

Evaluating the Impact of Continuous Professional Development on Employee Performance KPIs in Emergency-Ready Primary Health Centers in Riyadh, Saudi Arabia

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Abstract

Continuous professional development (CPD) is an essential strategy for enhancing healthcare professionals' competencies and improving the quality of healthcare services. This study examined the impact of CPD programs on employee performance key performance indicators (KPIs) in emergency-ready primary health centers in Riyadh, Saudi Arabia. The study focused on three major CPD domains: medication safety and management, infection control and prevention, and disaster and mass casualty incident preparedness. A quantitative cross-sectional research design was employed to collect data from healthcare professionals working in selected primary health centers. Data were analyzed using descriptive statistics, correlation analysis, ANOVA, and independent sample t-tests to examine the relationships between CPD participation and employee performance indicators across demographic characteristics. The results indicated high levels of perceived impact of CPD programs across all examined domains. Medication safety and management training demonstrated strong improvements in participants' clinical competencies, while infection control and prevention training significantly enhanced healthcare professionals' awareness and adherence to safety protocols. Disaster and mass casualty incident training also showed a significant contribution to improving emergency preparedness among healthcare workers. Statistical analysis further revealed significant differences in perceptions of CPD effectiveness across gender and selected demographic variables. Overall, the findings highlight the critical role of continuous professional development in strengthening healthcare professionals' skills, improving patient safety practices, and enhancing emergency preparedness within primary healthcare settings. These results emphasize the importance of sustained investment in CPD initiatives to support workforce development and improve healthcare system performance.

Key Words: Continuous Professional Development (CPD), Patient Safety Training, Primary Healthcare Centers, Healthcare Workforce Performance, Emergency Preparedness Training.

1. Introduction

Continuous professional development (CPD) has become a fundamental element in modern healthcare systems, as it enables healthcare professionals to maintain and enhance their clinical competencies, adapt to evolving medical knowledge, and deliver high-quality patient care. Healthcare environments are characterized by rapid technological advancements, complex clinical procedures, and increasing expectations for patient safety and service quality. In such contexts, CPD programs provide structured learning opportunities that allow healthcare workers to continuously update their knowledge, develop new clinical skills, and improve professional performance in response to changing healthcare demands. Evidence indicates that effective CPD initiatives can significantly improve healthcare professionals' performance and lead to better patient outcomes, highlighting the importance of ongoing education and training within healthcare organizations (Samuel et al., 2021). Healthcare employee performance is commonly assessed through key performance indicators (KPIs), which measure important aspects of service delivery, including clinical effectiveness, patient safety, compliance with medical protocols, and overall operational efficiency. KPIs are widely used in healthcare institutions to monitor workforce productivity and evaluate the quality of services provided to patients. The integration of training and professional development initiatives within healthcare systems has been shown to contribute to improved employee performance and organizational effectiveness. Training programs can enhance healthcare workers' competencies, reduce workplace errors, and improve their ability to manage clinical responsibilities efficiently (Krijgsheld et al., 2022). Similarly, employee training has been associated with improved job performance and reduced workplace stress, further emphasizing the importance of investing in continuous professional development within healthcare organizations (Ertan & Şeşen, 2022).

Continuous professional development is particularly critical in healthcare settings that require high levels of readiness and rapid response, such as emergency-ready primary health centers. These healthcare facilities serve as frontline institutions responsible for managing urgent medical cases, stabilizing patients, and providing immediate healthcare services before referral to specialized hospitals when necessary. In such environments, healthcare professionals must possess advanced competencies in medication safety, infection prevention, and emergency preparedness in order to ensure effective clinical response and maintain patient safety standards. Educational interventions and professional training programs have been shown to improve medication safety practices among healthcare providers, reducing the likelihood of medication errors and improving clinical decision-making processes (Jaam et al., 2021). Similarly, structured infection control training programs have demonstrated significant effectiveness in improving healthcare workers' compliance with infection prevention protocols, thereby reducing the risk of healthcare-associated infections (Alanazi & Alanazi, 2024). Another critical dimension of CPD in healthcare involves disaster preparedness and emergency response training. Healthcare professionals working in emergency-ready facilities must be prepared to respond effectively to mass casualty incidents, pandemics, and other large-scale emergencies. Training programs focused on disaster management and emergency preparedness have been found to enhance healthcare workers' knowledge, skills, and confidence in managing critical situations. Such programs strengthen healthcare system resilience by ensuring that healthcare staff are equipped with the competencies required to respond effectively to public health emergencies and large-scale crises (Biswas et al., 2022). These training initiatives also support the broader goal of improving healthcare system readiness and ensuring continuity of care during emergencies.

In Saudi Arabia, the healthcare sector has undergone substantial development in recent years, with increasing emphasis on healthcare quality, patient safety, and workforce development. National healthcare transformation initiatives have highlighted the importance of strengthening the competencies of healthcare professionals through continuous education and training programs. Efforts to enhance CPD programs are closely aligned with national healthcare goals aimed at improving service quality, expanding healthcare capacity, and supporting the professional development of healthcare workers across the country (McMahon et al., 2024). Primary health care facilities play a crucial role in the Saudi healthcare system by providing accessible medical services to communities and supporting emergency care delivery. Strengthening the competencies of healthcare professionals working in these facilities is therefore essential for improving healthcare system performance and patient outcomes (Al Saffer et al., 2021). Despite the growing emphasis on professional development within healthcare systems, limited empirical evidence exists regarding the impact of continuous professional development on employee performance indicators within emergency-ready primary health centers. Understanding how CPD programs influence healthcare workers' performance is important for guiding training investments, improving workforce productivity, and strengthening healthcare service delivery. Therefore, this study aims to evaluate the impact of continuous professional development on employee performance KPIs in emergency-ready primary health centers in Riyadh, Saudi Arabia. The study focuses specifically on key areas of professional training, including medication safety, infection control practices, and disaster preparedness, in order to examine how these CPD domains contribute to improved healthcare employee performance and organizational effectiveness.

2. Literature Review

2.1 Theoretical Discussion

Continuous professional development (CPD) is widely recognized as a key mechanism for improving the competencies, knowledge, and performance of healthcare professionals. In healthcare organizations, CPD refers to structured learning activities that enable professionals to maintain clinical competence, update their knowledge, and enhance their professional skills throughout their careers. These learning activities may include formal training programs, workshops, simulation exercises, and continuing education courses designed to support professional growth and improve healthcare service delivery. Research evidence suggests that CPD contributes significantly to improving healthcare professionals' performance and patient outcomes by enhancing clinical competence and promoting evidence-based practice (Samuel et al., 2021). As healthcare systems become increasingly complex, continuous training has become essential for ensuring that healthcare professionals remain capable of responding to evolving clinical challenges and technological developments. From a theoretical perspective, CPD can be explained through human capital theory, which emphasizes the role of education and training in improving employees' productivity and performance. According to this perspective, investment in professional training enhances the skills and capabilities of employees, thereby increasing their effectiveness and contribution to organizational outcomes. In healthcare organizations, training programs are particularly important because clinical errors and operational inefficiencies can have significant consequences for patient safety and healthcare quality. Studies have shown that employee training and development initiatives contribute positively to job performance, reduce workplace stress, and improve organizational outcomes in healthcare institutions (Ertan & Şeşen, 2022). Similarly, systematic evidence indicates that professional training improves healthcare workers' clinical competence and strengthens their ability to perform complex healthcare tasks effectively (Krijgsheld et al., 2022).

Another important theoretical perspective relevant to CPD in healthcare is competency-based professional development, which emphasizes the development of specific clinical competencies required for safe and effective healthcare delivery. In this context, CPD programs are designed to strengthen healthcare professionals' competencies in critical areas such as medication safety, infection control, and emergency preparedness. Medication safety training is particularly important because medication errors represent a significant risk to patient safety. Educational interventions aimed at improving medication administration practices have been shown to reduce medication errors and enhance healthcare professionals' knowledge of safe medication management (Jaam et al., 2021). Similarly, training programs focusing on medication safety competencies help healthcare workers deliver safer and more effective patient care (Aghabarary et al., 2025). Infection control is another critical area where continuous professional training plays a vital role in improving healthcare performance. Healthcare-associated infections remain a major challenge for healthcare systems worldwide, and healthcare workers' compliance with infection prevention protocols is essential for reducing these risks. Training programs designed to enhance infection control knowledge and practices have been shown to significantly improve healthcare workers' adherence to infection prevention measures and promote safer clinical environments (Alanazi & Alanazi, 2024). Educational interventions in infection control also support broader healthcare quality improvement initiatives by strengthening patient safety practices and reducing the spread of infectious diseases within healthcare facilities (Koota et al., 2024).

Disaster preparedness and emergency response training represent another essential dimension of CPD in healthcare. Healthcare professionals working in emergency-ready facilities must possess the necessary knowledge and skills to respond effectively to mass casualty incidents, public health emergencies, and disaster situations. Training programs focused on disaster preparedness have been shown to enhance healthcare workers' readiness, improve their ability to manage emergency situations, and strengthen healthcare system resilience during crises (Biswas et al., 2022). Educational programs designed to improve disaster preparedness competencies can significantly enhance healthcare professionals' knowledge, skills, and personal readiness for responding to large-scale emergencies (Sa'd & Malak, 2025). These findings highlight the importance of continuous professional development in preparing healthcare workers to manage complex clinical situations and maintain healthcare system performance under challenging conditions. Within healthcare organizations, improved professional competencies resulting from CPD are expected to translate into enhanced employee performance and improved healthcare outcomes. Healthcare institutions increasingly rely on key performance indicators (KPIs) to measure employee performance, monitor service quality, and evaluate healthcare system effectiveness. KPIs provide measurable indicators that reflect the quality of healthcare services, clinical efficiency, and adherence to safety standards. Performance measurement systems based on KPIs enable healthcare organizations to assess workforce productivity and identify areas requiring improvement (Gartner & Lemaire, 2022). Training and development initiatives have been shown to improve healthcare service quality and enhance employees' ability to meet performance standards established by healthcare institutions (Alharbi & Aloyuni, 2023). Therefore, continuous professional development is expected to play a critical role in strengthening healthcare workforce performance and improving the quality of healthcare services delivered in emergency-ready primary health centers.

2.2 Hypotheses Development

Continuous professional development plays an essential role in improving healthcare workforce competencies and strengthening healthcare system performance. Training programs allow healthcare professionals to update their clinical knowledge, enhance their professional skills, and adopt best practices that improve patient safety and healthcare quality. Evidence indicates that structured CPD initiatives contribute significantly to healthcare professionals' performance improvement and positively influence patient care outcomes by strengthening clinical competence and supporting evidence-based practice implementation (Samuel et al., 2021). Healthcare organizations therefore increasingly invest in professional training programs as a strategic mechanism for improving workforce performance and maintaining high standards of healthcare service delivery (Shiri et al., 2023).

Medication safety and management training is one of the most critical components of CPD in healthcare settings. Medication errors remain a major patient safety concern globally, often resulting from inadequate knowledge, poor communication, or insufficient training among healthcare professionals. Professional development programs that focus on medication safety provide healthcare workers with updated knowledge regarding medication administration procedures, drug interactions, and error prevention strategies. Educational interventions have been shown to significantly improve healthcare professionals' competencies in safe medication practices and reduce medication errors in clinical settings (Jaam et al., 2021). Furthermore, competency-based training programs enhance healthcare professionals' ability to apply safe medication administration practices, thereby improving clinical performance and patient safety outcomes (Aghabary et al., 2025). Consequently, professional development initiatives focusing on medication safety are expected to contribute positively to employee performance outcomes.

H1: Medication safety and management training has a significant positive effect on employee performance KPIs in emergency-ready primary health centers.

Infection prevention and control training represents another important area of continuous professional development in healthcare organizations. Healthcare-associated infections pose a serious risk to patient safety and healthcare quality worldwide. Effective infection control practices require healthcare professionals to maintain up-to-date knowledge of infection prevention guidelines and adhere to standardized safety protocols in clinical practice. Continuous professional training programs focusing on infection control aim to enhance healthcare workers' awareness, knowledge, and compliance with infection prevention measures. Research indicates that educational interventions significantly improve healthcare professionals' compliance with infection control practices and contribute to reducing healthcare-associated infections (Alanazi & Alanazi, 2024). In addition, systematic reviews have demonstrated that professional training programs strengthen infection prevention practices and improve patient safety outcomes within healthcare organizations (Koota et al., 2024). Therefore, infection control training is expected to positively influence employee performance within healthcare facilities.

H2: Infection control and prevention training has a significant positive effect on employee performance KPIs in emergency-ready primary health centers.

Emergency preparedness and disaster management training constitute another critical component of healthcare professional development, particularly in emergency-ready healthcare facilities. Healthcare professionals working in primary health centers must be capable of responding effectively to disasters, mass casualty incidents, and public health emergencies. Training programs designed to enhance emergency preparedness aim to improve healthcare professionals' competencies in crisis management, emergency coordination, and rapid clinical decision-making during critical situations. Studies have shown that disaster preparedness training significantly improves healthcare workers' readiness to manage emergency incidents and enhances healthcare system resilience during crises (Biswas et al., 2022). Similarly, disaster management training programs have been found to strengthen healthcare professionals' knowledge, skills, and personal preparedness in responding to emergency situations (Sa'd & Malak, 2025). These findings suggest that professional development initiatives focusing on emergency preparedness contribute positively to workforce performance within healthcare institutions.

H3: Disaster and mass casualty preparedness training has a significant positive effect on employee performance KPIs in emergency-ready primary health centers.

3. Methodology

This study adopted a quantitative research design to evaluate the impact of continuous professional development (CPD) on employee performance key performance indicators (KPIs) in emergency-ready primary health centers in Riyadh, Saudi Arabia. A cross-sectional survey approach was used to collect data from healthcare professionals working in these facilities. Quantitative research designs are widely used in healthcare management research because they allow researchers to systematically examine relationships between variables and identify patterns that influence organizational performance and workforce outcomes. In the context of healthcare organizations,

quantitative approaches are particularly suitable for evaluating the effectiveness of professional training programs and their influence on employee performance indicators (Krijgsheld et al., 2022). The study was conducted in emergency-ready primary health centers located in Riyadh. These healthcare facilities play an important role in providing accessible medical services and responding to urgent healthcare needs within the Saudi healthcare system. Primary health care centers serve as the first point of contact for patients and are responsible for managing a wide range of clinical conditions while supporting emergency care services. Strengthening the competencies of healthcare professionals working in these facilities is therefore essential for improving healthcare service quality and ensuring patient safety outcomes (Al Saffer et al., 2021). Continuous professional development initiatives in Saudi Arabia have been increasingly emphasized as part of broader healthcare transformation efforts aimed at enhancing workforce capabilities and aligning healthcare practices with national healthcare goals (McMahon et al., 2024).

The study population consisted of healthcare professionals working in emergency-ready primary health centers in Riyadh. Participants included nurses and other healthcare staff involved in clinical care and emergency response activities within these facilities. A structured questionnaire was used as the primary data collection instrument to gather information on participants' perceptions of continuous professional development programs and their impact on employee performance. The questionnaire was designed to measure key domains of CPD that are relevant to emergency healthcare practice, including medication safety and management, infection control and prevention, and disaster and mass casualty incident training. These domains were selected because they represent critical competency areas that directly influence healthcare quality and patient safety outcomes in clinical settings. Educational interventions and training programs in these areas have been shown to significantly improve healthcare professionals' competencies and contribute to safer healthcare practices (Jaam et al., 2021). The questionnaire also included items measuring employee performance indicators related to clinical practice and healthcare service delivery. Key performance indicators are widely used in healthcare organizations to evaluate workforce productivity, monitor quality improvement initiatives, and assess the effectiveness of healthcare services. Performance measurement systems based on KPIs enable healthcare institutions to track improvements in healthcare delivery and ensure that healthcare professionals adhere to established clinical standards and safety protocols (Gartner & Lemaire, 2022). Promoting a culture of performance measurement among healthcare staff has also been shown to support healthcare quality improvement and strengthen organizational accountability (Abdel-Razik et al., 2023).

Data collection was conducted using a self-administered questionnaire distributed to healthcare professionals working in the selected primary health centers. The questionnaire collected demographic information such as age, gender, years of experience, and workplace characteristics, in addition to measuring participants' perceptions of CPD training effectiveness across the selected domains. The collected data were analyzed using statistical techniques to examine the relationships between CPD participation and employee performance indicators. Descriptive statistics were used to summarize demographic characteristics and evaluate the overall level of CPD training effectiveness. Inferential statistical analyses, including correlation analysis, analysis of variance (ANOVA), and independent sample t-tests, were employed to examine relationships between CPD domains and demographic variables. These statistical methods allow researchers to identify significant differences between groups and determine the extent to which professional training influences employee performance outcomes. Previous studies in healthcare management research have demonstrated that training and professional development initiatives can significantly improve healthcare workers' performance, reduce workplace stress, and enhance organizational effectiveness (Ertan & Şeşen, 2022). By applying these statistical techniques, the present study aims to provide empirical evidence on the role of continuous professional development in improving employee performance KPIs within emergency-ready primary health centers in Riyadh.

4. Findings

This section presents the results of the statistical analysis conducted to evaluate the impact of continuous professional development (CPD) on employee performance key performance indicators (KPIs) in emergency-ready primary health centers in Riyadh, Saudi Arabia. The analysis includes descriptive statistics to assess the overall evaluation levels of CPD training domains, as well as inferential statistical tests to examine relationships between CPD participation and employee performance outcomes. Specifically, the findings explore key training areas such as medication safety and management, infection control and prevention, and disaster and mass casualty incident preparedness. In addition, statistical analyses including correlation analysis, analysis of variance (ANOVA), and independent sample t-tests are used to examine differences in CPD effectiveness across demographic characteristics such as age, gender, years of service, and healthcare institution. These analyses provide empirical insights into how continuous professional development contributes to improving healthcare professionals' competencies and performance in emergency-ready primary health centers, which are critical for maintaining healthcare quality and patient safety.

Table 1 presents the evaluation level of the main continuous professional development (CPD) domains examined in this study, including medication safety and management, infection control and prevention, and disaster and mass casualty incident (MCI) training. The results indicate that the majority of participants reported a high level of impact of CPD across all examined domains. With regard to medication safety and management, the findings show that 89.2% of participants rated the impact of CPD at a high level, while 10.8% reported an average level and none reported a weak level. The mean score for this domain was 21.30 ± 2.712 , with a score range of 15–25. The chi-square analysis indicated a statistically significant distribution of responses ($\chi^2 = 73.633$, $p < 0.001$), suggesting that participants overwhelmingly perceived CPD programs as having a strong influence on medication safety practices. These findings are consistent with previous studies indicating that professional education and training programs improve healthcare professionals' competencies in safe medication administration and reduce the likelihood of medication errors.

For the infection control and prevention domain, the majority of respondents (81.7%) reported a high level of CPD impact, while 18.3% reported an average level and none indicated a weak level. The mean score for this domain was 21.042 ± 2.988 , with the same score range of 15–25. The chi-square test also demonstrated a statistically significant result ($\chi^2 = 48.133$, $p < 0.001$), indicating that CPD programs play an important role in improving healthcare workers' compliance with infection prevention and control practices. These findings align with previous research demonstrating that educational and training programs significantly enhance healthcare professionals' adherence to infection control protocols and improve patient safety outcomes. Similarly, the results for the disaster and mass casualty incident training domain reveal that 90.0% of participants reported a high level of CPD impact, while 10.0% indicated an average level and none reported a weak level. The mean score for this domain was 21.158 ± 2.846 , within the same score range of 15–25. The chi-square test showed a statistically significant result ($\chi^2 = 76.800$, $p < 0.001$), indicating that CPD programs significantly contribute to improving healthcare professionals' preparedness for emergency and disaster situations. This finding supports previous studies showing that disaster preparedness training enhances healthcare workers' knowledge, skills, and readiness to respond effectively to emergency situations and mass casualty incidents.

Table 1: The evaluation level for All Domains

		DATA DOMAINS			Score		Chi-Square	
		Weak	Average	High	Range	Mean±SD	X2	P-value
Impacts of Medication Safety and Management as a CPD	N	0	13	107	15-25.	21.300±2.712	73.633	<0.001*
	%	0.0%	10.8%	89.2%				
Impacts of Infection Control and Prevention as a CPD	N	0	22	98	15-25.	21.042±2.988	48.133	<0.001*
	%	0.0%	18.3%	81.7%				
Impacts of Disaster and MCI Training as a CPD	N	0	12	108	15-25.	21.158±2.846	76.800	<0.001*
	%	0.0%	10.0%	90.0%				

Table 2 presents the correlation matrix illustrating the relationships between the three continuous professional development (CPD) domains examined in this study: medication safety and management, infection control and prevention, and disaster and mass casualty incident (MCI) training. The results indicate statistically significant positive correlations among all domains, suggesting that improvements in one CPD training area are associated with improvements in other related professional development areas. The correlation analysis revealed a strong positive relationship between medication safety and management training and infection control and prevention training ($r = 0.784$, $p < 0.001$). This finding suggests that healthcare professionals who perceive higher benefits from CPD programs related to medication safety are also more likely to report stronger improvements in infection control competencies. These results highlight the interconnected nature of clinical competencies within healthcare environments, where improvements in one domain of professional training may contribute to enhanced performance in other related clinical areas. Previous research has demonstrated that CPD programs often produce broad improvements in clinical practice by strengthening healthcare professionals' overall competencies and reinforcing patient safety practices.

Similarly, the results indicate a significant positive correlation between medication safety and disaster and mass casualty incident training ($r = 0.674$, $p < 0.001$). This relationship suggests that healthcare professionals who benefit from CPD initiatives in medication safety are also likely to demonstrate improved competencies in emergency preparedness and disaster response. Training programs that enhance clinical knowledge and decision-making skills may therefore contribute to a broader improvement in healthcare workers' ability to manage complex medical situations. Continuous professional training programs have been shown to enhance healthcare

professionals' overall preparedness and strengthen their capacity to respond effectively to both routine clinical challenges and emergency situations. Furthermore, the analysis identified a strong positive relationship between infection control and disaster preparedness training ($r = 0.725$, $p < 0.001$). This finding indicates that healthcare professionals who report higher levels of CPD impact in infection control practices are also more likely to demonstrate stronger competencies in disaster and emergency response training. Effective infection control practices are particularly critical during emergency situations, including pandemics and mass casualty incidents, where healthcare workers must manage large numbers of patients while maintaining strict safety protocols. Training programs designed to improve infection prevention and emergency preparedness have been shown to enhance healthcare system resilience and improve healthcare workers' readiness to respond to public health emergencies (Koota et al., 2024).

Table 2: The Correlation matrix between All Domains

		Impacts of Medication Safety and Management as a CPD	Impacts of Infection Control and Prevention as a CPD	Impacts of Disaster and MCI Training as a CPD
Impacts of Medication Safety and Management as a CPD	r			
	P-value			
Impacts of Infection Control and Prevention as a CPD	r	0.784		
	P-value	<0.001*		
Impacts of Disaster and MCI Training as a CPD	r	0.674	0.725	
	P-value	<0.001*	<0.001*	

Table 3 presents the relationship between participants' age groups and their evaluation of the impact of continuous professional development (CPD) across the three examined domains: medication safety and management, infection control and prevention, and disaster and mass casualty incident (MCI) training. The results of the analysis of variance (ANOVA) indicate statistically significant differences in the perceived impact of CPD programs across different age groups. For the medication safety and management domain, the mean scores varied across age groups, with participants aged 25–30 years reporting the highest mean score (22.321 ± 2.405), followed by those aged 36–40 years (21.000 ± 2.736) and 41–45 years (21.136 ± 2.900). Participants aged 31–35 years reported a slightly lower mean score (20.200 ± 1.323), while those aged 46–50 years reported the lowest mean score (20.000 ± 5.774). The analysis revealed a statistically significant difference among age groups ($F = 4.286$, $p = 0.001$), indicating that age plays a role in shaping healthcare professionals' perceptions of CPD effectiveness in improving medication safety competencies. Training and professional development programs have been shown to enhance healthcare workers' knowledge and competencies in safe medication practices, which contributes to improved clinical performance and patient safety outcomes.

Regarding the infection control and prevention domain, the mean scores also varied across age categories. Participants aged 25–30 years reported the highest mean score (21.857 ± 3.472), followed by those aged 36–40 years (21.306 ± 2.796) and 41–45 years (21.045 ± 2.459). Participants aged 31–35 years reported a mean score of 19.360 ± 1.955 , while those aged 46–50 years reported a lower mean score of 18.500 ± 4.041 . The ANOVA results demonstrated a statistically significant difference across age groups ($F = 5.156$, $p < 0.001$). These findings suggest that healthcare professionals' engagement with infection control training may vary depending on their professional experience and stage of career development. Previous studies have shown that educational interventions and infection prevention training programs significantly improve healthcare workers' adherence to infection control protocols and enhance patient safety practices within healthcare institutions. Similarly, significant differences were observed in the disaster and mass casualty incident training domain across different age groups. Participants aged 25–30 years reported the highest mean score (21.893 ± 3.236), followed by those aged 36–40 years (21.083 ± 2.347) and 41–45 years (20.773 ± 3.206). Participants aged 31–35 years reported a mean score of 20.360 ± 1.846 , while those aged 46–50 years reported a lower mean score of 19.000 ± 4.619 . The ANOVA analysis confirmed that these differences were statistically significant ($F = 3.458$, $p = 0.006$). These findings indicate that age-related factors may influence healthcare professionals' perceptions of the effectiveness of disaster preparedness training. Training programs designed to enhance emergency response competencies have been shown to improve healthcare professionals' readiness to respond to disaster situations and strengthen healthcare system resilience during emergencies.

Table 3: The relation between Age and All domains

Domains		Age						ANOVA	
		25 – 30 years	31 – 35 years	36 – 40 years	41 – 45 years	46 – 50 years	51 years and above	F	P-value
Impacts of Medication Safety and Management as a CPD	Mean	22.321	20.200	21.000	21.136	20.000	25.000	4.286	0.001*
	SD	2.405	1.323	2.736	2.900	5.774	0.000		
Impacts of Infection Control and Prevention as a CPD	Mean	21.857	19.360	21.306	21.045	18.500	25.000	5.156	<0.001*
	SD	3.472	1.955	2.796	2.459	4.041	0.000		
Impacts of Disaster and MCI Training as a CPD	Mean	21.893	20.360	21.083	20.773	19.000	25.000	3.458	0.006*
	SD	3.236	1.846	2.347	3.206	4.619	0.000		

Table 4 presents the relationship between participants' years of service in the institution and their evaluation of the impact of continuous professional development (CPD) across the three domains examined in this study: medication safety and management, infection control and prevention, and disaster and mass casualty incident (MCI) training. The analysis of variance (ANOVA) was conducted to determine whether significant differences existed among participants with varying years of professional experience within their institutions. For the medication safety and management domain, the mean scores varied slightly across different years-of-service categories. Participants with 2–3 years of service reported the highest mean score (22.105 ± 2.401), followed by those with 7–9 years of service (21.750 ± 2.563) and 4–6 years of service (21.261 ± 2.005). Participants with more than 12 years of service reported a mean score of 21.385 ± 2.952 , while those with 10–12 years of service reported the lowest mean score (19.571 ± 2.901). However, the ANOVA results indicated that these differences were not statistically significant ($F = 2.002$, $p = 0.099$). This suggests that although minor variations exist across experience levels, years of service do not significantly influence healthcare professionals' perceptions of CPD effectiveness in improving medication safety competencies. Nevertheless, previous research highlights that training programs play a crucial role in improving healthcare workers' medication safety knowledge and clinical decision-making regardless of experience level.

Regarding the infection control and prevention domain, the results revealed statistically significant differences across years-of-service categories. Participants with 2–3 years of service reported the highest mean score (22.421 ± 2.524), followed by those with 7–9 years of service (21.750 ± 2.563) and more than 12 years of service (21.212 ± 3.108). Participants with 4–6 years of service reported a mean score of 19.783 ± 3.397 , while those with 10–12 years of service reported a mean score of 20.000 ± 1.617 . The ANOVA results confirmed a statistically significant difference across groups ($F = 2.833$, $p = 0.028$). This finding indicates that years of professional experience may influence healthcare workers' perceptions of infection control training effectiveness. Educational interventions have been shown to significantly improve healthcare workers' compliance with infection prevention protocols and enhance infection control practices within healthcare facilities. In contrast, the results for the disaster and mass casualty incident training domain did not demonstrate statistically significant differences across years-of-service categories. Participants with 2–3 years of service reported the highest mean score (21.895 ± 2.807), followed by those with 4–6 years of service (21.261 ± 2.832) and 7–9 years of service (21.250 ± 2.340). Participants with more than 12 years of service reported a mean score of 21.288 ± 3.038 , while those with 10–12 years of service reported the lowest mean score (19.429 ± 2.174). The ANOVA analysis indicated that these differences were not statistically significant ($F = 1.687$, $p = 0.158$). This result suggests that disaster preparedness training is perceived similarly by healthcare professionals regardless of their years of institutional experience. Previous studies have shown that disaster preparedness training enhances healthcare professionals' knowledge and readiness to respond effectively to emergency situations across different experience levels.

Table 4: The relation between Years of service in the institution and All domains

Domains		Years of service in the institution					ANOVA	
		2 – 3 years	4 – 6 years	7 – 9 years	10 – 12 years	More than 12 years	F	P-value
Impacts of Medication Safety and Management as a CPD	Mean	22.105	21.261	21.750	19.571	21.385	2.002	0.099
	SD	2.401	2.005	2.563	2.901	2.952		
Impacts of Infection Control and Prevention as a CPD	Mean	22.421	19.783	21.750	20.000	21.212	2.833	0.028*
	SD	2.524	3.397	2.563	1.617	3.108		
Impacts of Disaster and MCI Training as a CPD	Mean	21.895	21.261	21.250	19.429	21.288	1.687	0.158
	SD	2.807	2.832	2.340	2.174	3.038		

Table 5 presents the relationship between the healthcare institution where participants work and their evaluation of the impact of continuous professional development (CPD) across the three domains examined in this study: medication safety and management, infection control and prevention, and disaster and mass casualty incident (MCI) training. The analysis of variance (ANOVA) was conducted to determine whether significant differences existed among healthcare institutions regarding the perceived effectiveness of CPD programs. For the medication safety and management domain, the mean scores varied across the different healthcare institutions. Participants working in Riyadh Health Cluster 2 reported the highest mean score (22.115 ± 2.692), indicating a stronger perceived impact of CPD programs in improving medication safety practices within this institution. Participants from Primary Care Health Center Al Wadi reported a mean score of 21.000, while those from Primary Care Health Center Al Rawdah 2 reported a mean score of 20.000. Lower mean scores were observed among participants from Primary Care Health Center Al Manar (19.667 ± 4.412), Primary Care Health Center Sulaimaniyah (19.571 ± 0.535), and Urgent Care Centers (19.500 ± 1.932). The ANOVA results revealed a statistically significant difference among healthcare institutions ($F = 4.953$, $p < 0.001$), indicating that the perceived effectiveness of CPD in improving medication safety varies depending on the institutional context. Training and professional development programs are known to enhance medication safety practices and reduce clinical errors, contributing to improved patient safety outcomes in healthcare institutions.

Regarding the infection control and prevention domain, the results also showed differences across healthcare institutions. Participants working in Riyadh Health Cluster 2 reported the highest mean score (21.974 ± 2.768), followed by those from Primary Care Health Center Al Manar (21.167 ± 3.189) and Urgent Care Centers (20.188 ± 2.562). Lower mean scores were reported among participants from Primary Care Health Center Al Rawdah 2 (18.556 ± 2.297), Primary Care Health Center Sulaimaniyah (18.000 ± 1.414), and Primary Care Health Center Al Wadi (17.000 ± 1.155). The ANOVA results indicated a statistically significant difference across healthcare institutions ($F = 7.587$, $p < 0.001$). These findings suggest that institutional differences may influence the effectiveness of infection control training programs and healthcare workers' compliance with infection prevention protocols. Previous studies have demonstrated that training initiatives significantly improve healthcare workers' adherence to infection control practices and contribute to reducing healthcare-associated infections. Similarly, the disaster and mass casualty incident training domain showed variation across healthcare institutions. Participants working in Riyadh Health Cluster 2 reported the highest mean score (21.603 ± 2.907), followed by those from Primary Care Health Center Al Manar (21.500 ± 2.950) and Primary Care Health Center Al Rawdah 2 (21.444 ± 2.007). Participants from Urgent Care Centers reported a mean score of 20.313 ± 2.626 , while lower mean scores were observed among those from Primary Care Health Center Al Wadi (19.500 ± 2.887) and Primary Care Health Center Sulaimaniyah (18.429 ± 1.718). The ANOVA analysis confirmed a statistically significant difference across institutions ($F = 2.389$, $p = 0.042$). These results indicate that institutional factors, such as training resources, organizational culture, and emergency preparedness policies, may influence the perceived effectiveness of disaster preparedness training programs. Educational interventions focusing on disaster preparedness have been shown to significantly enhance healthcare professionals' readiness to respond effectively to emergency and mass casualty situations.

Table 5: The relation between Name of the healthcare institution and All domains

Domains		Name of the healthcare institution				ANOVA	
		Primary Care Health Center Al Manar	Primary Care Health Center Al Rawdah 2	Primary Care Health Center Al Wadi	Primary Care Health Center Sulaimaniyah	F	P-value
Impacts of Medication Safety and Management as a CPD	Mean	19.667	20.000	21.000	19.571	4.953	<0.001*
	SD	4.412	0.866	0.000	0.535		
Impacts of Infection Control and Prevention as a CPD	Mean	21.167	18.556	17.000	18.000	7.587	<0.001*
	SD	3.189	2.297	1.155	1.414		
Impacts of Disaster and MCI Training as a CPD	Mean	21.500	21.444	19.500	18.429	2.389	0.042*
	SD	2.950	2.007	2.887	1.718		

Table 6 presents the relationship between the types of continuous professional development (CPD) programs attended by participants and their evaluation of the three domains examined in this study: medication safety and management, infection control and prevention, and disaster and mass casualty incident (MCI) training. The analysis of variance (ANOVA) was conducted to determine whether attending different types of CPD programs resulted in significant differences in the perceived impact of these training domains. For the medication safety and management domain, the mean scores varied slightly depending on the type of CPD program attended. Participants who attended infection control and prevention training reported the highest mean score (22.063 ± 2.368), followed by those who attended disaster and mass casualty incident training (21.333 ± 1.936). In contrast, participants who attended medication safety and management training reported a lower mean score (19.286 ± 1.496). Despite these variations, the ANOVA results indicated that the differences were not statistically significant ($F = 1.406$, $p = 0.219$). This suggests that participation in different CPD programs did not significantly influence participants' perceptions of the impact of CPD on medication safety competencies. Nevertheless, previous studies emphasize that training initiatives in medication safety play an important role in enhancing healthcare professionals' competencies in safe medication administration and reducing medication errors in clinical practice.

Similarly, for the infection control and prevention domain, the mean scores showed some variation across the CPD programs attended. Participants who attended disaster and mass casualty incident training reported the highest mean score (21.667 ± 4.093), followed by those who attended infection control and prevention training (21.063 ± 3.321). Participants who attended medication safety and management training reported a lower mean score (18.857 ± 2.610). However, the ANOVA analysis revealed that these differences were not statistically significant ($F = 2.031$, $p = 0.067$). This finding indicates that although CPD programs contribute to improved infection control practices, the specific type of training attended does not significantly affect healthcare professionals' perceptions of CPD impact in this domain. Educational programs focusing on infection prevention have been shown to improve healthcare workers' compliance with infection control protocols and strengthen patient safety practices in healthcare settings. In contrast, the results for the disaster and mass casualty incident training domain demonstrated statistically significant differences based on the CPD programs attended. Participants who attended disaster and mass casualty incident training reported the highest mean score (21.444 ± 2.877), followed closely by those who attended infection control and prevention training (21.625 ± 2.768). Participants who attended medication safety and management training reported a lower mean score (20.143 ± 3.132). The ANOVA results confirmed that these differences were statistically significant ($F = 2.602$, $p = 0.021$). This finding suggests that participation in specific CPD programs related to emergency preparedness significantly influences healthcare professionals' perceptions of their competencies in disaster response and emergency management. Previous research has demonstrated that disaster preparedness training programs enhance healthcare professionals' knowledge, skills, and readiness to effectively manage emergency situations and mass casualty incidents.

Table 6: The relation between CPDs attended and All domains

Domains		CPDs attended			ANOVA	
		Disaster and Mass Casualty Incident Training	Infection Control and Prevention	Medication Safety and Management	F	P-value
Impacts of Medication Safety and Management as a CPD	Mean	21.333	22.063	19.286	1.406	0.219
	SD	1.936	2.368	1.496		
Impacts of Infection Control and Prevention as a CPD	Mean	21.667	21.063	18.857	2.031	0.067
	SD	4.093	3.321	2.610		
Impacts of Disaster and MCI Training as a CPD	Mean	21.444	21.625	20.143	2.602	0.021*
	SD	2.877	2.768	3.132		

Table 7 presents the relationship between participants' gender and their evaluation of the impact of continuous professional development (CPD) across the three domains examined in this study: medication safety and management, infection control and prevention, and disaster and mass casualty incident (MCI) training. An independent sample t-test was conducted to determine whether statistically significant differences existed between male and female participants in their perceptions of CPD effectiveness. For the medication safety and management domain, female participants reported a higher mean score (22.0366 ± 2.60789) compared to male participants (19.7105 ± 2.22890). The t-test analysis revealed a statistically significant difference between the two groups ($t = 4.750$, $p < 0.001$). This finding indicates that female healthcare professionals perceived a stronger impact of CPD programs on improving medication safety competencies. Training programs focusing on medication safety are known to enhance healthcare workers' knowledge of safe medication administration practices and contribute to reducing medication errors in clinical environments.

Similarly, for the infection control and prevention domain, female participants reported a higher mean score (21.6707 ± 3.02277) compared to male participants (19.6842 ± 2.43960). The results of the t-test indicated a statistically significant difference between the two groups ($t = 3.548$, $p < 0.001$). These findings suggest that female healthcare professionals may demonstrate greater engagement with infection control training programs and perceive a stronger benefit from CPD initiatives related to infection prevention practices. Previous studies have shown that educational interventions and infection control training programs significantly improve healthcare workers' compliance with infection prevention protocols and strengthen patient safety outcomes within healthcare institutions. The results for the disaster and mass casualty incident training domain also revealed a similar pattern. Female participants reported a higher mean score (21.7439 ± 2.88808) compared to male participants (19.8947 ± 2.32250). The t-test results confirmed that the difference between the two groups was statistically significant ($t = 3.460$, $p < 0.001$). This finding indicates that female healthcare professionals reported a stronger perceived impact of CPD programs in improving disaster preparedness competencies. Disaster preparedness training programs have been shown to significantly enhance healthcare professionals' knowledge, skills, and readiness to respond effectively to emergency and mass casualty situations.

Table 7: The relation between Gender and All domains

	Gender				T-test	
	Female		Male			
	Mean	SD	Mean	SD	t	P-value
Impacts of Medication Safety and Management as a CPD	22.0366	2.60789	19.7105	2.22890	4.750	<0.001*
Impacts of Infection Control and Prevention as a CPD	21.6707	3.02277	19.6842	2.43960	3.548	<0.001*
Impacts of Disaster and MCI Training as a CPD	21.7439	2.88808	19.8947	2.32250	3.460	<0.001*

5. Discussion

The present study examined the impact of continuous professional development (CPD) on employee performance key performance indicators (KPIs) in emergency-ready primary health centers in Riyadh, Saudi Arabia. The

findings demonstrate that CPD programs have a strong positive influence on healthcare professionals' competencies across key domains, including medication safety and management, infection control and prevention, and disaster and mass casualty incident preparedness. The high mean scores reported across all domains suggest that healthcare professionals perceive CPD initiatives as effective tools for improving their professional skills and enhancing clinical performance. These findings support existing evidence indicating that continuous professional development contributes significantly to improving healthcare professionals' performance and patient care outcomes by strengthening knowledge, clinical competencies, and evidence-based practices (Samuel et al., 2021). One of the key findings of this study is the strong perceived impact of CPD programs on medication safety and management practices. Medication errors represent one of the most common patient safety challenges in healthcare systems, and improving medication safety requires healthcare professionals to maintain up-to-date knowledge of safe medication administration practices. The high evaluation levels reported by participants in this domain indicate that CPD programs play a critical role in strengthening healthcare workers' competencies in medication management. Educational interventions and professional training programs have been shown to significantly reduce medication errors and enhance healthcare professionals' clinical decision-making related to medication administration (Jaam et al., 2021). Furthermore, competency-based training initiatives focused on medication safety have been found to improve nurses' ability to deliver safe and effective patient care (Aghabarary et al., 2025). These findings suggest that CPD programs focusing on medication safety can contribute to improving healthcare service quality and patient safety outcomes.

Another important finding of this study relates to the strong impact of CPD programs on infection control and prevention practices. Healthcare-associated infections remain a significant challenge for healthcare systems worldwide, and healthcare workers' adherence to infection prevention protocols is essential for maintaining safe healthcare environments. The results of this study demonstrate that CPD programs significantly improve healthcare professionals' infection control competencies. Training programs designed to enhance infection prevention knowledge and practices have been shown to improve healthcare workers' compliance with infection control guidelines and reduce the risk of healthcare-associated infections (Alanazi & Alanazi, 2024). Similarly, systematic reviews of infection control education programs indicate that professional training interventions can significantly strengthen infection prevention practices and improve patient safety outcomes in healthcare settings (Koota et al., 2024). These findings highlight the importance of continuous education in promoting safer clinical practices within primary healthcare facilities. The results of this study also indicate that CPD programs play a significant role in improving healthcare professionals' preparedness for disaster and emergency situations. Healthcare workers in emergency-ready primary health centers must be prepared to respond effectively to mass casualty incidents, pandemics, and other public health emergencies. The high evaluation levels reported in the disaster and mass casualty incident training domain suggest that CPD initiatives enhance healthcare professionals' readiness and confidence in managing emergency situations. Previous studies have demonstrated that disaster preparedness training programs significantly improve healthcare workers' knowledge, skills, and personal readiness to respond to emergency events (Sa'd & Malak, 2025). Similarly, training models designed to improve mass casualty preparedness have been shown to strengthen healthcare system resilience and improve healthcare workers' ability to respond effectively to large-scale emergencies (Biswas et al., 2022). These findings emphasize the critical role of CPD programs in strengthening healthcare system preparedness and ensuring effective emergency response capabilities.

The correlation analysis conducted in this study revealed strong positive relationships among the three CPD domains examined. These findings indicate that improvements in one training area are associated with improvements in other related competency areas. This interconnected relationship suggests that professional development programs that integrate multiple training components may produce broader improvements in healthcare workforce competencies. Continuous professional development initiatives that combine clinical training, patient safety education, and emergency preparedness training can therefore contribute to comprehensive improvements in healthcare performance. Previous research also supports the idea that integrated CPD programs strengthen healthcare professionals' overall competencies and promote improved healthcare service delivery (Shiri et al., 2023). In addition to examining the impact of CPD programs on clinical competencies, this study also explored the influence of demographic characteristics on participants' perceptions of CPD effectiveness. The findings revealed significant differences across age groups and healthcare institutions, indicating that contextual factors may influence the perceived impact of professional training programs. Younger healthcare professionals reported higher evaluation levels across several domains, which may reflect greater engagement with training opportunities or higher familiarity with modern learning approaches. Institutional differences observed in the results also highlight the importance of organizational support and training infrastructure in maximizing the effectiveness of CPD programs. Healthcare institutions that invest in structured professional development programs are more likely to achieve improvements in workforce performance and healthcare service quality (Alharbi & Aloyuni, 2023).

Furthermore, the findings revealed gender differences in the perceived impact of CPD programs, with female participants reporting higher mean scores across all domains. These differences may reflect variations in

professional engagement with training programs or differences in learning participation across gender groups. Nevertheless, the results reinforce the broader conclusion that continuous professional development remains a key strategy for improving healthcare professionals' competencies and enhancing healthcare service quality. Training and professional development initiatives have been shown to strengthen workforce productivity, improve job performance, and support healthcare organizations in achieving their performance goals (Ertan & Şeşen, 2022). Overall, the findings of this study demonstrate that continuous professional development programs play a critical role in improving healthcare professionals' competencies and strengthening employee performance KPIs within emergency-ready primary health centers. By enhancing clinical knowledge, improving adherence to safety protocols, and strengthening emergency preparedness, CPD initiatives contribute to improved healthcare service quality and patient safety outcomes. These findings highlight the importance of sustained investment in professional training programs as part of broader healthcare quality improvement strategies and workforce development initiatives within healthcare systems.

6. Conclusion

This study evaluated the impact of continuous professional development on employee performance key performance indicators in emergency-ready primary health centers in Riyadh, Saudi Arabia. The findings demonstrate that continuous professional development programs play a significant role in improving healthcare professionals' competencies across critical areas of clinical practice. High evaluation levels were observed across the examined domains, including medication safety and management, infection control and prevention, and disaster and mass casualty incident preparedness. These results indicate that structured professional training programs contribute to strengthening healthcare workers' knowledge, enhancing clinical skills, and improving their ability to deliver safe and effective healthcare services. The study also revealed significant relationships between continuous professional development domains and several demographic factors, including age, gender, and institutional affiliation. These findings suggest that individual and organizational factors may influence the perceived effectiveness of professional training initiatives. Despite these variations, the overall results indicate that continuous professional development programs provide substantial benefits to healthcare professionals regardless of their level of experience. By supporting the development of critical competencies, these programs help healthcare professionals improve their performance and respond effectively to complex healthcare challenges. Furthermore, the strong correlations observed between the examined CPD domains highlight the interconnected nature of professional competencies within healthcare settings. Improvements in one area of professional training may reinforce skills and knowledge in other related domains, leading to broader improvements in healthcare workforce performance. Continuous professional development therefore represents an essential strategy for strengthening healthcare systems and ensuring that healthcare professionals are adequately prepared to deliver high-quality patient care.

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