journal of Multidisciplinary Healthcare, 14, 459–491. https://doi.org/10.2147/JMDH.S255256
46. Zaij, S., Pereira Maia, K., Leguelinel-Blache, G., Roux-Marson, C., Kinowski, J. M., & Richard, H. (2023). Intervention of pharmacist included in multidisciplinary team to reduce adverse drug event: A qualitative systematic review. BMC Health Services Research, 23, 927. https://doi.org/10.1186/s12913-023-09512-6