Interprofessional Collaboration In Healthcare: Integration Of Pharmacy, Laboratory Medicine, Nutrition, And Nursing Services For Enhanced Patient Outcomes

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Abstract

The contemporary nature of the healthcare system calls for an unprecedented level of interprofessional collaboration. This paper presents an integrative review of the collaborative activities within the disciplines of pharmacy, laboratory, nutrition, and nursing. Using contemporary literature and evidence-based practice, this review ascertains the disciplines' collaboration in refining patient care, clinical outcomes, and the efficacy of health systems. The review articulates communication models, integrated collaboration systems, and teamwork frameworks designed for interprofessional cooperation. However, the review also discusses the phenomenon of interprofessional collaboration through the prisms of professional silos, communication barriers, and systems analytic challenges, for which several evidence-based solutions are proposed. The review illuminates the positive impact of

collaborative working relationships in interprofessional pharmacy, medicine, nutrition, and nursing on patient safety and the efficiency of care in medication management, diagnostic, and nutritional aspects. The study articulates outcomes of collaborative interprofessional work, the cost of healthcare resources, and the availability of modern technological solutions. The review's main outcomes focus on improving interprofessional collaboration within health care institutions. For optimal integration of nursing, pharmacy, nutrition, and laboratory医学 in patient care and management, acute and primary care, comprehensive frameworks and models are proposed.

Interprofessional Collaboration, Pharmacy Services, Clinical Laboratory, Nutrition Care, Nursing Practice, Patient Outcomes, Healthcare Integration, Team-based Care, Medication Safety, Quality Improvement

INTRODUCTION

1.1 Background and Context

Health systems around the world face unprecedented and ongoing challenges, such as ageing populations, the growing burden of chronic disease, complex and costly pharmacotherapy, and the need for optimal and economical health service delivery (World Health Organization, 2010). These issues have brought to light the shortcomings of siloed healthcare delivery and have brought to the forefront the need for interprofessional collaboration. The integration of pharmacy, laboratory medicine, nutrition, and nursing is vital to the provision of holistic and integral patient care, as these disciplines address the diverse and complex requirements of patients in all health care environments.

The modern healthcare environment is characterized by the presence of patients with complex health issues, such as multiple chronic conditions that require the coordinated efforts of diverse healthcare professionals. The traditional model of care, where the healthcare professionals function in a siloed and independent manner within their scope of practice, has been shown to be inadequate for these complex situations. Research has documented that poor coordination of healthcare delivery among professionals leads to a spectrum of challenges, including but not limited to, medical and other errors, suboptimal patient outcomes, and adverse health events (Bates et al, 1995).

Interprofessional collaboration is working together with patients, families, caregivers, and communities, and is defined by the World Health Organization to happen, "when multiple health workers from different professional backgrounds collaborate to provide the best possible quality of care" (WHO, 2010). This method of collaboration is vital in addressing the issues of problem medications, correct case diagnoses, managing Malnutrition, and providing nursing care in all dimensions. Studies prove that there is a relation to patient safety and its improvement due to reduced medical errors, and the satisfaction of the patients with the clinical outcomes due to the effective collaboration of interprofessional teams (Reeves et al., 2017).

1.2 Rationale for Integration

Each of the four fields examined in this review have their own individual and unique skills that, when combined together, can further improve the quality of services and the patient experience. From his/her/their knowledge in pharmacotherapy, medication management and, in general, pharmacology, the pharmacist's contributions go beyond mere medication

dispensing to medication management through comprehensive medication reviews and, in the process, dealing with any medication-related issues, clinical therapeutic monitoring, and medication-related patient education. Clinical laboratory practitioners supply essential diagnostic information through the delivery of timely and accurate test results, and proper test results' interpretation. They ensure that laboratory results are of good quality and are reliable, offer consultative services concerning test choice and interpretation, and are vital in disease detection and monitoring.

Nutritionists address dietary needs, manage malnutrition and disease, and help with disease management through therapeutic diet interventions. They are involved in the process of nutritional screening and assessment, and formulation of customized nutrition care plans, management of enteral and parenteral nutrition, and education of patients and other members of the health care team on nutrition. Nurses are patient advocates, care coordinators, treatment providers, and Continuous Patient Monitors (CPM). They are often considered to be the \"glue\" of the healthcare team, and the main point of contact for patients. They ensure that information flows smoothly between healthcare team members.

The merging of multiple distinct areas of expertise produces an effect far greater than the sum of each individual's contribution alone. Take the case of a patient with diabetes. For optimal management of the patient's diabetes, the care team comprises a health pharmacist, a nurse, a dietician, and a laboratory scientist managing the patient's laboratory tests for glucose monitoring and HbA1c and a nurse providing patient education, administering medications, and monitoring the patient. When these members of the care team are able to work together colaboratively, and not in professional silos, the patient benefits from a much more thorough and effective care.

Additionally, the collaborative nature of these infections means that an intervention from one profession can make the work of another profession more effective. For example, laboratory tests results of a patient are important when a pharmacist is making a decision regarding the specific drug, dosage, and the regimen of medications to be used in a patient. Changes to the diet of a patient caused by a pharmacist should be considered when the dietician is creating a nutritional care plan for the patient. When a nurse conducts a patient's assessment, the results can inform the pharmacist on the needed medications and the dietician on potential foods to avoid. This interaction points to the need for some form of collaboration of these different health professionals.

1.3 Objectives of the Research

The objectives of this particular review include the following:

1. Examine the functions, contributions, and roles, both current and potential, of pharmacy, lab medicine, nutrition, and nursing within contemporary multidisciplinary and interprofessional healthcare systems.
2. Examine different collaborative models and frameworks that promote interprofessional collaboration and particular tactics of collaborative implementation.
3. Assess the presence of interprofessional collaboration in the system and determine its effect on patient-generated outcomes, system costs, and system efficiency.
4. Analyze and suggest evidence-based solutions for the barriers to collaboration that exist on the individual, organizational, and system levels.
5. Investigate the impact of technology and other innovative tools on interprofessional collaboration.

6. Investigate the educational models and the competencies available to equip health professionals with the necessary skills to work in collaboration with other professionals.
7. Provide health care institutions with practical evidence so they may interprofessionally integrate health care practices in different settings.

1.4 Purpose of the Work

The work in this context provides valuable information on interprofessional collaboration, encompassing four important healthcare disciplines, and its potential implications for numerous groups. In the case of healthcare managers, this information serves as a guide in the area of resource distribution, managerial structuring, organizational frameworks, and refining processes. In the case of decision-makers, this information provides evidence in interprofessional collaboration for the development and implementation of policies, legislative frameworks, reimbursement systems, flexible standards, and quality measures that promote interprofessional collaboration in healthcare systems.

LITERATURE REVIEW

2.1 Pharmacy Services in Healthcare Delivery

2.1.1 Evolution of Pharmaceutical Care

The involvement of pharmaceutical care in health system services has changed from a product focused to a patient centered. This evolution has been happening for a few decades. Initially, pharmacists were considered as drug specialists, and their scope of work included compounding, dispensing, and verifying medication orders for accuracy and controlling drug distribution. However, from the 1960s and more rapidly in the 1990s, the profession changed focus to a more therapeutic clinical role.

Pharmacy practice changed when Hepler and Strand introduced pharmaceutical care in 1990. Hepler and Strand stated that pharmaceutical care is, 'the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life' (Hepler & Strand, 1990). With this in mind, it was decided that the responsibilities of a pharmacist are no longer limited to the correct dispensing of drugs. It was the responsibility of a pharmacist to ensure, to the best of their ability, that a drug did not leave the pharmacy without a plan in place to achieve therapeutic goals or to ensure that patients' lives would not be negatively impacted through the use of drugs.

2.1.2. The Role of a Pharmacist in a Healthcare Team

A pharmacist's knowledge of a wide range of topic areas allows them to play a valuable and varied role in interprofessional teams in health care. One of the most important abilities of a pharmacist is ensuring the safety of medicines and serving as a final screen to catch any possible errors in the medication before the patient is given it. Pharmacists are able to recognize medication errors and adverse events, identify potential interactions, and mitigate inappropriate prescriptions before they ever reach a patient (Kaboli et al., 2006). As part of a unit review of medication orders, they confirm the selection of the correct medication, and review the medication orders for appropriate dosages, the correct route of administration, the correct frequency, the appropriate duration, and the presence of allergies, contraindications, and other potential drug interactions.

In addition to the role of medication safety, pharmacists are responsible for other important aspects of medication optimization. This is the process of ensuring individual patients,

receiving the most appropriate medication for their condition, are on a therapy regimen that has been optimized to both achieve the therapeutic goals and avoid adverse side effects, while also ensuring that the regimen is simplified enough to facilitate patient compliance. Pharmacists provide expertise in therapeutic monitoring, especially in the case of those high-risk agents that require close monitoring for dosage adjustments, such as anticoagulants, antibiotics, immunosuppressants, and other medications that have a narrow therapeutic range, as well as those that require close laboratory or clinical monitoring.

You must care for patients, for which you must educate them on the proper and incorrect use of medication, medication effect and side effect and even precautions with proper side effect management. This knowledge will improve patients understanding and adherence, which are the keys determinants to medication effectiveness. It is found that pharmacist counseling not only improves medication adherence, but patients satisfaction is also increased.

2.1.3 Pharmacy in Ambulatory and Community Settings

Research on pharmacy integration has predominantly addressed hospitals, but there are also important roles for pharmacists in interprofessional collaboration in ambulatory clinics and community pharmacies. In primary care clinics, clinical pharmacists collaborate with physicians, nurses, and other health professionals to manage chronic diseases, optimize medication therapies, and educate patients. Integration of pharmacists into primary care clinics has been shown to improve the management of diabetes, hypertension, and hyperlipidemia along with lower costs of healthcare.

Though community pharmacists work under a different model, they also engage in interprofessional collaboration through medication therapy management, immunization, and screening services, and through relationships with pharmacists who prescribe medications. As one of the most accessible healthcare professionals, community pharmacists are a significant link between patients and the healthcare system. With shared health records and better interprofessional communication, the collaboration of community pharmacists with other health professionals can enhance medication management and improve health outcomes for patients.

2.2 Clinical Laboratory Services

2.2.1 Laboratory Medicine and Clinical with Clinical Decision Making

In contemporary health care, clinical laboratory testing serves an integral role seeing as 70% of laboratory data underpins clinical decisions (Forsman, 1996). Medical laboratory scientists, clinical pathologists, medical technologists, and laboratory assistants as laboratory specialists generate crucial diagnostic information that aids in the identification, diagnosis, treatment, and prognosis of diseases. Laboratory results and timeliness of results, reliability, and accuracy of which are crucial determine results and thus healthcare and patient outcomes, quality of which are dependent on laboratory results.

2.2.2 Laboratory Integration with Clinical Teams

As part of an effort to improve the use and understanding of laboratory tests, integrating laboratory professionals with clinical teams is an emerging trend in health care. In the past, laboratory services performed as ancillary support services, with no direct and continuous collaboration with clinical staff. Laboratory services were a black box in which test orders were submitted, specimens were collected, and laboratory results were reported and acted upon by clinical teams with no further engagement of laboratory professionals. Although this model enabled operational efficiency in response to a high volume of routine laboratory tests, it led

to a lack of optimal test utilization, results misinterpretation, and clinically relevant laboratory input on decision points being completely overlooked.

Modern paradigms in healthcare emphasize the consultative role of laboratory professional in test ordering, results interpretation and clinical correlation (Plebani, 2006). Clinical pathologists and senior laboratory scientists function as consultants to clinical teams on what tests to order, strategies to apply when results are complex or unexpected, and what additional tests might be useful. This consultative role is particularly useful in the case of complex or specialized tests in which test ordering and results interpretation require high levels of expertise.

The multifaceted collaboration between the laboratory and the pharmacy has benefits in many areas. For instance, the Therapeutic Drug Monitoring (TDM) process would need the laboratory personnel to be in sync with the pharmacists in order to adjust the dosages accordingly. During the TDM process, the laboratory specialists assist in determining the appropriate time to capture samples, the required specimens, and the expected timeframe for analysis, while pharmacists assist with the clinical context to facilitate the interpretation of results by advising on the patient's medications, dosing, and other clinical variables that impact absoprtion, distribution, metabolism, and excretion of the drug.

2.2.3. Point-of-care Testing and Laboratory Oversight

Point-of-care testing (POCT) – which involves moving test results from the laboratory to the patient's bedside or clinic – is an example of an area that demands particular collaboration between laboratory and clinical staff. With POCT, clinicians can make timely decisions within minutes, as opposed to the hours required to obtain results from a laboratory. Examples of POCT include blood glucose, coagulation (INR), cardiac enzyme, blood gas, urinalysis, and rapid tests for various infectious diseases.

Nevertheless, POCT raises additional concerns about the quality and regulations of the practice. With the testing being done by individuals with no laboratory training and consequently little supervision of the quality control and error detection elements of the practice, there is no guarantee that devices will be kept up to date or properly calibrated. There are also concerns that the outcomes of the tests will not be recorded properly in the patients' charts. These are some of the concerns that are aimed to be solved through laboratory oversight in POCT programs, where laboratory professionals control the selection of devices and the training and competency control of users as well as quality and regulatory oversight of the control and testing programs.

2.3 Nutrition Services in Healthcare

2.3.1 Role of Clinical Nutrition

A considerable area of concern are the hospitalized patients and those in the community population, as the extent of the issue involves malnutrition of both undernutrition and overnutrition. There is an issue of malnutrition with a considerable prevalence of 20-50%, depending on which patients are studied and how it is assessed (Norman et al., 2008). With malnutrition also comes other detrimental outcomes; increased morbidity and mortality, prolonged hospital length of stay, greater readmission rates, higher costs of healthcare, impaired wound healing, increased risk of infections, and lower quality of life. Despite the impact of malnutrition, it's quite surprising that it is so rarely recognized, and left untreated in the healthcare setting, as it is a prevalent issue.

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Medical and social history. Dietary and nutrition history, biochemistry and clinical history are all a part of medical and social history. There are various instruments that have been validated that include NRS-2002, MUST, SGA, and MNA. Systematic screening of individuals allows for the identification of a nutrition risk patient systematically.

Diagnosis involves identification nutrition clinical problems that nutritionists are able to address independently. Documenting nutrition problem is made easier, and communication is improved among the clinicians. Diagnoses that are nutrition based involve, inadequate oral intake, malnutrition, and difficulty with swallowing, nutrient and drug interactions, inadequate knowledge concerning nutrition, and either loss of weight, or gaining weight.

2.3.2 Interprofessional Nutrition Care

Providing thorough nutrition care in the health care field will always call for the collaboration of staff from different professional fields. This is because the factors affecting one's nutrition are medical conditions, the medications one takes, one's functional ability, and one's psychosocial situation. Nutrition care is the one field that has no medical diagnosis, and for that reason, nutrition care has to partner with medical practitioners to implement a medical nutrition therapy plan in the course of treatment. Nutrition practitioners hold the expertise to translate medical nutrition needs into practical nutrition care and manage the nutrition related components of care.

Implementation of nutritional interventions calls for close collaboration of nurse and nutritionist. Nutrition nurses monitor and report food intake, administer enteral and parenteral nutrition, and assess tolerance of feeds, and report to nutrition care plan complications in interventions. They also reinforce the nutrition education that nutritionists provide, and assist patients in overcoming adversities regarding the dietary changes required. Collaborative nutrition education also enhances the nutritional outcomes of the patients and helps reduce complications related to poor nutritional status (Mowe et al., 2008).

2.4 Nursing Practice and Care Coordination

2.4.1 Nursing Roles in Modern Health Care System

As the largest occupations to exist in the world, the nursing profession encompasses over 20 million nurses globally. Their participation in the health care occupations is vital as they provide primary patient care in every health care setting. These establishments are hospitals, clinics, long-term care facilities, home health, schools, and communities. Specific to nursing

practice, nurses perform various responsibilities inclusive of direct patient care and advocacy, medication administration, monitoring health status, treatment and procedural execution, health education, care coordination, and participation in quality improvement and research activities (Institute of Medicine, 2011).

Specific components of the nursing practice is determined by the level of education attained, the nursing license obtained, and the practice setting nursing is in. Under the supervision of registered nurses or physicians, licensed practical nurses (LPNs) or licensed vocational nurses (LVNs) provide basic bedside care. Comprehensive patient assessment, nursing care plan development, medication and treatment administration, care coordination, and supervision of other nursing personnel are activities registered nurses (RNs) perform. Clinical nursing practice is more advanced for Advanced practice registered nurses (APRNs) including nurse practitioners, clinical nurse specialists, nurse anesthetists, and nurse midwives. They possess a graduate degree in nursing and are equipped with the clinical skills to make diagnoses, prescribe medication, and provide other advanced treatment options.

2.4.2 Nursing as the Hub of Interprofessional Collaboration

The fact that nurses are the most involved with patients and the most present in the healthcare team makes them the best health professionals to coordinate and organize the collaboration for the different members of the team. Nurses are in contact with all other health professionals who deal with the patients in their care and act as points of communication for the other team members of the healthcare team. They collect and coordinate contributions from various professionals like doctors, pharmacists, lab technicians, dieticians, therapists and social workers, and then use that information to create a coherent care plan for the patient.

The Part Nursing Medication Administration Collaborations foster relationships with pharmacists and physicians. Nurses acquire medication orders from physicians and check orders with pharmacists to ensure orders are necessary and safe. Nurses then prepare and distribute medications to patients, monitoring patients for therapeutic effects and adverse reactions. Nurses communicate their clinical concerns and outcomes to the physicians and pharmacists. Collaborations between nurses, physicians, and pharmacists are essential for ensuring the safety and effectiveness of medications.

Nurses have an important obligation in the process of medication reconciliation through the comparison of medication orders against the patients' actual medication use and determining any discrepancies. As part of the admission process, nurses gather and document complete medication histories inclusive of prescription medications, over-the-counter medications, supplements, and any herbal products. This data is shared with physicians and pharmacists in order to obtain medication order accuracy. In the course of care transitions, nurses also validate and cross-check the medications, and make sure the patients are cognizant of any modifications in their medications.

Nursing Leadership Role within the Interprofessional Teams

Aside from their coordinating function, nurses are also taking up formal leadership roles within the interdisciplinary teams and within health care organizations. Nurse leaders are instrumental in cultivating a collaborative culture, alleviating teamwork barriers, formulating interprofessional protocols and pathways, and advocating interdisciplinary teamwork. The Institute of Medicine's Future of Nursing report has emphasized that nurses must be full partners in health care redesign and must assume leadership roles at all levels (Institute of Medicine, 2011).

Clinical nurse leaders and nurse managers have the ability to create unit-level environments that either facilitate or inhibit interprofessional collaboration. They organize the expected norms of collaboration, provide coordination of multidisciplinary meetings, integrate time for collaboration, and manage any of the issues regarding the disruption of communication. In nursing leadership and quality improvement, the collaboration of interprofessional teams to solve patient safety issues or to enhance care processes is the nursing leadership role.
Advanced practice nurses, especially nurse practitioners and clinical nurse specialists, are often the official team leaders or coordinators of specialized programs such as heart failure clinics, diabetes management, or transitional care programs. In these positions, they work as a part of the interdisciplinary team with a clinical pharmacist, registered dietitian, medical social worker, and other health professionals to achieve integrated care for chronic disease and to ensure continuity of care.

THEORETICAL FRAMEWORKS ON INTERPROFESSIONAL COLLABORATION

The knowledge of interprofessional collaboration theories allows health care systems to devise more sophisticated models of collaboration and to overcome the obstacles of interprofessional collaboration. Many theories have been developed to explain the functions of interprofessional teams, and the variables that enhance or inhibit their effectiveness.
The Interprofessional Education Collaborative (IPEC) Core Competencies framework serves as the principal model for interprofessional practice within healthcare. This framework, designed by education and practice authorities from diverse healthcare fields, delineates four domains of competency necessary for the achievement of interprofessional collaboration (Interprofessional Education Collaborative, 2016):
1. Values and Ethics for Interprofessional Practice. Work with professionals from other disciplines within an atmosphere of mutual respect and shared values. This encompasses respecting and acknowledging the diverse cultures, values, and perspectives of other disciplines, employing ethical principles, interprofessionally, and respecting patient and health user dignity, privacy, and confidentiality.
2. Roles and Responsibilities. Employ the understanding of your role and that of other professionals to accurately evaluate and address the health care needs of individual patients and patient populations. This involves recognizing one's own boundaries and seeking illustrative guidance, commending one's roles and responsibilities, and understanding how various disciplines' roles interrelate.
3. Interprofessional Communication. Engage in an interprofessionally responsive and responsible manner during your communication to patients, families, and communities and professionals within and outside health disciplines in a way that promotes a collaborative health and wellness approach. This includes selection of appropriate communication methods, active listening, constructive feedback, and dispute resolution.
4. Teams and Teamwork: Apply the values and principles of relationship building and the dynamics of teams to work effectively and in different roles to plan, implement and assess patient/population-centered care. This includes working with healthcare providers in participatory decision-making, incorporating patient values in care, and building and sustaining functional teams and teams' continuous performance improvement.

These competencies can serve as the foundation for interprofessional education frameworks and for assessing interprofessional collaboration in practice environments. Healthcare organizations can use these competencies to design education programs, assess collaborative functionality, and determine needs for further development.

Other frameworks also help explain interprofessional collaboration. Social Identity Theory describes the impact of professional identity on collaboration behavior, such as in-group favoritism and out-group bias, which are key considerations in siloed and tribal behaviors that obstruct collaboration. The Contact Hypothesis argues that interprofessional interactions of a positive nature, particularly when the participants hold equal status and work toward a common goal, can diminish hostility and improve collaboration.

From a systems theory perspective, interprofessional collaboration is further affected not just by the individual competencies of those involved, but also by the system's structures, processes, and culture. This perspective indicates the need for consistent policies and supportive systems and leadership that allow for collaboration to occur, even when recipients of the collaboration are highly competent, at the level of the systems.

Integration Models and Collaborative Practices

3.1 Multidisciplinary Rounds and Team Meetings

Multidisciplinary rounds might be the most prevalent and most documented forms of interprofessional collaboration in the literature. These are coordinated meetings in which professionals of various disciplines are brought together and engage in collaborative discussions of patient care. They share information, make decisions and develop care plans in a coordinated manner. Numerous studies have shown that structured multidisciplinary rounds that include pharmacy, nursing, nutrition and other relevant disciplines have improved communication, decreased errors, enhanced coordination, and improved patient outcomes (O'Leary et al. 2011).

Achieving effective multidisciplinary rounds depends on a number of factors. For a start, they need to be organized, with a particular structure that includes predefined agendas, scheduled meetings, and systematic processes of patient review. Meetings that are unstructured are unlikely to achieve the necessary discussion and participation. Then, the contribution interdisciplinary participation ought to be assumed, and this would be captured through protected time, expectation-setting and recognition of the value of each profession's contribution, without which collaboration becomes impossible. Next, rounds ought to focus on outcomes, and not just on the disease, but rather on patient-centered outcomes. Finally, the communication that rounds ought to feature should be respectful and be not just inclusive, but also be based on evidence.

3.2 Clinical Pathways and Protocols

Clinical pathways, care pathways or critical pathways, are time-based, interdisciplinary, and evidence-based plans of care that integrate processes of several health care professions to target a specific patient problem or procedure within a specific time frame. Pathways outline specific interventions to be performed, information to be monitored and outcomes to be expected. Developing and using clinical pathways requires all of the disciplines involved to collaborate so that care can be comprehensive and coordinated (Kinsman et al.\, 2010).

Clinical pathways that are structured effectively yield numerous benefits. They mitigate variations in practice by customizing care by best evidence instead of personal choices. They enhance communication by defining roles and responsibilities for each discipline. They allow

for the quicker recognition of deviations from anticipated progress so that the timely corrective action can be taken. They improve productivity by removing useless or redundant tasks. Studies show that clinical pathways improve outcomes, decrease complications, reduce length of stay, and decrease costs in multiple conditions.

3.3 Management of Medication Systems

Effective management of medication involves several professionals such as the pharmacist, nurse, doctor, and other supporting staff to work together as a single entity. They integrate and manage the medication use process which has several components including prescribing, transcribing, dispensing, administering, and monitoring. Each of the components mentioned involve a multitude of healthcare staff and have the potential to cause discrepancies if a unified approach to collaboration is not put in place. (BRates, et al 1995).

When physicians are in the prescribing step they are assessing the patient, developing a management plan and writing out medication orders. They are the primary prescribers. They may interface with pharmacists in the collaborative practice where the pharmacist has prescribing privileges for a defined list of medications, or consultation with the pharmacist for choice of agent and dosage. Clinical pharmacists have the ability to use clinical decision support within computerized provider order entry to alert the prescriber for possible discrepancies, but these criteria need to be set carefully in order to not cause alert fatigue.

3.4 Nutritional Screening and Intervention Programs

Alongside Nurses, Nutritionists with structured nutritional screening programs are able to determine risk nutrition and potential problems long before issues arise. Nurses can use validated screening instruments when patients enter and/or are re-evaluated during a hospitalization. These instruments include the Nutritional Risk Screening 2002 (NRS-2002), Malnutrition Universal Screening Tool (MUST), or Short Nutritional Assessment Questionnaire (SNAQ) (Kondrup et al., 2003).

The instruments have in common evaluating recent weight loss along with reduced nutritional intake, BMI, and severity of illness. A positive screen must refer patients to nutrition for an assessment and intervention. This two-step approach ensures that nutrition professionals with limited resources are directed to those patients who stand to gain the most and that high sensitivity in identifying patients most in need of assistance is prioritized.

3.5. Point of Care Testing Program

Testing patients' blood or bodily fluids to have laboratory results ready instantly at the time of the clinical consultation is the essence of Point-of-care testing (POCT). Most blood glucose tests (by patients, nurses, or family members) are POCT. Other common examples include tests for the management of anticoagulation, for evaluation of chest pain (cardiac biomarkers), blood gas levels in critically ill patients, rapid tests for infectious diseases, and urinalysis. Testing is done not laboratory personnel, which is lower in quality and may raise regulatory concerns, but the rapid turnaround time is certainly a benefit.

Cooperative Point-of-Care Testing (POCT) programs provide laboratory management and interdisciplinary teamwork. Laboratory professionals play a key role in assessing and choosing POCT devices with respect to analytical performance and clinical usefulness, usability, and laboratory information system (LIS) connectivity. They also develop policies and procedures for the performance of POCT, provide training and competency evaluations for all POCT operators, and establish quality control and proficiency testing programs. They track POCT usage and quality indicators, ensure adherence to the Clinical Laboratory Improvement

Amendments (CLIA) and other regulatory requirements, and provide technical and troubleshooting assistance.

Most POCTs are performed by nurses and other clinical staff, and so competence in the proper collection of specimens, operation of the device, quality control, interpretation, and documentation of the results is mandatory. Point-of-Care Coordinators, who are usually nurses with additional training, act as liaisons between clinical areas and the laboratory, and they are responsible for problem- solving, and policy compliance, and providing support for system implementation.

The role of the pharmacist in POCT becomes even more essential when it comes to applications directly related to pharmacotherapy, like in the case of INR testing that is used to manage patients on warfarin. Anticoagulation clinics, pharmacist-managed, have point-of-care INR testing so that they can make immediate changes to the INR dose and counsel the patient. Collaborative practice models that include oversight of testing and pharmacist-managed anticoagulation therapy have proven to be more effective than usual care in improving therapeutic control, minimizing bleeding and thrombotic complications, and increasing satisfaction of patients.

Ensuring that team members have access to results and that documentation is complete is a growing concern when it comes to POCT devices and information systems. POCT results not having visibility in the medical record can lead to duplication of testing, critical values being missed, and clinical decisions being made that are not complete. There is a growing trend of laboratory information systems along with electronic health records that pass seamlessly connected to POCT devices to enhance documentation and communication.

Evidence of Enhanced Patient Outcomes

4.1 Effect on Medication Safety

Research shows the effect of interprofessional collaboration on medication safety is not only substantial but also uniform and consistent across the literature. Problems related to medication, such as the negative consequences of medication, medication-related mistakes, and inadequate medication therapy, remain one of the largest and most expensive problems in health care. In the US, medication-related mistakes negatively impact the health of 1.5 million people each year, at a cost of more than $40 million. Adverse drug events that could be avoided lead to extreme morbidity, mortality, and unnecessary health care costs (Bates et al., 1995).

Chisholm-Burns et al. (2010) conducted a systematic review and meta-analysis of 298 studies involving pharmacists on the health care team in various settings and with various diseases. The meta-analysis provided evidence to support the claims that there is in fact a relationship between the savings of lives (26 studies reported decreased mortality between 14% and 78%) and the participation of pharmacists on interprofessional teams, as well as decreased adverse drug events and improved therapeutic outcomes and patient satisfaction. The benefits were all documented in a variety of health care settings such as hospitals, clinics, nursing homes, and community pharmacies, and with a variety of health conditions, including cardiovascular problems, diabetes, infectious diseases, and critical illness.

Kaboli et al. has done something numerous other researchers reviewed, and that is to study of the inclusion of pharmacist in patient care in hospitals. In their review of 36 studies, they found that the inclusion of a pharmacist in ward rounds resulted in the 78% decrease of

avoidable adverse drug events of the ward compared with the ward without a pharmacist. The other Pharmacists' interventions related to inappropriate medications were cessation of medications, recommendations of alternative therapies, and initiation of therapies, and other revisions of dosage to be more appropriate.

4.2 Diagnostic Accuracy and Laboratory Utilization

The collaboration between laboratory professionals and clinical teams helps improve both the accuracy of diagnostic testing and appropriate utilization of tests. Preanalytical laboratory errors, which happen before the laboratory analyzer, make up between 60 and 70% of laboratory errors and can lead to wrong test results, misdiagnosis, unnecessary testing, and inappropriate and delayed treatment. Most of these preanalytical errors happen due to improper specimen collection, and specimen handling and transport. These tasks rest on the clinical staff, especially nurses.

Nutritional Outcomes

Interprofessional nutritional care leads to improved patient outcomes related to malnutrition and nutritional status. Careful attention to malnutrition in hospitalized patients is especially critical, given its high prevalence, estimated at 20-50% in hospitalized patients, and depending on the population and the assessment method used. The impact of malnutrition is substantial, contributing to increased complications, longer hospital stays, higher mortality rates, elevated healthcare costs, and decreased overall quality of life (Norman et al., 2008).

Kruizenga et al (2005) conducted studies on the impacts of systematic nutritional screenings done by nurses, along with automatic referrals of at-risk patients to nutrition services, as part of randomized controlled trials. The intervention group was subjected to structured screenings, nutritional assessments by the dietitians, sequential individualized nutrition care plans, and follow-up. In comparison to the normal care group, the intervention group demonstrated better nutritional and dietary intake, weight loss, and quality of life. Furthermore, the intervention group spent on average 2.6 days lesser on hospital stays. The intervention proved to be cost effective as the nutrition program costs were outweighed by the savings, as a result of decreased hospital stay length.

4.4 Overall Patient Outcomes and Satisfaction

Assessing the contribution of interprofessional collaboration without scopes of studies and interventions, evidence shows, it improves overall patient outcomes which include, and are not limited to, patient mortality and morbidity rates, length of hospital stay, healthcare costs, and patient satisfaction. A systematic Cochrane review by Reeves et al. (2017) assessed interprofessional collaboration interventions in various settings. A review of such diversity with such a degree of heterogeneity in the scope of interventions and outcome measures showed variety in outcomes with positive effects such as, reducing clinical errors, shortening hospital stay, better management of chronic diseases, improved mental health, and overall patient satisfaction.

O'Leary et al (2011) studies specifically focuses on the impact of structured interdisciplinary rounds on hospitalist services. In their work, they executed a standardized rounding framework that included physicians, nurses, pharmacists, case managers, and social workers. In a comparison to regular care, it resulted to not only a 1.1 days (or 15%) reduction in hospital stay, $1200 reduction, per admission , in direst cost, rise in communication among the team and, improved satisfaction in patients and their families, overall, to positive feed back. The

positive effects were kept over time suggesting that structured interprofessional collaboration interpractices should be implemented.

Care models that emphasize collaborative, team-based care in primary settings, or primary care medical homes, have demonstrated enhancements in care quality, patient outcomes, and cost savings. These models typically feature collaboration among physicians, nurse practitioners, physician assistants, nurses, medical assistants, pharmacists, behavioral health providers, and care coordinators. Well-functioning medical home models have been shown to improve the management of chronic diseases (i.e., diabetes, hypertension, heart failure), increase the utilization of preventive services, and reduce emergency room visits and hospitalizations, while improving patient satisfaction. Although outcomes depend on certain characteristics of the implementation and the target population, the overall evidence is in favor of interprofessional primary care teams.

Barriers to Interprofessional Collaboration

5.1. Professional Silos and Hierarchies

As a result of their lack of interprofessional relationships, traditional healthcare organizations leave little to no room for interprofessional relationships. Each healthcare discipline generally has its own unique education, professional associations, governing bodies, and scopes of practice, and as a result, each has unique identities and cultures. While these identities are vital for defining and maintaining professional situational accountability, they can lead to a lack of understanding regarding interprofessional roles, defensiveness around specific professional boundaries, unwillingness to collaborate IRIPRO, and a narrow view of interprofessional roles (Reeves et al., 2010).

Professional socialization during education and early practice experience reinforces professional identity and can inadvertently promote stereotypes or biases about other professions. Graduate students and early-career practitioners may internalize these messages around professional hierarchies, territorial boundaries, and professional superiority which can lead to dispositions around collaboration that are counterproductive to a spirit of collaboration. These attitudes may persist throughout careers if not actively addressed through interprofessional education and practice experiences.

Institutional arrangements, particularly the dominance of clinicians, restrict, rather than, facilitate collaboration across professions, as these arrangements create power differentials that block communicative and respect reciprocity. Studies show that in hierarchical systems, nurses and even pharmacists, and other members of the healthcare team, are not free to voice, and to challenge, and lexically contribute to the clinical dialogue for decision-making processes, even when such individuals are qualified to do so. This situation can place patients at significant risk when clinicians do not, and/or when clinicians do not take seriously the clinical concerns of other healthcare professionals.

5.2 Communication Challenges

Without timely, accurate, and effective communication among team members, interprofessional collaboration is doomed to fail. Unfortunately, several obstacles pose barriers to effective communication in healthcare settings. Field-specific language and jargon can cause communication breakdown – especially when members from other disciplines use different terms or employ specialized language that others do not understand. For instance, drug interaction, from the perspective of a pharmacist, would need an intervention, and a physician

would accept it if it is monitored and not anticipated, whereas an understanding of enteral feeding techniques may vary for nutritionists from that of nurses.

Healthcare professionals' absences and distances from each other result in notable gaps in communication, and there is a widespread phenomenon in healthcare of different professions being located in different geographical areas: pharmacists being located in a central pharmacy, lab personnel in outer district laboratories, and nutritionists located in offices that are away from the patient care areas. Though there is the possibility of different colleagues being on the same shift, there is little chance of them being in the same physical area and crossing paths. This phenomenon requires the different healthcare professionals to communicate using different means like sending faxes, using telephone communication, and other electronic means of communication. These means are far less effective than being able to communicate in person (Leonard et al., 2004).

Time is always an important aspect of communication. The reality of most fields can mean that there is little to no communication. This is the case in healthcare, and especially in acute care, where multidisciplinary rounds are done in meetings, and where lengthy checklists can lead to even more strained communication, meaning that there is no chance for enough discussion from a role.

5.3 Organizational and Systemic Barriers

Healthcare enterprises may lack the foundational elements necessary to promote interprofessional collaboration, despite the willingness and capabilities of individual staff members. Specific organizational settings such as insufficient staffing, which prevents the collaboration of multiple healthcare workers, lack of allocated time for interprofessional rounds, separate office settings for different roles that decreases the likelihood of spontaneous collaboration, limited interprofessional training, and insufficient organizational collaboration or leadership support (D'Amour and Oandasan, 2005).

Collaboration across different professions is made very difficult due to finances and payment methods. The traditional u fee-for-service payment model is one that only pays for physician services. When healthcare professionals other than physicians collaborate, there is no reimbursement or payment incentive. Activities such as time spent by pharmacists on medication management or dietitians on counseling and care coordination in interprofessional teams do not generate any revenue making it difficult to finance their sustainment. This reimbursement model creates inequity of value for other non-uh physician services and creates incentive misalignment.

Value based payment models and bundled payment models do trust to keep more in line with interprofessional collaboration because it focuses on outcomes and efficiency rather than value of services, but the alignment is still there but still better that fee for service models. The healthcare system, and even individual organizations within the system, still primarily operate within the fee for service model. However, even within value based models there are reasons to make it difficult to share the savings and share the blame that comes with that value model to their different professionals, even different organizations, that are involved in a patient's care.

Differing levels of supervision, accountability, and reporting can cause fragmentation and inefficiency within an organization. For example, nursing staff report to nurse managers, while pharmacists report to pharmacy managers, and so on. This can lead to heterogeneity, in which various units within an organization operate on different metrics and strategic initiatives. Equal

accountability for all units within an organization would require the implementation of matrix management, or some other novel approach, which crosses the boundaries of traditional departmental management structures.

There are some regulatory and accreditation barriers to innovation and collaboration. These barriers include but are not limited to, scope of practice, credentialing, and supervision rules which defines what non-physician professionals can do autonomously. Liabilities also discourage collaborative partnerships when the roles are not clearly defined within an organization. Additionally, standards set by accreditation bodies often emphasize the individual professional services rather than an interprofessional team approach.

5.4 Educational Gaps

The education of healthcare professionals has been, and to some extent continues to be within a single discipline, having little or no opportunity for interprofessional education. Medical education, nursing education, pharmacy education, and other healthcare professional education occurred in isolation of each other, each having their own prescribed curricula, educations cultures, and clinical training environments. While every discipline included some coursework that focused on the role of other professions, interactions among students of the different professions, and thus, opportunities for collaborative skills building, were exceedingly rare (Reeves et al, 2013).

Educational practices that do not focus on inter-professional education contribute to an increase in professional silos. These silos create and reinforce professional identities and boundaries and do not promote necessary skills to collaborate effectively within inter-professional teams. Students may graduate without knowledge of other professions and their contributions, develop stereotypes of other professions, lack experience in joint practice, and possess underdeveloped skills in communication and collaboration. These gaps in education carry into practice, where professionals may want to collaborate, but do not have the knowledge and competencies to do so in an effective manner.

Professional education has increasingly recognized these limitations and incorporated interprofessional education (IPE) into curricula. Many health professions programs now include IPE experiences where students from different disciplines learn together about collaborative practice. These experiences range from introductory activities helping students understand each other's roles, to case-based learning where interprofessional student teams develop care plans, to actual clinical experiences where students work together caring for patients under supervision.

6. Strategies for Enhancing Interprofessional Collaboration

6.1 Interprofessional Education

Interprofessional education (IPE) represents the foundation for preparing healthcare professionals for collaborative practice. IPE is defined as occurring "when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes" (WHO, 2010). The goal is not simply for students to learn about other professions but to develop collaborative competencies and attitudes that will transfer into future practice.

Effective IPE requires several key elements. First, it must involve active learning with students from different professions truly interacting rather than simply attending the same lecture. Case-based learning, simulation, clinical experiences, and project-based learning engage students in collaborative problem-solving that develops teamwork skills. Second, IPE should

occur longitudinally across the curriculum rather than as isolated experiences, allowing competencies to develop progressively. Third, IPE should include both classroom-based learning about collaboration and authentic clinical experiences where students work together in patient care under appropriate supervision.

The IPEC Core Competencies framework provides guidance for designing comprehensive IPE curricula (Interprofessional Education Collaborative, 2016). Programs can use these four domains—values and ethics, roles and responsibilities, communication, and teams and teamwork—to structure learning outcomes and assess student progress. Competency-based assessment ensures that students develop and demonstrate necessary collaborative skills before entering independent practice.

Evidence supports IPE's effectiveness in improving knowledge, skills, and attitudes related to interprofessional collaboration. A Cochrane systematic review by Reeves et al. (2013) found that IPE interventions generally show positive effects on learners' reactions, attitudes, and knowledge. Some studies also demonstrated changes in collaborative behavior and patient outcomes, though evidence linking IPE to long-term practice changes and patient outcomes remains limited due to methodological challenges in conducting long-term studies.

IPE must extend beyond pre-licensure education to include practicing professionals. Continuing professional education increasingly incorporates interprofessional learning opportunities. Organizations implementing new collaborative practice models should provide IPE for staff to develop necessary competencies. Team training programs for practicing professionals have shown improvements in teamwork behaviors and patient safety outcomes.

Faculty development is essential for successful IPE implementation. Faculty members must understand interprofessional collaboration principles, develop facilitation skills for interprofessional learning activities, and value IPE as important professional education. Many faculty received siloed professional education themselves and may need support in shifting to interprofessional approaches. Faculty development programs, communities of practice for IPE educators, and institutional support for IPE facilitate successful implementation.

6.2 Organizational Culture and Leadership

Creating organizational culture that values and supports interprofessional collaboration requires commitment from leadership at all levels. Senior leaders set the tone through their statements, priorities, resource allocation decisions, and behavior. Middle managers and unit leaders translate this into daily practice by implementing collaborative structures, holding staff accountable for collaborative behavior, and removing barriers to teamwork.

Leadership strategies for promoting collaborative culture include:

Establishing shared vision and goals: Leaders articulate a clear vision of patient-centered care delivered through interprofessional collaboration. They establish organizational goals emphasizing teamwork, quality, and safety that transcend individual departments. They communicate why collaboration matters for patients, staff, and the organization.

Allocating resources: Leaders dedicate resources necessary for collaboration including time for team meetings, staffing sufficient to allow collaborative activities, physical spaces supporting teamwork, information technology enabling communication, and funding for interprofessional training.

Creating structures and processes: Leaders establish interprofessional governance structures such as interdisciplinary practice councils, implement collaborative processes like

multidisciplinary rounds and care conferences, and develop policies supporting collaborative practice rather than maintaining siloed approaches.

Recognizing and rewarding collaboration: Leaders make collaboration an explicit expectation in performance evaluations, recognize and celebrate examples of effective teamwork, and include collaborative behavior in promotion and leadership selection criteria. They address behaviors that undermine teamwork.

Modeling collaborative leadership: Leaders demonstrate collaborative approaches in their own interactions, seek input from diverse perspectives, show respect for all disciplines, and avoid perpetuating hierarchies or professional silos.

Nurse leaders play particularly important roles given nursing's size, presence across all care settings, and central position in care coordination. Nurse leaders who champion interprofessional collaboration create environments where nurses feel empowered to contribute fully to team decisions, communication flows effectively, and professional silos are minimized. The Institute of Medicine's Future of Nursing report specifically called for nurses to serve as full partners in healthcare redesign and to take leadership roles in improving care delivery (Institute of Medicine, 2011).

Creating collaborative culture requires addressing resistance and skepticism. Some professionals may question whether collaboration is worth the time investment, doubt that other disciplines truly value their contributions, or feel that collaborative models threaten their autonomy or authority. Leaders must address these concerns through transparent communication, demonstrating benefits of collaboration, ensuring all voices are heard and valued, and providing support for adapting to new ways of working.

Organizational culture change takes time and sustained effort. Initial enthusiasm may wane if results are not immediately apparent or if implementation challenges arise. Leaders must maintain commitment through inevitable setbacks, continue reinforcing the importance of collaboration, and celebrate progress. Assessment of organizational culture and collaborative effectiveness should be ongoing, with results used to guide continuous improvement efforts.

6.3 Structured Communication Tools and Protocols

Implementing structured communication tools and protocols addresses many communication barriers that impede interprofessional collaboration. These tools provide standardized frameworks for information exchange, reducing variability, misunderstandings, and omissions.

The SBAR (Situation-Background-Assessment-Recommendation) communication framework has been widely adopted in healthcare to structure communication, particularly in high-stakes or time-sensitive situations (Leonard et al., 2004). SBAR provides a template:

- **Situation**: What is happening with the patient?
- **Background**: What is the relevant clinical context?
- **Assessment**: What do you think the problem is?
- **Recommendation**: What do you think should be done?

This structure ensures that communication includes all essential elements in logical sequence. Research has shown that SBAR implementation improves communication completeness, reduces errors, enhances team members' confidence in communicating concerns, and improves relationships between nurses and physicians. While originally developed for nurse-physician communication, SBAR can be used for any interprofessional communication.

Team huddles provide brief, regular opportunities for team members to share information, identify priorities, anticipate challenges, and ensure everyone is aligned. Huddles typically

occur at the start of shifts or at regular intervals during the day, lasting 5-15 minutes. Participants stand in a circle and quickly share updates, concerns, or needs. Huddles improve team situational awareness, enhance coordination, and provide opportunities for mutual support.

Structured handoff protocols ensure complete information transfer during transitions of responsibility between healthcare professionals. Handoffs represent high-risk periods for information loss leading to errors. Standardized handoff protocols define what information must be communicated, in what format, with what documentation, and with what verification of understanding. The I-PASS handoff bundle (Illness severity, Patient summary, Action list, Situational awareness and contingency planning, Synthesis by receiver) has been shown to reduce medical errors and adverse events.

Electronic health records (EHRs) with shared documentation capabilities facilitate interprofessional communication by providing all team members real-time access to comprehensive patient information. However, EHR design significantly impacts whether systems support or hinder collaboration. Key features supporting interprofessional collaboration include:

- Shared documentation that all team members can access
- Interprofessional flowsheets or dashboards displaying key information from multiple disciplines
- Secure messaging enabling efficient team communication
- Integration of results from pharmacy, laboratory, and other services
- Alerts and notifications for critical information
- Mobile access enabling communication despite physical separation
- Documentation templates supporting standardized communication

Poor EHR design can hinder collaboration by fragmenting information across multiple screens, requiring excessive documentation time, lacking integration across services, or failing to support team workflows. Organizations implementing or optimizing EHRs should actively involve representatives from all relevant disciplines in design and configuration decisions to ensure systems support interprofessional collaboration.

6.4 Team Training Programs

Comprehensive team training programs develop the knowledge, skills, and attitudes necessary for effective interprofessional collaboration. While professional education provides foundational competencies, team training addresses specific teamwork skills and can be delivered to practicing professionals.

TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety), developed by the Agency for Healthcare Research and Quality and Department of Defense, represents the most widely implemented healthcare team training program in the United States (King et al., 2008). TeamSTEPPS provides evidence-based tools and strategies organized around four core competencies:

1. **Leadership**: Team leaders organize team activities, provide direction and structure, set priorities, facilitate information sharing, and model teamwork behaviors.
2. **Situation Monitoring**: Team members actively scan the environment and each other's performance, maintain shared understanding of the situation, recognize risks and changes, and cross-monitor each other's work.

3. **Mutual Support**: Team members provide backup for each other, offer assistance proactively, speak up about concerns, resolve conflicts constructively, and maintain a positive team climate.
4. **Communication**: Team members exchange information clearly, completely, and accurately using structured tools, verify understanding, and adjust communication to the needs of the situation.

TeamSTEPPS implementation typically includes classroom training for staff, in-situ coaching to apply skills in actual clinical settings, integration of tools into daily practice, and measurement of teamwork behaviors and outcomes. Research has demonstrated that TeamSTEPPS implementation improves teamwork behaviors, enhances communication, increases staff satisfaction, and improves patient safety culture. Some studies have also shown improvements in clinical outcomes such as reduced adverse events.

Simulation-based interprofessional education provides opportunities for healthcare professionals to practice collaborative skills in realistic but controlled environments where mistakes won't harm real patients. Simulation scenarios can recreate high-stakes situations requiring teamwork such as resuscitation, surgical crises, or complex clinical presentations. Interprofessional teams work through scenarios while being observed, then participate in facilitated debriefing where performance is analyzed and learning points are identified.

Simulation-based team training has shown effectiveness in improving team performance, communication, and clinical outcomes. For example, obstetric emergencies teams trained through simulation have demonstrated reduced time to intervention, improved technical skills, and reduced adverse outcomes. Surgical teams trained together through simulation show improved teamwork behaviors and efficiency. The immersive, experiential nature of simulation provides powerful learning that transfers to clinical practice.

Crisis resource management (CRM) training, adapted from aviation's crew resource management, focuses on non-technical skills essential for managing high-stakes clinical situations. CRM emphasizes situational awareness, communication, task management, decision-making under pressure, and teamwork. These skills complement clinical expertise and significantly impact outcomes in crisis situations. CRM training has been implemented in various specialties including anesthesia, emergency medicine, and critical care.

Other team training approaches include action teams for quality improvement, where interprofessional groups work on specific improvement projects while developing collaboration skills; interprofessional retreats or workshops focusing on team development; and coaching or mentoring for interprofessional teams working together over time.

Effective team training requires several key elements: Active learning rather than passive lectures; practice of skills through role-play, simulation, or real cases; facilitated reflection and feedback; relevance to participants' actual practice; support for transferring learning into practice; and leadership commitment to team training as organizational priority.

6.5 Performance Measurement and Quality Improvement

Measuring and monitoring interprofessional collaboration outcomes enables healthcare organizations to assess current performance, identify improvement opportunities, track progress over time, and demonstrate value of collaborative initiatives. "What gets measured gets done," and explicit measurement signals organizational priorities.

Relevant metrics for interprofessional collaboration span multiple domains:

Process Measures assess whether collaborative activities are occurring as intended:

- Participation rates in multidisciplinary rounds or team meetings
- Timeliness of consultations or referrals between disciplines
- Completeness of interprofessional documentation
- Utilization rates of collaborative protocols or pathways
- Number of interprofessional interactions or communications

Outcome Measures assess impacts on patients, safety, and quality:

- Medication error rates and adverse drug events
- Hospital-acquired conditions (infections, pressure ulcers, falls)
- Clinical outcomes for specific conditions
- Hospital length of stay and readmission rates
- Patient satisfaction and experience scores
- Mortality rates
- Healthcare costs and resource utilization

Team Functioning Measures assess interprofessional team performance:

- Team climate or collaboration assessments completed by team members
- Communication effectiveness ratings
- Conflict frequency and resolution
- Psychological safety (team members' comfort in speaking up)
- Staff satisfaction and burnout rates
- Turnover rates

Multiple validated instruments are available for assessing interprofessional collaboration and team functioning. The Collaborative Practice Assessment Tool (CPAT), Assessment of Interprofessional Team Collaboration Scale (AITCS), and Interprofessional Collaborative Competency Attainment Survey (ICCAS) assess various aspects of collaboration from different perspectives.

Quality improvement methodologies provide frameworks for systematically enhancing interprofessional collaboration. The Plan-Do-Study-Act (PDSA) cycle, a cornerstone of improvement science, involves planning a change, testing it on a small scale, studying the results, and acting to adopt, adapt, or abandon the change. This iterative approach enables organizations to test collaborative initiatives, learn from experience, and refine approaches before broad implementation.

Lean and Six Sigma methodologies can be applied to identify and eliminate waste in care processes, reduce variation, and improve efficiency through interprofessional collaboration. These approaches emphasize understanding current processes through value stream mapping, identifying root causes of problems, designing improved processes, and measuring results.

Future Directions and Recommendations

7.1 Technology and Innovation

Strengthening interprofessional collaboration through advanced technologies poses a double-edged sword. Clinical Decision Support Systems (CDSS) embedded in EHRs can potentially improve collaborative decision-making through evidence-based recommendations. As an example, computerized sepsis alerts can send simultaneous notifications to physicians, nurses, and pharmacists, encouraging a Coordinated Rapid Response Team (CRRT) participation. Alert fatigue and poor design, however, can lead to ineffectiveness, thus requiring a meticulous design and continuous improvement. Integration of virtual care and telehealth technologies offers the possibility of interprofessional collaboration over great distances and potentially

over underserved areas where specialized services are available. For example, virtual multidisciplinary tumor boards allow collaborative case reviews with oncologists, surgeons, radiologists, and pathologists across different locations. Remote telepharmacy services offer pharmacy support to distant facilities lacking an in-house pharmacy and, in turn, allows dietitians and other specialists to remotely support underserved patients. The COVID-19 pandemic had positively impacted and accelerated the use of telehealth services and interprofessional collaboration. Challenges however, remain in the areas of reimbursement, cross-state licensure, and access to technology.

AI and machine learning functionalities can allow different professionals to work together by detecting patients who require immediate attention due to potential risks, forecasting dietary requirements and proposing corresponding actions, advising on potential improvements to prescriptions for a pharmacist to analyze, or by identifying clinical lab values that need further evaluation. Nevertheless, the positive potential of AI must be complemented by human discernment and decision-making, and by human evaluation of the AI's conclusions.

7.2 Policy and Regulatory Considerations

Healthcare policies and regulations have a direct bearing on interprofessional relationships and, therefore, policy reforms are essential to improve multi-disciplinary team collaboration. Scope of practice regulations are physician and profession-specific, and almost all American states have some rules that can hinder the activities of non-physician healthcare professionals. While the balance of scope of practice regulations is essential to patient safety and appropriate supervision in training, overly conservative regulations can disallow the full contributions of otherwise competent practitioners to existing patient care.

Several factors influence advocacy for scope of practice reforms: policies are appropriately aligned with the level of training and competencies of the profession; are conducive to practitioners performing at their highest level of licensure; allow for equitable collaborative practice with oversight; and regulations are devoid of restrictive competition to the profession, focusing instead on safety and effectiveness.

There is little doubt that reimbursement policies influence the patterns of healthcare delivery. As mentioned previously, the traditional fee-for-service model in and of itself incentivizes little interprofessional collaboration, since reimbursement is received for physician services only. Value-based reimbursement, bundled payments, and capitation payment reform may, in principle, provide the necessary collaboration. However, equitable payment, and the avoidance of negative consequences, is important for this to work in practice.

Some Medicare reimbursement policies reflect a greater recognition of the contributions of non-physician providers, such as "incident-to" billing, which allows supervision of non-physician providers by a physician, and direct billing by nurse practitioners and other advanced practice providers. Medicaid reimbursement policies are variable at the state level, as are private payer policies.

The importance of measuring and reporting on the quality of healthcare teams and collaboration is growing. The inclusion of quality reporting indicators on the measurement of integration, interprofessional collaboration, and teamwork may reflect the importance of those dimensions. However, the measurement of interprofessional collaboration is still a work in progress.

7.3 Research Priorities

Despite robust evidence supporting concerned collaboration, there remains critical gaps. The following constitute the key priorities for future research:

Any research on the collaboration should based on diversity. More research is needed to understand the most effective collaboration models for different contexts. A vast amount of existing research focuses on single-center initiatives, which is of limited generalizability. More rigorous research is needed to inform organizations about effective models.

Effective research on the cost of interprofessional collaboration is needed to inform address the business case to administrators and payers. In the literature, there is a contrast between the abundance of studies detailing costs… and the lack of studies on the costs of implementation, operational costs, and the costs of outcomes. Research on the cost of such initiatives from the perspective of social cost would inform policy decision.

The evidence supporting the effectiveness of collaboration is immense. The gap, therefore, is implementation. Research to address this gap is needed to identify the conditions necessary to scale and sustain interprofessional collaboration. More research is needed to understand the facilitators to the implementation of effective changes to sustain evidence from research to practice.

Vulnerable populations experience fragmented care, and this is why studies that impacts health equity and health disparities are important. Future studies should focus on interprofessional collaboration, and its benefits on underserved populations, and how interprofessionl collaboration models assist with health disparity.

Studies on the impact of interprofessional collaboration are important and should be s longitudinal, and focus on the big picture of sustainabilty of interprofessional collaboration. A number of published studies often focus on the short term, and the benefits of interprofessional collaboration, and its positive impacts on patients and communities, but what is often left out is the evolutionary aspects over time.

These studies would more strongly link interprofessional education (IPE) to practice outcomes, and strengthen the evidence base surrounding interprofessional collaboration. Additionally, showing the positive impacts of IPE on collaborative practice and patient outcomes would strengthen the argument surrounding the cost benefits of IPE.

Research on the right balance of interprofessional teams of health care professionals supports the effective design of interprofessional teams. Things to consider are establishing leadership, size of the team, what health care professionals are needed versus optional, and how the team should be structured.

7.4 Recommendations for Practice

Based on the evidence, the criteria must be established on how to strengthen the collaboration of the sections of pharmacy, laboratory, nutrition, and nursing services to the healthcare organizations and will include the following:

1. Develop and include every field Structural multidisciplinary rounding with agenda setting, patient review processes, and available times for attendance.
2. Use and create clinical pathways and protocols for the role definition of the personnel to be integrated for common problems or procedures and to achieve coordinated care.
3. Develop communication policies and use standard communication SBAR, team huddle, and structured handover to improve information flow.

4. Develop shared documentation systems through electronic health records and other tools for the purposes of information exchange and communication among teams.
5. Provide interprofessional education and team training opportunities with orientation to new staff, continual education, and custom training for teams designed to implement new collaborative models.
6. Redesign environments to improve collaboration. For example, create shared workspaces, team stations, or co-location of different disciplines.
7. Introduce joint governance models with members of all disciplines, and in the committees, councils, or teams that create clinical policies and guidelines, include representatives from all disciplines.

Develop metrics that evaluate both the process and the results of collaboration, including process indicators such as participation in meetings and timeliness of communication as well as outcome indicators such as the results of safety, patient experience and clinical outcomes.

Develop metrics that evaluate both the processes and results of collaboration, including metrics for the processes such as participation in meetings and timeliness of communication, as well as metrics for the outcomes such as safety, patient experience, and clinical outcomes.

Recognizing and rewarding collaboration in the workplace through performance evaluation systems that include competencies in teamwork, recognition of effective collaboration, and including collaborative skills in promotion criteria.

Developing a sense of a respectful and shared accountability for results through leadership advocacy and containment of behaviors that sabotage teamwork, focusing on patient-centered goals that traverse the professionally defined borders.

Organizations should begin in those areas where the need is greatest, or where the leadership support is the strongest, and build on the lessons from early iterations to expand the range of structures and processes that support collaboration. Pilot projects can demonstrate value in approaches that test and refine the design for a broader implementation. Engaging frontline staff members in the design and implementation processes fosters a sense of ownership and enables innovative solutions to the practical challenges.

For a collaborative structure and behavior to remain effective and sustainable, there must be a dedication to those elements even in the absence of initial enthusiasm. This encompasses recruiting and orienting newly hired staff members to the culture of collaboration, refresher training, monitoring collaborative behaviors and providing feedback to teams, continuous quality improvement to collaboration processes and systems to leadership advocacy to the processes of organizational restructuring.

Organizations ought to establish benchmarks for themselves and for other entities to analyze both successful and unsuccessful initiatives. Tools to assist with this can be found in professional organizations, collaboratives in quality improvement, and academic literature. Nevertheless, tailoring to the local context is vital. Successful initiatives in one institution may require adjustments for other contexts, demographic and geographic populations, or organizational cultures.

CONCLUSION

To achieve the quality and safety of healthcare services required in the 21st century, the integration of pharmacy, laboratory medicine, nutrition, and nursing services must be an

interdisciplinary collaboration, and this integration must be prioritised. This review has provided and analyzed an unparalleled body of evidence to illustrate the fact that, in all of the various contexts and populations, interprofessional collaboration that is structured in an organized way achieves significant advancements in safety regarding medications, accuracy of diagnoses, improvement of nutrition, reduction of medical errors and costs in healthcare, and subsequently enhances numerous outcomes in health and satisfaction of the patients.

Pharmacists, nutritionists, laboratory technicians, and nurses all contribute to the interprofessional team and each have their own unique and invaluable roles in patient care. A pharmacists' role includes utilizing their specialized knowledge in pharmacotherapy and medication management. Laboratory professionals provide the healthcare team with accurate diagnostic information through their quality and efficient testing. Nutritionists tackle the crucial but often overlooked issue of malnutrition and optimize the patient's nutritional status to assist with healing and the management of disease. Nurses, the primary coordinators of the healthcare team, are responsible for the continuous monitoring of the patient, as well as providing communication link for the patient to the rest of the healthcare team. The way these healthcare professionals work together enhances the overall care of the patient through synergy, a phenomenon that cannot be reached by any deiscipline working apart.

There is a great deal of well-established evidence that supports this unique form of collaboration. The involvement of pharmacists in interprofessional healthcare teams decreases the risk of preventable adverse drug events by 78% and mortality in several clinical conditions. The incidence of malnutrition and nutrition-related complications are lower with the presence of interprofessional healthcare teams and therefore the duration of the patient's stay is often decreased. There is better and more accurate laboratory and clinical collaboration, as well as testing, with these teams. Errors are decreased and communication is improved by utilizing interprofessional approaches to patient care. The length of stay is also decreased leading to improved satisfaction of the patient and their family.

In order for interprofessional collaboration to be effective, however, there are significant obstacles that need to be overcome, including issues that are common in most, if not all, healthcare organizations. Professional isolation, communication issues, conflicts in organizational objectives, organizational structure and hierarchy, resource allocation, incentive misalignment and educational deficits all affect teamwork. Overcoming these barriers requires effort at all levels: policy changes that revise regulatory and reimbursement policies to be in line with the promotion of collaboration and intra-organizational cultural changes and leadership that foster changes in organizational structure and resource allocation. Educational changes that promote collaboration and intra-organizational cultural leadership changes to foster positive leadership changes that promote collaboration provide the changes needed.

Organizational leadership, education, and communication are key to overcoming these barriers. These include sustained interprofessional education, team collaboration competencies, effective communication, culture changes that focus on resource allocation, error/issue reporting systems, and reporting collaborative outcomes. Purposefully designed technological changes can also be beneficial.

The future demands efforts from all stakeholders involved. Healthcare administrators need to focus on interprofessional partnerships during the planning phase, assign appropriate support, eliminate structural constraints, and foster responsibility for collaboration within the practice. Modernizing frameworks for policies and regulations, tailoring reimbursement models to

value, interprofessional competences, and team-based care collaboration models are all critical for policymakers. Educators need to teach healthcare trainees the importance of collaboration through an interprofessional lens and foster the skills to collaborate for existing healthcare practitioners through the continued educational process. Healthcare professionals need to accept the importance of collaboration, obtain the skills necessary, and move past professional stereotypes, biases, and attitudes to focus on patient teamwork.

The ability to effectively share and manage integrated professional services through all levels of organizations is becoming more crucial for success, especially as healthcare systems around the globe are adopting value-based care that prioritizes quality of care delivered and the overall healthcare system costs. The COVID-19 pandemic emphasized the importance of interprofessional collaboration when responding to complex challenges in health care. It also showed the determination of Healthcare professionals to support one another, as they worked through incredibly challenging times. Healthcare organizations in the future, that make integrated interprofessional collaboration their core, as opposed to an optional add-on, will have the best opportunities to face new challenges, provide quality care, and prosper in the advanced healthcare systems that will be available.

The multi-disciplinary collaboration of pharmacy, lab, nutrition, and nursing services represents a fundamental shift from the traditional fragmented and siloed care delivery to collaboration centered on the patients' needs in a more interdisciplinary and collaborative team approach. It is evidence of decades of research into the benefits of this approach, and recent coordinated research outcomes demonstrate a shift is more than a desired goal. It is a necessary evolution, multiple research studies demonstrate the need for change in the care delivery model, the research along with successful practices demonstrate the way forward. However, multiple studies identified that this evolution and change in practice, is significant in its challenges.

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