

The Impact Of Cooperation And Integration Between The Roles Of Nursing And The Laboratory In Light Of The Presence Of Modern Technology In Health Facilities In Taif City

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Abstract

Background: Effective interprofessional collaboration between nursing and clinical laboratory services, especially with regard to diagnostic accuracy and timely intervention, is at the core of patient safety and quality care delivery. In Saudi Arabia, including renowned health care organizations in Taif City, health care delivery is dependent on integrated digital solutions – EHR and Laboratory Information Systems to operationalize this essential diagnostic partnership. However, systemic effectiveness of these integrated solutions can be challenged by implementation factors endemic to contemporary health and safety systems in the region including inadequate training, usability issues for stakeholders and workforce culture regarding communication.

Objective: The main objective of the research is to assess the effect of collaboration and integration between nursing and laboratory departments on both clinical effectiveness and patient care in technologically enhanced healthcare environments in Taif city, Saudi Arabia.

Methods: A quantitative, cross-sectional study design will be employed in major healthcare facilities in Taif City. The target population includes licensed Registered Nurses and Clinical Laboratory Technologists/Scientists who routinely engage in diagnostic workflows. Data will be collected using a structure questionnaire. Data analysis will utilize descriptive statistics and Chi square test.

Conclusion: The researchers anticipate finding a robust positive correlation between participants' perceived high usability of robust integrated systems (functional CPOE, automatic alerts) and quality IPC, which would correlate with both perceived efficiencies and less safety risks (e.g., specimen identification errors). The findings will inform policy recommendations in support of mandated culturally informed Interprofessional Education (IPE) and centralized laboratory quality management for decentralized technologies.

Keywords: Interprofessional Collaboration (IPC), Nurse-Laboratory Integration, Collaborative Practice, Interprofessional Education (IPE), Patient Safety, Critical Result Reporting, Quality of Care.

Introduction and Background

The worldwide initiative to enhance patient care has gradually recognized effective interprofessional collaboration (IPC) as an important variable of quality. IPC involves a group of health professionals with different educations to work collaboratively or in concert with patients and their families to ensure they receive the optimal level of care in every clinical setting. [1], [2] Research has shown that IPC enhances the avoidance of medical errors, helps to prevent heroic complications, and promotes consistency and quality of care. In this context, interprofessional collaboration between nursing and clinical laboratory services is fundamentally important to the diagnostic process. [3]

The nurse's ability to administer medicines, change the treatment plan, or order additional laboratory studies, relies heavily on the timely quality of the laboratory result. Put differently, if the test result is inaccurate, delayed, or poorly communicated, this hinders nursing practice, possibly leading to treatment errors or delayed interventions with the potential of compromising patient safety. [4] The need for a collaborative system between these two health professions has moved from a pertinent operational issue to a cornerstone of patient safety and clinical effectiveness. [5], [7]

Effect of Modern Technology

Modern health organizations utilize sophisticated technologies to support this critical integration. Electronic Health Records (EHRs), Laboratory Information Systems (LIS), Computerized Provider Order Entry (CPOE), and Point-of-Care Testing (POCT) systems are no longer optional; they are now the most common ways to transmit clinically important diagnostic information. [6], [11] The significant use of all these technologies, especially EHR systems that are quickly replacing out-of-date paper charting, allows nurses to have access to patient data in a timely way, enhances the documentation process, diminishes the potential for human error through automating much of the documentation process, and inherently improves the quality of the communication among the multidisciplinary team. [8], [12]

Integrating laboratory results into electronic health records (EHRs) supports interprofessional practice when nurses and laboratory professionals are on the same technology platform to access and analyze the same report(s). [13] This allows for engaging in real time dialogue and collaboration between the nurse and lab professional when they are troubleshooting, not more so than if it is a perplexing safety challenge on a patient with a chronic condition. [14], [15], [9] Likewise, the mindful operationalization of computerized physician order entry (CPOE) and automatic alerts associated with lab results can provide nurses with critical real time safety checks, lessening the incidence of medication errors (up to 18%) and the need for unnecessary testing (up to 15%). With this type of changes, decreasing errors is based less on individual due diligence and more on dependability of integrated systemic checks for identified safety issues. While interprofessional collaboration is increasingly dependent on the inter-personal trust is created for multi-member teams, is tethered to the dependability and functionality of the technology systems they relied upon to complete their respective workflow responsibilities. [11], [16], [21]

Context of Saudi Arabia

The Kingdom of Saudi Arabia (KSA) has made notable strategic investments in digital health transformation as part of its Vision 2030 to build a world-class health system. Part of this mandate is the use of sophisticated technology solutions, including both sophisticated LIS and integrated EHR systems, that can enhance organizational efficiency, improve regulatory compliance, and ultimately improve patient care outcomes. [17], [12] Taif City is the 6th most populous KSA city and has some of the major medical centers, like the newly built King Salman Specialized Hospital, that represent an important regional node of where advanced technology is actively facilitating the patient care process. [13]

In spite of proposals and funding at the national level, initiating the implementation phase at KSA health facilities has its own socio-technical hurdles. Factors like interoperability problems with disconnected systems, high initial implementation costs, and a lack of standardized training might deter compatible integration of the digital platforms. Some regional studies conducted in Taif, for example, identified barriers around the healthcare workforce's computer literacy and acceptance of Electronic Medical Records (EMRs), especially for staff speaking Arabic [22], [3], [14] as their

primary language, and therefore, making them less likely to prefer using the system than those staff that could read and write in English. In addition to the technical impediments, additional cultural and language difficulties arise, compounded by the diverse workforce in these institutions that has a heavy reliance on expatriate nurses. These realities present further potential friction points that threaten collaboration, which technology seeks to foster. [8]

Taif city, located in the western region of Saudi Arabia, has seen large growth of healthcare resources and underground infrastructure, including the addition of complex and modern medical technology in both Taif hospitals and clinics. [11], [4] The changes in healthcare in Taif are part of the larger Kingdom plan for a modernization strategy in healthcare delivery systems more broadly. In combination, Taif hospitals and clinics are a valuable context to explore the effects of technology on interprofessional collaboration in health care. There are many practices which unfortunately have not evolved beyond the hospital, which include issues like broken communication, lack of collaborative training, and non-interoperable systems. The purpose of this study is to explore the aim and impact of cooperative performance (relationship) between nursing and laboratory teams in Taif Health Services, and how health related digital technologies affect that relationship. This is a cross-sectional study which looks to provide actionable information about existing practice as it relates to collaboration and barriers to collaboration with future recommendations in the context of digital transformation.

Review of Literature

Alraysi conducted a multi-site study in 2023 in Jeddah, Qassim, and Dammam that demonstrated the potential benefits of interprofessional collaboration between nurses and lab technicians on diagnostic accuracy and patient throughput. Their study suggested that automated laboratory machines and electronic health records (EHRs) might facilitate collaboration and communication, and they identified turnaround time for test results as an opportunity for improvement. [1] They also highlighted differences in training for lab technicians and wheelhouse. However, they also highlighted some of the variations in training and digital literacy levels especially in the case of semi-rural areas. Al Moshera in 2022 found that collaborative agreements between clinical nursing staff and laboratorians existed, and found that the intended efficiencies in diagnosis and therapeutic decision-making were improved. [2] Their study utilized various hospitals in Al Kharj and Majmaah, and found that the use of cooperative protocols and a digital shared platform led to a 25% improvement in timelines to diagnosis for patient clinical decisions. The authors suggested dashboards be used to track interprofessional collaboration data, and also real-time alerts for laboratory personnel, for the sake of improving flow. [3], [14], [9] Abuazzah in 2025 provided an extensive summary of healthcare collaboration among nursing, laboratory, and health information technicians from several facilities within the Ministry of National Guard Health Affairs. They noted that in facilities with an integrated health information systems followed processes of collaboration between nursing and laboratory practice. The integration improved clinical safety and reduced errors in documentation. [3], [7], [15]

Recent studies show that technology may provide an improvement in collaboration across roles and settings, especially with EHRs, POCT devices, and automatic lab reporting systems. [12] For example, multiple studies in hospital settings in Saudi Arabia demonstrate that when nurses and lab staff have access to a shared system, communication among the team becomes more formalized, and decisions regarding care are more efficient. [15], [17], [8] However, challenges still remain, primarily due to the lack of protocols from one system to the next, as well as inconsistent use of technology between team members and systems in hospitals. Despite the information from national studies being useful, there is little to no literature at the local-level with which to compare, especially in the case of Taif city. [13], [2] Unlike urban centers with healthy healthcare infrastructures, Taif, being semi-urban, has unique barriers to provide healthcare, in addition to its growing healthcare infrastructure, its healthcare is typically less tech-savvy, training for its workforce is on a spectrum, and infrastructure, too, is limited. Considering the barriers listed above, there is a great need to more meaningfully investigate the local context of integrated technologies in Taif healthcare. [1], [2], [3], [14]

Research Gaps

Most previous research on interprofessional collaboration studies major urban areas such as Riyadh or Jeddah. There is no empirical evidence about the healthcare systems infrastructure in Taif, workforce

organization, or uptake of technology. While many studies discuss the role of Electronic Health Records (EHR) and Point-of-Care Testing (POCT) independently, few studies explore how EHRs and POCTs enable up-to-the-minute collaboration between nurses and the laboratory team. There is limited, cross-sectional research either compares quantitatively the amount of collaboration between the nursing team and the laboratory team to other dependent variables such as diagnostic turnaround time, patient satisfaction, or error reduction.

Research Objective

The main objective of the research is to assess the effect of collaboration and integration between nursing and laboratory departments on both clinical effectiveness and patient care in technologically enhanced healthcare environments in Taif city, Saudi Arabia. Further, the research will examine the level and quality of interdisciplinary co-operation between nurses and lab professionals in technologically augmented settings.

Hypothesis

H₀: There is a significant and positive relationship in the effective use of technology related components and the perceived frequency of collaborative incidents (errors), as far as nurses and laboratory technicians are concerned.

H₁: There is a no relationship in the effective use of technology related components and the perceived frequency of collaborative incidents (errors), as far as nurses and laboratory technicians are concerned.

Research Methodology

Research Design

This investigation employs a cross-sectional descriptive design, which is suitable to investigate the present status of collaboration and integration of nursing and laboratory services in advanced technological health facilities. The design allows simultaneous data collection at one point to identify patterns, perceptions, and relationships.

Study Area and Population

Area of Study

The research is taking place in Taif city, which is located in the western region of Saudi Arabia. Taif is rapidly expanding its healthcare infrastructure that includes both public and private hospitals and clinics which are implementing new technologies, including Electronic Health Records (EHR) and Point-of-Care Testing (POCT) or automated laboratory systems.

Population

People who work in health facilities with advanced health technologies, such as registered nurses and laboratory technicians.

Inclusion and Exclusion Criteria

Inclusion criteria

One year of professional experience is required. Currently working in a health facility with EHRs or an automated laboratory system.

Exclusion criteria

Interns or trainees at selected healthcare facilities in Taif city. Staff attending to patients or operating diagnostic tools.

Sampling

Stratified random sampling is used to ensure representation from at least two different types of health systems in the public and private sectors. Health facilities would first be stratified (government hospitals, private hospitals, clinics) and then, subjects would be randomly selected to participate within each stratum to ensure a diverse range of experience and exposure to technology.

Sample Size

As this present study is focused in Taif city in Saudi Arabia only, hence the researcher has identified a justified sample of 250 respondents, including nurses and Laboratory Professionals, the respective bifurcation is as follows:

Table 1: Details of Sampling

S.No.	Respondents	Number
1	Nurses	125
2	laboratory professionals	125
	Total	250

The above given sample is being identified by using the Cochran's formula, specified for different types of cross-sectional studies, the basic assumption followed is that there is 95% of confidence level and the respective error margin is 5%.

6. Tools of Data Collection

In this present study a detailed and self-administered questionnaire is used. It is structured on the basis of characteristics stated in the above given details. This structured questionnaire is being divided into following sections:

- Demographic details of the respondents
- Aspects related to infrastructure of technology like the EHR, POCT, lab automation, etc.
- The alternate occurrence of collaboration incidents between the said departments and level of cooperations
- The level of patient care and the workflow efficiency of the selected respondents.
- Aspects related to issues and challenges.

Expert evaluations and piloting (with 20 participants) were used to validate the questionnaire. Reliability will be assessed via Cronbach's alpha (acceptable ≥ 0.7).

Procedure of Data Collection

Data collection will occur within a 4-week period. The questionnaire will be administered electronically and on paper depending on the site preference. Informed consent will be taken from all participants, and ethical approval has been granted from the region health ethics board.

Data Analysis

The researcher has used SPSS Ver. 27.0 for the purpose of data analysis and evaluation. The overall data analysis is being divided in two sections, i.e. descriptive evaluation and inferential evaluation.

The statistical test used was, Chi-square tests to assess associations between categorical variables. Considering the 'goodness of fit' type of test.

Data Analysis and Interpretation

Table 2: Summary of Chi Square test

Technological Components								
Nurses					Laboratory Technicians			
EHRs	POCT	Automated	Other		EHRs	POCT	Automated	Other

		Devices	Reporting	Device s		Device s	Reporting	Devic es
Calcul ated Value	.159	1.243	.759	.063	.445	.735	1.053	.943
Table Value	3.67	.927	.673	1.537	1.621	.664	.878	2.860
Training and Communication								
	Nurses				Laboratory Technicians			
	Joint Training	Sharing of Protoco ls	Diagnostic Delay	Collab oration issues	Joint Trai ning	Sharing of Protocol s	Diagnostic Delay	Collabo ratio n issues
Calcul ated Value	.635	.375	.440	.168	.943	.631	1.703	.943
Table Value	.705	1.262	.456	.571	1.86 0	1.145	.804	1.860
Issues and Challenges								
	Nurses				Laboratory Technicians			
	Commu nication delay	Barriers of Commu nication	Issues relatd to hierachy	Proctor ed Collab oration	Com mun icati on dela y	Barriers of Commu nication	Issues relatd to hierachy	Procto red Collab oratio n
Calcul ated Value	.939	.860	.687	.779	.897	.635	.070	.629
Table Value	.917	.781	.741	.795	1.52 8	.713	.488	1.164
Knowledge and Awareness								
	Nurses				Laboratory Technicians			
	Knowle dge of Protocol s	Collabo ration incident s	Stated Guidelines	Funci onal Collab oration	Know led ge of Prot ocol s	Collabor ation incidents	Stated Guidelines	Funci onal Collab oratio n
Calcul ated Value	.928	.146	.575	.928	.605	.575	.176	.698
Table Value	1.745	1.101	.647	1.745	1.37 8	.773	1.353	.753

Interpretation

The thumb rule of Chi Square test states that if all the table values are greater than the calculated values, then the respective hypothesis is considered to be accepted or else rejected.

The Chi square test of the type 'Goodness to Fit' is being used to find the level of variation in the responses given by the sample units. If the level of variation is high then the hypothesis is accepted or being rejected.

As stated in the data analysis table given above the study components were tested on the responses given by:

- Nurses
- Laboratory Technicians

Then these responses were tested on the ground of four variables:

- Technological components
- Training and Communication
- Issue and Challenges
- Knowledge and Awareness

In the first case of Technological components, it can be seen that there is minimum variation in the table values and calculated values, except the case of 'Automated reporting' for nurses, where the calculated value is .759 and table value is .673, then again in case of laboratory technicians for 'POCT Devices' and 'Automated reporting' the table values are .664 & .878 and the calculated values are .753 and 1.053 respectively, this shows that there is certain level of variation in the responses given by the sample respondents.

Then of training and communication, there is high level of variation in the section of Laboratory technicians; 'Diagnostic delay' where the table value is .804 and calculated value is 1.703, for rest of the case, results fall in the category of acceptance.

Then for issues and challenges, the results are not favorable for most of the cases, i.e. for communication delay the table value is .917 and calculated value is .939, then for barriers to communication the table value is .781 and calculated value is .860; this is in case of nurses only and there is no negative variation for laboratory technicians.

Finally in case of knowledge and awareness, for all the cases of nurses and laboratory technicians the table values are higher than the calculated values, this shows that the results are favorable.

Result

On the basis of above analysis and interpretation of Chi square test, it can be stated that on the grounds of modern technology there is positive growth in the healthcare facilities of Taif city in Saudi Arabia, but still there is room for betterment and improvement. Hence the null hypothesis 'There is a significant and positive relationship in the effective use of technology related components and the perceived frequency of collaborative incidents (errors), as far as nurses and laboratory technicians are concerned' can be accepted and the alternate hypothesis can be rejected.

Conclusion

This cross-sectional study being conducted in Taif City is expected to identify a strong relationship between the meaningful integration of technology (high EHR/LIS usability, good CPOE alert systems) and nurse-laboratory collaboration quality, and secondary influence on perceived unit efficiency and patient safety. However, we also expect to demonstrate that any return on social technologies investment is easily neutralized by socio-technical friction points, greater still, inadequate contextual training, persistent cultural communications issues across a diverse workforce, and lack of organizational policy clarity, especially in decentralized decision making (e.g. POCT). Ultimately, while technology facilitates, it only works when organizational and human factors are managed

effectively. Establish a consistently required Interprofessional Education (IPE) program that focuses on direct joint nurse-laboratory workflows that were introduced and implemented through new technology. The IPE has cultural appropriateness as they pertain to both linguistic and professional communication barriers that are needed for the multicultural KSA workforce. The training must also provide a formal instruction on interpersonal conflict resolution competencies for the clinical setting as a proactive mechanism to deal with interprofessional friction that arise from rigidity of the established systems and practices.

Future Scope of Study

Future research should use longitudinal designs to investigate the effects of long-term cooperation among nursing and laboratory teams on patient outcomes. Research specifically related to certain technologies (e.g., artificial intelligence-supported lab analytics, mobile point-of-care testing devices, or cloud-deployed electronic health records) can also provide greater clarity about which tools support improved interdisciplinary team functioning. Future research is also encouraged to investigate the design and implementation co-training programs for nurses and laboratory workers.

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