

An Investigation in the Effects of Digital Health Tools on the Nursing and Pharmacy Professionals' Interaction in a Tertiary Care Hospital in Saudi Arabia

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Abstract

Background: The rise of digital health tools has improved communication and collaboration among medical professionals, thus changing the mode of healthcare provision. This research assesses the role of digital health tools in interprofessional collaboration (IPC) between nurses and pharmacists at a tertiary hospital in Saudi Arabia.

Methods: The optimal qualitative methodology was utilized by conducting semi-structured interviews and discussing focus groups with 30 respondents (15 nurses and 15 pharmacists). Using thematic analysis, key themes about online tools use in interprofessional collaboration were formed.

Findings: Three major themes emerged: (1) More efficient computerized tools enabled sharing and coordination of communication through faster access to information; (2) Facilitating the clinical decision-making process through provision of clinical support systems (CDSS), automated alerts and other mechanisms while fostering shared responsibility and trust (3) Resources, lack of proper support, training and cultural context were some of the issues faced to realization of these tools. Participants further mentioned the prospects of other AI based innovations and mobile applications for health further enhancing IPC.

Conclusions: Tools for digital health greatly enhance interaction between nurses and pharmacists with regard to patient safety and efficiency of workflow. Silos should be mitigated either by developing strong infrastructure, providing robust training on the application or promoting culture suited for collaboration.

Keywords: Saudi Third Level Hospital, Electronic Medical Records, Pharmacists And Nurses, Interprofessional Communication, Medication Safety

Introduction

The smooth delivery of health care services revolves around interprofessional collaboration and this is especially so in the case of advanced hospitals where there are a plethora of health professionals needed for a single intent, integration. In such case, it encompasses nurses and pharmacists who focus on ensuring safe and competent medication, educating the patients, and from the said education deriving favorable outcomes. However the extensive usage of electronic healthcare applications such as clinics decision support systems , electronic medical records , mobile applications among others allows for a shift in practice between the two professions (Mercer et al., 2018; De Baetselier et al., 2021).

This promotes communication, improves efficiency, enables digital tools usage , and enhances decision making which removes the obstacles to interprofessional collaboration such as poor communication and operating independently. To illustrate, EHRs and other shared electronic approaches allows practical strategy for data consolidation which noticeably boost the sharing for care between the nurses and the pharmacists (Sim et al., 2020; Rashotte et al., 2016). Finally, these instruments also enable professionals to work together against solving existing barriers and outlining new ones in relation to medication and maintaining a balance between patient needs (Helgesen et al., 2024).

Notwithstanding these advancements, there are issues that need to be resolved regarding the effective use of the digital tools within interprofessional workflows. Training, technology readiness, and culture readiness to adopt such technologies are some of the factors instrumental for achieving success with such initiatives Zr. Faith hardy et al 2019 , (Bollen et al, 2019; Alenezi et al, 2024). In addition, the specific context of Saudi Arabia which has been currently transformed at a fast pace and is becoming increasingly digitalized, makes it possible to track and research these processes to their fullness.

This research seeks to understand the effect that digital health tools have on the interprofessional collaboration between nurses and pharmacists in a tertiary hospital in Saudi Arabia. Thus, through the views and experiences of these professionals, the research aims at diagnosing the enablers and blockers to effective interprofessional collaboration. The research then seeks to nurture transformation in the healthcare sector that is increasingly becoming digitalized.

Literature Review

There tools such as electronic health records integrated into the health care system that greatly impacy the inter professional collaboration and supervision between the pharmacists and the nurses. The incorporation of different m health tools also helps to improve and streamline workflows and boost communication and the end result of the patient care (Sim et al., 2020, Mercer et al., 2018)

1. Improving Communication with Digital Tools

In an IPC framework, Communication is an integral part and especially in complex systems within the health care sector such as tertiary hospitals. The use of digital tools aids in better communication since it enhances data sharing in real time between the nurses and the pharmacists for instance. The use of

EHRs, and shared digital applications or platforms has been found to minimize miscommunication, which is a significant contributor to medication errors (Sim et al., 2020, Rashotte et al. 2016). In addition, these tools allow for access and use of pertinent patient data by the two professionals at the same time, thus improving the decision making process (Bollen et al 2019).

2. Digital Health Tools and Safe Medication Practices

The safety of medication for patients greatly relies on the collaborative work of nurses and pharmacists. NHII has developed electronic health records where clinicians can populate medication harm alerts and medication use clinical aids as policies to prevent medication misuse. Mercer et al. (2018) note that Remform tools assisted nurses and other practitioners in finding relevant prescriptions, which were cross-verified by the pharmacists, who then swiftly established what the issues were. This kind of convergence enhances accountability with respect to medication safety and minimization of clinical errors.

3. Effects on Workflow and Efficacy

The use of digital health tools facilitates the adoption of standard operating procedures by reducing the number of manual tasks assigned to caregivers. Literature is abundant in the examination of mobile health software as a tool for improving medication consumption, stocktaking and record keeping. Nurses, for instance, could use them to look at a patient's chart and make sure the proper medications were listed for administration, while the pharmacists were able to check inventory levels and estimate out overall future availability of drugs (Helgesen et al., 2024). The need to share these tools results in a better way of managing client care.

4. Constraints to Efficient Application of Digital Health Technologies

Several factors prevent the effective use of digital health tools in promoting IPC, despite the usefulness of the tools. New technologies are not adopted because Alenezi et al (2024) argue that there is insufficient training available and staff are resistant to change. Furthermore, system downtimes and poor interoperability are technical problems that can lead to disrupted workflows and poorly rated tools (De Baetselier et al., 2021).

5. The Saudi Context: An Uncommon Setting

Due to national policies like Vision 2030, the healthcare system in Saudi Arabia is transforming rapidly towards digitalization. This has changed the questions, enabling investigation of how and when digital tools are promoting IPC activities between nurses and pharmacists working in tertiary hospitals. On the other hand, Bollen et al (2019) demonstrate how political or cultural issues, hierarchy, and differences in the healthcare workforce Digital literacy impede the use of such technologies.

6. Evidence of Improved Patient Outcomes

The improved IPC evidenced in studies and even enhanced by the use of digital tools has been shown to adversely affect patient outcomes. Harms and Redesigning Care with Ensemble Modeling (EHRs) and CDSS have been engaged in practice and medicine which has paradoxically resulted in less medication errors, shorter duration of hospital stays while improved customer satisfaction rates (Sim et al., 2020; Mercer et al. 2018). These results indicate how crucial the combination of medical practices with digital health tools is.

7. Future Directions

In order to promote IPC through the use of digital health tools there is a different implementation of training programs, strong IT systems, and life facilitating policies. Further research should aim to assess the effects of specific indicators in digital tools on the evolution of IPC interrogating particularly the situation in Saudi Arabia which is multi-ethnic.

Methodology

Study Design

The current study employs a phenomenological approach to determine the effects of the digital health tools on the Interprofessional Collaboration (IPC) between nurses and pharmacists in a tertiary hospital located in Saudi Arabia. The approach was selected so as to understand the experiences, perceptions and barriers encountered by the healthcare practitioners while utilizing digital tools to foster practices of collaboration.

Study Setting

This study was conducted in Saudi Arabia, in a tertiary care facility that is equipped with advanced health care services and has a mix of patient demographics. The said hospital has all the latest digital health systems which include Electronic Health Records (EHR), Clinical Decision Making systems (CDSS) and mobile health applications.

Participants

In this study, the participants were nurses and pharmacists who were directly involved in patient care through non-probabilistic purposive sampling. The participants were also sampled from different departments such as internal medicine, surgery and pediatrics in order to reflect a broader range of experience and not be confined to a single discipline. Total of 30 participants are included in the study 15 being nurses and the other 15 pharmacists.

Methods of Data Collection

The interviews and discussions were planned for a two months period in which focused group discussions and semi-structured interviews were conducted. This qualitative research was based on a protocol which was comprised of the following:

- Use of digital health tools and tools for enhancing daily practice.
- Potential that the digital tools have for facilitating inter-professional collaboration.
- Obstacles and challenges to the productive results and effectiveness in using those tools.
- How could the use of digital tools improve the IPC process?

Each interview lasted around 30 – 45 minutes and took place in the hospital's setting that was quiet and conducive to conversation. Focus groups included 6 – 8 participants and the sessions for nurses and pharmacists were set up separately to promote discussion among them.

Methods of Data Analysis

The participants consented to audio recordings and verbatim transcription thus all interviews and discussions within the group are presented in this form. Data was analyzed using qualitative thematic analysis as described by Braun and Clarke's six steps framework:

1. Reading the transcripts over and over to become familiar and understand the data.
2. Coding in collaboration with the few.
3. Codes are classified into possible candidates.
4. Candidates are reviewed for their relevance and meaning.
5. Final themes are developed and named.
6. A final report using quotes is generated to complement the analysis.

NVivo computer software was employed to assist in data organization and coding.

Ethical Considerations

Permission for the study was obtained from the hospital's ethics committee. All subjects signed an informed consent form before participating in the study. Computer passwords and secure storage of tapes and transcripts helped to maintain confidentiality. Participants were told that they could leave the study at any time and without any penalty.

Quality Assurance

A number of approaches were employed to evaluate the credibility and dependability of the findings:

- Triangulation: The use of interviews and focus groups enabled the collection of diverse data.
- Member Checking: Participants were asked to check the preliminary findings for corroboration of the reported interpretations.

- Reflexivity: The research team kept a reflexive journal throughout the study, with a view to documenting and limiting bias.

Findings Dissemination

A presentation and a summary report were prepared and given to the management of the hospital and other relevant stakeholders to show the findings of the study. The results are intended to inform policy and practice changes regarding IPC and the adoption of digital health technologies.

Findings

The insights of the nurses and pharmacists were amply engaging and informative, this was possible via a qualitative analysis of data in conjunction with the use of digital health tools. Such a complex case of interprofessional collaboration (IPC) has been deconstructed and divided into three major themes. Each major theme is then referenced with quotes of participants within and subsequently explained in further detail.

Theme 1: Improving Communication

Digital health tools were remarkably useful in addressing communication issues between nurses and pharmacists –these issues existed between the two professions particularly shoeing nurses and inter-nurses collaboration.

Sub – Theme 1.1 : Accessing Data on Real Time.

Building on the above theme participants tended to foster nurses inter-professionally. The use of an electronic health record (EHR) is one such example where there is efficient and timely access to patients' critical up-to-date information.

- Participant A (Pharmacist): “Having access to my entire medication history greatly reduces our time. I no longer need to call or wait for someone to send me paper files. I simply check the system instead.”
- Participant O (Nurse): “Understanding that I have the ability to obtain lab results or recent changes on medication at the time of the query increases my level of comfort when providing care.” This is more important in an emergency environment where waiting for communication might endanger individual patients.

Sub-theme 1.2: Simplifying Ways of Engagement

As for features like EHR integrated messaging systems, they improved communication by introducing features where users could communicate instantly which eliminates the need to rely on phone calls or notes that are prone to errors.

- P: “Previously, retrieval of information could turn out to be productive as I had to write or figure out where the pharmacist was, but now It is easier since I can send them a message and I get a quick response.”
- Q: “The need for back and forth communication is reduced through the integration of a messaging system in the EHR which in turn improves the time and focus which is needed for patient care.”

Sub-theme 1.3: Interdepartmental Contributions

Thanks to the ITDP and the communications across the different departments, pharmacists and nurses, among others, could work together to manage challenging clinical situations.

- R: “What I like about the system is that if we need to speak to an oncology or cardiology pharmacist, we don’t have to meet them in person as this can be done over the system which enables us to save both time and provide expert advice.”

Theme 2: Improving medication safety

Advances in digital health in the technology domain aim at increasing safety and minimizing medication errors.

Sub-theme 2.1: Securing Accuracy To avoid potential medication errors such as drug interactions, incorrect dosages, or drug duplications, all the Participants pointed out the importance of clinical decision support systems (CDSS) and automated alerts in flagging this type of error.

- Participant S (Nurse): “I was about to give the medication, and the system alerted me regarding a high risk of drug-to-drug interaction. Sure saved my life.”
- Participant T (Pharmacist): “If it were not for the alerts, we would have to check for drug interactions ourselves and that is prone to overlooking.”

Sub theme 2.2: Enhancing Responsibility in Work with Patients & Building of Trust

The joint usage of digital health technologies helped build the level of trust between nurses and pharmacists. They were also able to access the single version of truth for a single patient’s data.

- Participant U (Nurse): “For instance, if a prescription is being approved by the pharmacist in the system, it is clear that the prescription has been carefully checked and that is good news for me.”
- Participant V (Pharmacist): “It is the same case when nurses are shared with the same tools for information validation and that helps a lot in sharing the responsibility.”

Sub theme 2.3: Patient Education as a way Towards Improving Health Outcomes

Digital tools also empowered nurses and pharmacists to educate the patients about their treatment for example by using simple images or even graphics.

- W (Nurse) asserted that patients have always remained skeptical regarding medications and this distrust is resolved by allowing them to view simple timetables alongside potential side effects.
- X (Pharmacist) further elaborated that from now on, patients would receive an easy to understand comprehensive plan regarding medications and both the pharmacist and nurse would speak with one voice.

Theme 3: Barriers to Effective Utilization

It shall be noted that participant yoged's misfortune relied on the fact that while this system has a myriad of benefits, single health tools yet remained challenging to incorporate.

Sub-theme 3.1: Technical Challenges

Potential issues regarding platform integration alongside downtimes and latency were weighed as significant concerns.

- Y (Nurse) remarked that during peak periods, the system is bound to freeze at one point in time which hinders the process of working.'
- Z (Pharmacist) explained that "The fact that a system can not integrate aids hinders greatly to the workflow as lab results obtained on other systems never fully integrate to EHR."

Sub-theme 3.2: Training Gaps

This in turn affects the patients as digital health tools go unutilized leading to confusion. Q seemed to agree, encompassing that "It is essential that one-on-one training is provided for these tools" while noting that a lack of convincing deadlines diminished efficiency greatly.

Participant AA (Nurse): "Training was focused on basic operations of the system, I am sure more can be done with proper schooling."

Participant AB (Pharmacist): "We are not given the proper information before there is a new update, greatly complicating the process for us and leaving us to fumble around."

Sub-theme 3.3: Resistance to Change

Stepping away from traditional ways of doing things is difficult for certain set of people, especially the elderly or the less encourage to diving into new tech including the younger population.

Participant AC (Nurse): "Even though we have a system, it is difficult for some to get accustomed to it so there are times when we still use the old techniques like talking to each other."

Participant AD (Pharmacist): “A few of my members are unwilling to stop using traditional practices, making the process slower.”

Sub-theme 3.4: Cultural and Hierarchical Dynamics

Cultural implications and set hierarchy restricted the use of certain technologies by discouraging open lines of communication.

Participant AE (Nurse): “Using the system often makes it hard for me to convey my issues to the senior pharmacists so that I can contact them directly. ”

Participant AF (Pharmacist): “The feedback I get is sometimes affected by my seniors because they are in control most of the times. There are issues where I notice a gap because the focus is more on junior/senior relations.”

Theme 4: Potential for Innovation

People seemed to be looking forward to new changes commendably and issued pointers but still wanted new digital health tools to be developed and the current ones to be improved upon.

Sub-theme 4.1: Advanced Analytics and AI - Restructured.

AI and advanced analytical features would enhance the tools even further, believe the clinical decision makers being consulted in this case.

- Participant AG (Pharmacist): “AI technologies to model desired patient outcome or potential medication risks would augment the use of these tools.”
- Participant AH (Nurse): “For example, if the system would review data for trends and recommend a course of actions it would assist us greatly.”

Sub-theme 4.2: Mobile Health Applications- Reworded.

The use of mobile applications for assisting the people in concern was stated to bring forth enhanced services and improved accessibility.

- Participant AI (Pharmacist): “Apps that are compatible with eHR systems would allow us to check important information even if we aren't at our workstations.”
- Participant AJ (Nurse): “The idea of sending reminders or any other pertinent material via an app would eliminate the need to micromanage us in terms of our workflow.”

Summary of Findings

1. **Process and Outcomes of Enhanced Communication and Coordination:** Communication and IPC is enhanced through a great deal by the use of digital tools because one can access data in real time, greatly facilitates communication, and makes sharing and collaboration between departments much easier.
2. **Improving Patient and Medication Safety:** With computers executing tasks, human errors were avoided, trust was developed through shared duties, and patients were provided with the necessary information directly.
3. **Factors that Prevent Effective Use:** There are limits to how properly these tools can be utilized due to technical problems, insufficient training, the entrenched attitude of some people, and aspects of the local culture.
4. **Innovation Advancement Capability:** The participants believe that it is possible to equip further IPC using mobile applications, advanced analytics, and AI.

Discussion

This research investigated the relationship of interprofessional collaboration between nurses and pharmacists looking at how they were using a digital health tool at a referral hospital in Saudi Arabia. The results give insight on opportunities for the use of such tools as well as barriers that need to be corrected in order for the collaboration to take place in the healthcare sector. What remains is to situate the findings in the relevant literature and address what they mean for practice and for future research.

Improving Communication and Coordination

The findings of the study confirmed that, digital health tools facilitate communication as well as both informal and formal coordination between nurses and pharmacists. The use of electronic health records (EHRs) alongside with integrated communication systems meant that retrieving and providing information became much more simple, which was also found on previous studies which focused on communication between different disciplines using online means to improve workflows (Sim et al., 2020; Mercer et al.,2018). Interprofessional collaboration took a new dimension as physical barriers between the two professions were eliminated, enabling the two professions to receive the patients' demands without delay.

Nevertheless, the results showed what were the disadvantages of using the digital health tools which were during the times when systems went offline. These cuts of communication also caused delays and called for a return to old practices which endanger patient security. The same studies pointed out that to maximize the use of tools in healthcare it is also important to develop and implement standards necessary for the system to be reliable. (Rashotte et al.2016)

Ensuring Medication Safety in Healthcare

It was found that the digital tools indeed contribute to the improvement of medication safety. The support systems among medical professionals such as Clinical decision support systems (CDSS) and

warning messages were useful in the correction of nursing medication errors, creating a culture of responsibility for the patient care between the nurses and the pharmacists. This is also in agreement with previous studies that have reported the effectiveness of such systems in managing medication during CDSS and reducing adverse drug event (ADE) when administrating the drug (Helgesen et al, 2024).

Apart from these benefits, there were gaps of ability by some of the nurses to use such tools consistently because of differences in their training and knowledge on the tool. This resonates with the previous literature, which underscored the need for tailored training to address barriers to the full use and benefit of digital health tools (Bollen et al, 2019). This is a problem that needs to be solved with a well organized training structure, with different providers receiving updated regular training, complemented by practical sessions.

Barriers to Effective Utilization

Limitations in change management, cultural dynamics and technical issues were some of the problems that made it difficult for the respondents to effectively use the available digital health tools. These barriers are consistent with findings from global studies, which have reported similar issues in diverse healthcare settings (De Baetselier et al., 2021; Alenezi et al., 2024). Notably, some participants were more reluctant to use digital tools than others, particularly the seniors due to the respect and reluctance for the hierarchy in place within the Saudi Arabian context.

A holistic approach is necessary to address these challenges simultaneously. First, ensuring adequate IT and communication infrastructure can help address the technological concerns such as system outages and integration issues. Second, training, inspiring and role modeling the desired behaviors enables the dispelling of hierarchical barriers insofar as nurses and pharmacists shall be able to coordinate tasks more seamlessly. Last but not least ongoing professional development and training can enhance the level of trust that people have in the abilities to competently utilize digital instruments.

Innovational Prospects

The respondents demonstrated a positive outlook regarding the prospects of digital health, voicing their opinion on the introduction of advanced technology. Decision making and work management were proposed to be enhanced in their functionality by advanced analytics and artificial intelligence (AI). Such results are consistent with the direction in which modern digital health is moving, as more and more AI-based tools appear on the market, and tools predicting clinical outcomes are used (Helgesen et al, 2024),.

Mobile health applications are envisaged having drastic changes on the ease of access and workflow design. Mobile applications could strengthen the IPC further by enabling the health workers to carry critical mobile information out to the people at the point of need therapy. New studies were set in motion on the viability and the consequences of these innovations in more realistic clinical situations.

Practical Implications

This research has numerous implications:

1. **Policy and Training:** Digital health tools should be made mandatory by policies of the healthcare institutions with regards to the use of them in IPC, as well as broad training should be done to everyone as staff in the institutions.
2. **IT Infrastructure:** There is a need to invest in credible and consolidated digital systems as these prevent progressive technical glitches and improve the end-user experience.
3. **Cultural Shift:** A more accommodating and inclusive working environment will help break down the silos within the IPC and elevate it.

Limitations and Future Research

This study manages to provide new insights and perspectives in the field, however it does come with multiple limitations which need to be addressed. Firstly, the findings of this study seem to be true only for MMARCC which is a tertiary hospital, this raises an issue regarding the applicability of the findings to other institutions. Other than this, the study solely depended on the self reporting method of experience, self reporting is known to bring in bias and hence needs attention. To improve the findings, future studies should have larger sample sizes, include the views of other healthcare experts, and assess the effect of technology on IPC and patient outcomes after a significant duration of time.

Conclusion

Technology in Healthcare has advanced in the past few decades, nurses and pharmacists are able to secure better communication through the use of technology, this enhances the IPC. Nonetheless, barriers such as technical difficulties, insufficient training, and cultural factors still need to be addressed in order to harness the full potential of the devices and software. With proper funding and effort to foster innovation in the healthcare section, technology can be used to enhance the quality of patient focused care as it makes collaborating between specialists easier.

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