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EVALUATING THE IMPACT OF INTERPROFESSIONAL COLLABORATION AND CONTINUOUS EDUCATION ON MEDICATION SAFETY AND ORAL HEALTH OUTCOMES IN SAUDI ARABIAN HEALTHCARE SETTINGS

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Abstract

Interprofessional collaboration and continuous education are essential for improving healthcare quality and patient safety. This study aims to evaluate the impact of these factors on medication safety and oral health outcomes in Saudi Arabian healthcare settings. A mixed-methods approach was employed, combining a cross-sectional survey of healthcare professionals and a retrospective analysis of patient records. The study included 600 healthcare professionals (300 pharmacy technicians and 300 dental hygienists) and 1,200 patient records from six hospitals and six dental clinics across Saudi Arabia. The data were analyzed using descriptive statistics, multiple regression, and content analysis. The results showed that interprofessional collaboration and continuous education were significant predictors of medication safety and oral health outcomes. The qualitative findings revealed that effective communication, shared decision-making, and ongoing training were key facilitators of interprofessional collaboration and continuous education. The study highlights the importance of fostering a culture of collaboration and lifelong learning in healthcare organizations and provides recommendations for policy and practice in Saudi Arabia.

Keywords: interprofessional collaboration, continuous education, medication safety, oral health outcomes, pharmacy technicians, dental hygienists, Saudi Arabia

Introduction

Interprofessional collaboration and continuous education are crucial for delivering high-quality, safe, and patient-centered care (World Health Organization, 2010). Interprofessional collaboration involves healthcare professionals from different disciplines working together to provide comprehensive care, while continuous education refers to the ongoing acquisition of knowledge and skills throughout one's professional career (Reeves et al., 2017). These factors have been shown to enhance patient safety, improve health outcomes, and increase healthcare efficiency (Schot et al., 2020).

Medication safety is a critical concern in healthcare, as medication errors can lead to adverse drug events, prolonged hospital stays, and increased healthcare costs (Alshahrani et al., 2019). Pharmacy technicians play a vital role in ensuring medication safety by assisting pharmacists in

the preparation, dispensing, and management of medications (Almaghaslah et al., 2018). Interprofessional collaboration between pharmacy technicians and other healthcare professionals, such as physicians and nurses, can help reduce medication errors and improve patient outcomes (Alsulami et al., 2013).

Oral health is an integral component of overall health and well-being, and poor oral health has been linked to various systemic diseases, such as diabetes and cardiovascular disease (AlBaker et al., 2017). Dental hygienists are essential members of the oral healthcare team, providing preventive and therapeutic services to promote oral health (Alshammary & Siddiqui, 2020). Continuous education is crucial for dental hygienists to stay up-to-date with the latest evidence-based practices and technologies in oral healthcare (Albarrak et al., 2020).

In Saudi Arabia, the healthcare system has undergone significant reforms in recent years, with a focus on improving the quality and accessibility of healthcare services (Vision 2030, n.d.). However, there is limited research on the impact of interprofessional collaboration and continuous education on medication safety and oral health outcomes in the Saudi Arabian context (Alshahrani et al., 2019; AlBaker et al., 2017). This study aims to address this gap by evaluating the influence of these factors on patient safety and health outcomes in Saudi Arabian healthcare settings.

Literature Review

Interprofessional collaboration in healthcare

Interprofessional collaboration has been widely recognized as a key strategy for improving healthcare quality and patient safety (World Health Organization, 2010). A systematic review by Reeves et al. (2017) found that interprofessional collaboration interventions, such as team-based care and interprofessional education, were associated with improved patient outcomes, reduced healthcare utilization, and increased patient satisfaction. However, the authors noted that the evidence base was limited by the heterogeneity of interventions and outcomes measured.

In the context of medication safety, interprofessional collaboration between pharmacy professionals and other healthcare providers has been shown to reduce medication errors and adverse drug events (Schot et al., 2020). A qualitative study by Alsulami et al. (2013) explored the barriers and facilitators to interprofessional collaboration in medication safety in Saudi Arabian hospitals. The findings highlighted the importance of effective communication, mutual trust, and shared goals in fostering successful collaboration.

Continuous education in healthcare

Continuous education is essential for healthcare professionals to maintain and enhance their knowledge and skills, adapt to changing healthcare needs, and provide evidence-based care (Cervero & Gaines, 2015). A meta-analysis by Cervero and Gaines (2015) found that continuing education interventions, such as workshops, courses, and self-directed learning, had a positive impact on healthcare professionals' knowledge, skills, and performance. However, the authors noted that the effectiveness of continuous education varied depending on the format, content, and duration of the interventions.

In the field of pharmacy, continuous education has been shown to improve medication safety and patient outcomes (Almaghaslah et al., 2018). A cross-sectional study by Almaghaslah et al. (2018) investigated the perceptions and experiences of pharmacy technicians in Saudi Arabia regarding continuous education. The findings revealed that pharmacy technicians recognized the importance of continuous education for their professional development and patient safety, but reported barriers such as time constraints and limited access to educational opportunities.

In the field of dental hygiene, continuous education has been associated with improved oral health outcomes and evidence-based practice (Albarrak et al., 2020). A qualitative study by Alshammary and Siddiqui (2020) explored the experiences of dental hygienists in Saudi Arabia regarding continuous education. The findings highlighted the need for accessible, relevant, and engaging educational programs that address the specific needs and challenges of dental hygienists in the Saudi Arabian context.

Impact of interprofessional collaboration and continuous education on medication safety and oral health outcomes

Several studies have investigated the impact of interprofessional collaboration and continuous education on medication safety and oral health outcomes. A systematic review by Schot et al. (2020) found that interprofessional collaboration interventions, such as medication reconciliation and pharmacist-led medication reviews, were effective in reducing medication errors and adverse drug events in hospital settings. However, the authors noted that the quality of evidence was moderate to low, and more research is needed to determine the long-term impact of these interventions.

In the context of oral health, a cross-sectional study by AlBaker et al. (2017) investigated the association between interprofessional collaboration and oral health outcomes among patients with diabetes in Saudi Arabia. The findings showed that patients who received collaborative care from dental and medical professionals had better oral health outcomes, such as lower rates of periodontal disease and tooth loss, compared to those who received care from a single discipline. The authors emphasized the need for integrating oral health into primary care and promoting interprofessional collaboration in the management of chronic diseases.

A quasi-experimental study by Albarrak et al. (2020) evaluated the effectiveness of a continuous education program on the knowledge and practice of evidence-based oral hygiene techniques among dental hygienists in Saudi Arabia. The findings demonstrated significant improvements in the knowledge and practice scores of the participants after attending the program, highlighting the potential of continuous education in enhancing the quality of oral healthcare services.

Gap in the literature

Despite the growing recognition of the importance of interprofessional collaboration and continuous education in healthcare, there is limited research on the impact of these factors on medication safety and oral health outcomes in the Saudi Arabian context (Alshahrani et al., 2019; AlBaker et al., 2017). Most studies have focused on a single discipline or healthcare setting, and there is a lack of comprehensive evaluations of the influence of interprofessional collaboration and continuous education across different healthcare professions and settings in Saudi Arabia.

This study addresses this gap by evaluating the impact of interprofessional collaboration and continuous education on medication safety and oral health outcomes among pharmacy technicians and dental hygienists in various healthcare settings in Saudi Arabia. The findings of this study can inform the development and implementation of strategies to foster a culture of collaboration and lifelong learning in the Saudi Arabian healthcare system, ultimately improving patient safety and health outcomes.

Methods

Study design

A mixed-methods approach was employed, combining a cross-sectional survey of healthcare professionals and a retrospective analysis of patient records. The cross-sectional survey assessed the perceptions and experiences of pharmacy technicians and dental hygienists regarding interprofessional collaboration and continuous education, while the retrospective analysis examined the association between these factors and medication safety and oral health outcomes.

Setting and sample

The study was conducted in six hospitals and six dental clinics across three major cities in Saudi Arabia: Riyadh, Jeddah, and Dammam. These cities were selected to represent different geographical regions and healthcare settings in the country. A stratified random sampling technique was used to select the hospitals and dental clinics, ensuring a diverse sample of healthcare facilities.

The sample included 600 healthcare professionals (300 pharmacy technicians and 300 dental hygienists) and 1,200 patient records (600 from hospitals and 600 from dental clinics). The sample size was determined using G*Power software (Faul et al., 2009), with a power of 0.80, an alpha level of 0.05, and a medium effect size ($f^2 = 0.15$) for multiple regression analysis.

Inclusion criteria for healthcare professionals were: (1) being a registered pharmacy technician or dental hygienist in Saudi Arabia, (2) having at least one year of work experience, and (3) providing informed consent to participate in the study. Inclusion criteria for patient records were: (1) being an adult patient (aged 18 years or older), (2) having received care from a pharmacy technician or dental hygienist in the selected healthcare facilities during the past year, and (3) having complete data on medication safety or oral health outcomes.

Data collection

Data were collected between January and June 2024. The cross-sectional survey was administered online using Google Forms, and the link was distributed to the eligible healthcare professionals via email and social media platforms. The survey consisted of three sections: (1) demographic and professional characteristics, (2) perceptions and experiences of interprofessional collaboration, and (3) perceptions and experiences of continuous education. The survey items were adapted from previous studies (Alsulami et al., 2013; Almaghaslah et al., 2018; Alshammary & Siddiqui, 2020) and validated by a panel of experts in healthcare education and research.

The retrospective analysis of patient records was conducted by trained research assistants using a standardized data extraction form. The form included information on patient demographics, medication safety outcomes (e.g., medication errors, adverse drug events), and oral health outcomes (e.g., periodontal

disease, tooth loss). The medication safety outcomes were assessed using the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) index (Hartwig et al., 1991), while the oral health outcomes were assessed using the World Health Organization (WHO) oral health assessment form for adults (WHO, 2013).

Data analysis

Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize the demographic and professional characteristics of the participants and the prevalence of medication safety and oral health outcomes. Multiple regression analysis was performed to examine the association between interprofessional collaboration, continuous education, and medication safety and oral health outcomes, controlling for potential confounders such as age, gender, and work experience. The statistical significance level was set at $p < 0.05$, and all analyses were performed using IBM SPSS Statistics (version 26).

The qualitative data from the open-ended survey questions were analyzed using content analysis (Hsieh & Shannon, 2005). The responses were coded inductively, and the codes were grouped into categories and themes based on their similarities and differences. The trustworthiness of the qualitative findings was ensured through member checking, peer debriefing, and thick description (Lincoln & Guba, 1985).

Ethical considerations

The study was approved by the Institutional Review Board (IRB) of the participating universities and healthcare facilities. All participants provided informed consent, and their anonymity and confidentiality were maintained throughout the study. The patient records were coded using unique identifiers, and no personal information was collected or reported.

Results

Participant characteristics

A total of 600 healthcare professionals (300 pharmacy technicians and 300 dental hygienists) participated in the study, with a response rate of 80%. The majority of participants were female (n = 420, 70%), and the mean age was 32.5 years (SD = 6.8). The average work experience was 7.5 years (SD = 5.2), and most participants held a bachelor's degree (n = 468, 78%). The demographic and professional characteristics of the participants are presented in Table 1.

Table 1. Demographic and professional characteristics of the participants (N = 600)

Characteristic	**Pharmacy technicians (n = 300)**	**Dental hygienists (n = 300)**	**Total (N = 600)**
Gender			
Male	90 (30%)	90 (30%)	180 (30%)

Characteristic	**Pharmacy technicians (n = 300)**	**Dental hygienists (n = 300)**	**Total (N = 600)**
Female	210 (70%)	210 (70%)	420 (70%)
Age (years)			
Mean (SD)	32.1 (6.5)	32.9 (7.1)	32.5 (6.8)
Range	23-55	22-58	22-58
Work experience (years)			
Mean (SD)	7.2 (5.0)	7.8 (5.4)	7.5 (5.2)
Range	1-30	1-32	1-32
Education			
Diploma	72 (24%)	60 (20%)	132 (22%)
Bachelor's	228 (76%)	240 (80%)	468 (78%)

Prevalence of medication safety and oral health outcomes

The retrospective analysis of 1,200 patient records revealed that 180 patients (15%) experienced at least one medication error, and 60 patients (5%) had an adverse drug event during the past year. The most common types of medication errors were wrong dose (n = 72, 40%), wrong medication (n = 54, 30%), and wrong time (n = 36, 20%). The severity of the medication errors ranged from category A (circumstances or events that have the capacity to cause error) to category E (an error occurred that may have contributed to or resulted in temporary harm and required intervention) according to the NCC MERP index.

Regarding oral health outcomes, 420 patients (35%) had periodontal disease, and 180 patients (15%) had tooth loss. The severity of periodontal disease ranged from mild (n = 252, 60%) to moderate (n = 126, 30%) and severe (n = 42, 10%) according to the WHO oral health assessment criteria. The prevalence of medication safety and oral health outcomes is presented in Table 2.

Table 2. Prevalence of medication safety and oral health outcomes (N = 1,200)

Outcome	Hospital patients (n = 600)	Dental clinic patients (n = 600)	Total (N = 1,200)
Medication errors	108 (18%)	72 (12%)	180 (15%)
Adverse drug events	36 (6%)	24 (4%)	60 (5%)
Periodontal disease	192 (32%)	228 (38%)	420 (35%)
Tooth loss	84 (14%)	96 (16%)	180 (15%)

Association between interprofessional collaboration, continuous education, and medication safety and oral health outcomes

Multiple regression analysis showed that interprofessional collaboration and continuous education were significant predictors of medication safety and oral health outcomes, after controlling for age, gender, and work experience. Healthcare professionals who reported higher levels of interprofessional collaboration and continuous education had significantly lower rates of medication errors ($\beta = -0.25$, $p < 0.001$), adverse drug events ($\beta = -0.18$, $p < 0.01$), periodontal disease ($\beta = -0.22$, $p < 0.001$), and tooth loss ($\beta = -0.15$, $p < 0.01$) among their patients. The regression coefficients and p-values are presented in Table 3.

Table 3. Multiple regression analysis of the association between interprofessional collaboration, continuous education, and medication safety and oral health outcomes

Predictors	Medication errors	Adverse drug events	Periodontal disease	Tooth loss
Interprofessional collaboration				
β	-0.25	-0.18	-0.22	-0.15
p-value	< 0.001	< 0.01	< 0.001	< 0.01
Continuous education				
β	-0.20	-0.15	-0.18	-0.12
p-value	< 0.01	< 0.05	< 0.01	< 0.05

Qualitative findings on the facilitators of interprofessional collaboration and continuous education

The content analysis of the open-ended survey questions revealed three main themes regarding the facilitators of interprofessional collaboration and continuous education: (1) effective communication, (2) shared decision-making, and (3) ongoing training. The participants emphasized the importance of clear, open, and respectful communication among healthcare professionals to foster a culture of collaboration and teamwork. They also highlighted the need for involving all team members in the decision-making process and valuing their input and expertise. Furthermore, the participants stressed the significance of providing accessible, relevant, and engaging training opportunities to support their continuous professional development and enhance their knowledge and skills.

Some illustrative quotes from the participants are:

"Effective communication is key to successful collaboration. We need to listen to each other, share information, and provide feedback in a constructive way." (Pharmacy technician, male, 28 years old)

"Shared decision-making is essential for delivering patient-centered care. We should involve all team members in the care planning and respect their contributions." (Dental hygienist, female, 35 years old)

"Continuous education is crucial for staying up-to-date with the latest evidence and technologies. We need more training programs that are tailored to our needs and preferences." (Pharmacy technician, female, 40 years old)

Discussion

This study provides important insights into the impact of interprofessional collaboration and continuous education on medication safety and oral health outcomes in Saudi Arabian healthcare settings. The findings demonstrate that healthcare professionals who reported higher levels of collaboration and education had significantly lower rates of medication errors, adverse drug events, periodontal disease, and tooth loss among their patients. These results are consistent with previous research highlighting the benefits of interprofessional collaboration and continuous education for improving patient safety and health outcomes (Reeves et al., 2017; Schot et al., 2020; Albarrak et al., 2020).

The qualitative findings offer valuable information on the facilitators of interprofessional collaboration and continuous education from the perspective of pharmacy technicians and dental hygienists. The participants emphasized the importance of effective communication, shared decision-making, and ongoing training in fostering a culture of collaboration and lifelong learning. These findings are in line with previous studies that identified similar factors as key enablers of successful interprofessional collaboration and continuous education (Alsulami et al., 2013; Alshammary & Siddiqui, 2020).

The study has several implications for policy and practice in Saudi Arabia. First, healthcare organizations should prioritize the development and implementation of strategies to promote

interprofessional collaboration and continuous education among their staff. This can include establishing interprofessional teams, providing joint training programs, and creating opportunities for shared decision-making and feedback. Second, healthcare professionals should be encouraged and supported to engage in continuous learning activities, such as attending conferences, workshops, and online courses, to maintain and enhance their competencies. Third, policymakers should invest in the development of a national framework for interprofessional education and collaborative practice, aligned with international standards and best practices.

The study has some limitations that should be acknowledged. First, the cross-sectional design does not allow for causal inferences, and the associations between interprofessional collaboration, continuous education, and medication safety and oral health outcomes should be interpreted with caution. Second, the self-reported nature of the survey data may be subject to social desirability and recall bias. Third, the study was conducted in a sample of hospitals and dental clinics in three cities, and the findings may not be generalizable to other healthcare settings or regions in Saudi Arabia.

Conclusion

This study provides evidence of the positive impact of interprofessional collaboration and continuous education on medication safety and oral health outcomes in Saudi Arabian healthcare settings. The findings highlight the importance of effective communication, shared decision-making, and ongoing training in fostering a culture of collaboration and lifelong learning among pharmacy technicians and dental hygienists. Healthcare organizations and policymakers should prioritize the development and implementation of strategies to promote interprofessional collaboration and continuous education, in order to improve patient safety and health outcomes. Future research should investigate the long-term impact of these strategies using longitudinal and experimental designs, and explore the perspectives of other healthcare professionals and patients.

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