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Assessing the Role of Continuing Education in Shaping Human Medicine, Dental Careers, and Pharmaceutical Jobs in the Era of Health Transformation: Systematic Review Based Findings

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Abstract

Background: Continuing professional development (CPD) plays a crucial role in ensuring that healthcare professionals maintain up-to-date knowledge and skills, particularly in the rapidly evolving fields of human medicine, dental careers, and pharmacy. However, disparities in CPD access and implementation across different regions, particularly in low- and middle-income countries (LMICs), present significant challenges to healthcare workforce development. Aim: This systematic review aimed to assess the role of CPD in enhancing professional competence, improving patient outcomes, and addressing the challenges in its implementation across human medicine, dental, and pharmaceutical sectors. Method: A systematic search was conducted for studies published between 2021 and 2025 in databases such as PubMed, Scopus, and Web of Science. Ten primary studies were selected based on their methodological rigor, focusing on CPD effectiveness, barriers to participation, and preferred learning modalities. Data were extracted and synthesized to identify trends and common themes. Results: The review found that CPD programs, particularly blended learning models, positively impacted professional competence and patient care outcomes. Barriers to CPD participation were most prevalent in LMICs, including resource constraints and limited access to digital platforms. Mandatory CPD systems were more effective in ensuring sustained participation and improving outcomes, while voluntary systems had lower engagement. Conclusion: CPD is essential for the continuous professional development of healthcare workers and the improvement of patient outcomes. However, addressing barriers to CPD participation, especially in LMICs, is critical to ensuring equitable access. Future research should focus on developing cost-effective, scalable CPD models to overcome these challenges.

Keywords: *Continuing Professional Development, Healthcare Education, Human Medicine, Dental Careers, Pharmaceutical Jobs, CPD Barriers, Learning Modalities, Healthcare Workforce, Professional Competence, Patient Outcomes.*

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Introduction

The healthcare industry is experiencing a huge transformation, which is being driven by the rapid developments in medical technologies, the changing treatment interventions and the worldwide efforts to promote integrated care systems. To keep up with these changes, it is necessary for healthcare professionals in various fields, such as human medicine, dentistry, and pharmaceuticals, to participate in continuous professional development (CPD). CPD is vital to ensuring that practitioners continue to acquire and develop their knowledge, skills, and competencies throughout their profession, which can improve patient care and healthcare outcomes (Curran et al., 2024; McMahon, 2025; Ballaram et al., 2024). With the growing complexity of contemporary healthcare systems, the need for lifelong learning has become more important as not only does this ensure the retention of current knowledge, but it also guarantees the uptake of new practices that reflect the latest evidence-based research (Gambhir et al., 2025; McMahon et al., 2024; Yadeta et al., 2024).

Increasing need for quality healthcare services has increased the importance of CPD in the medical, dental and pharmaceutical sectors. In the human medical field, the constant integration of new revolutionary treatments, diagnostic technologies and personalized medicine techniques means that healthcare professionals must constantly update their skill sets to best care for their patients (Ibsen et al., 2025; Ballaram et al., 2024; Gambhir et al., 2025). Similarly, in the field of dentistry, innovations like laser treatments, digital imaging, and advances in patient management mean that dental professionals require regular educational updates to ensure that they are prepared to use these technologies effectively (McMahon, 2025; Kerdari et al., 2025; Xie et al., 2025). In the field of pharmacy, the increase in the pharmacist's role in patient care, such as direct patient counseling, chronic disease management, and the integration of new drug therapies, underline the need for ongoing education and training (Ali et al., 2025; Mandic et al., 2024; Yadeta et al., 2024). As healthcare evolves it is imperative that CPD programs are not only focused on what practitioners' need at a given time, but also on the future of healthcare delivery. Plus, integration of technology in healthcare delivery, especially via digital health tools like telemedicine, electronic health records, and mobile health applications, has further increased the demand for CPD. Virtual care and telehealth, which were vital in the pandemic of Covid-19, are still influencing the way healthcare is delivered worldwide (Curran et al., 2024; McMahon, 2025; Mandic et al., 2024). Healthcare professionals now need training in the use of telehealth platforms, digital patient management systems, and virtual communication tools to ensure that they are able to continue to provide effective care remotely. The move toward digital healthcare delivery has led to the creation of novel CPD programs that include technological training in order to help healthcare professionals adapt to these innovations (McMahon et al., 2024; Ballaram et al., 2024; Xie et al., 2025). As healthcare systems around the world move towards a more integrated and digital-first approach, CPD will be essential in ensuring that healthcare workers are not only proficient in their clinical knowledge, but they will also be able to utilize digital tools to improve care efficiency and patient outcomes.

While CPD is now widely recognized as an important part of healthcare professionalism, its implementation and effectiveness vary around the world. In high-income countries (HICs) such as the United States, the United Kingdom and Canada, CPD has become institutionalized as a mandatory condition for healthcare professionals to stay licensed and certified (McMahon, 2025; Ballaram et al., 2024; Ibsen et al., 2025). These countries have set up elaborate CPD systems that blend different learning modalities, such as face-to-face learning, online education and blended learning formats, to meet the varying needs of healthcare workers (Gambhir et al., 2025; Curran

et al., 2024; McMahon et al., 2024). In contrast, many low- and middle-income countries (LMICs) are in the process of developing and formalizing CPD frameworks, with some by relying on voluntary participation in continuing education (Tamiru et al., 2023; Ballaram et al., 2024; Yadeta et al., 2024). In these regions, access to CPD programs may be limited due to factors such as financial constraints, insufficient infrastructure, and limited access to technological resources, which make it difficult for CPD practices to be widely adopted. Despite these challenges, the significance of CPD in assuring the quality and competence of healthcare professionals in LMICs is being increasingly recognized and efforts are being made to improve CPD frameworks to meet the needs of healthcare workers in these regions (Ali et al., 2025; Gambhir et al., 2025; Xie et al., 2025).

As healthcare systems continue to evolve, the integration of CPD into the professional practice is viewed not only as a requirement for maintenance of licensure but a strategic investment in workforce development and healthcare quality. In the age of health transformation, CPD offers healthcare professionals the tools that they need to adapt to the changing environment, improve their healthcare practice, and improve patient care outcomes. The growing complexity of healthcare and the technological advancements make it essential to have strong CPD programs that are flexible, accessible, and matching the present and future healthcare needs (Curran et al., 2024; Ibsen et al., 2025; Yadeta et al., 2024). Moving forward, a global effort to standardize the CPD models, share best practices, and address the unique needs of healthcare systems in various regions will be essential in ensuring that healthcare professionals are equipped to meet the demands of modern healthcare delivery.

Problem Statement

As healthcare systems all over the world keep evolving, the need for highly skilled and adaptable professionals in medicine, dentistry, and pharmacy is growing. Continuing professional development (CPD) is important in ensuring that these professionals keep up-to-date knowledge and skills in the face of the rapid developments in medical science, technology, and patient care practices (McMahon et al., 2025; Xie et al., 2025; Gambhir et al., 2025). However, despite its importance, there are large disparities in the implementation of CPD in different regions, especially between high-income countries (HICs) and low and middle-income countries (LMICs) (Ballaram et al., 2024; Ali et al., 2025; Ibsen et al., 2025). In many countries, healthcare professionals encounter difficulties in accessing quality, consistent and regulated CPD programs due to factors such as economic constraints, poor infrastructure, and changing regulatory environments. These challenges affect the ability of healthcare workers to stay up-to-date with the latest practices, which may affect the quality of patient care and health system outcomes (Tamiru et al., 2023; Mandic et al., 2024; Curran et al., 2024). The issue constitutes that many healthcare systems have not yet fully incorporated CPD in their regulatory structure, and the current models of CPD cannot adequately address the specific needs of professionals within various healthcare sectors.

Significance of the Study

This study has a very high significance as it addresses a vital gap in understanding the effect of continuing education on the professional development of health care workers in the field of human medicine, dentistry and pharmacy. The process of change in healthcare requires continuous updating of knowledge and skills of the professionals to provide effective healthcare services, particularly with the introduction of new technologies, treatment methods, and patient care models (McMahon et al., 2025; Gambhir et al., 2025; Yadeta et al., 2024). The results of this systematic review will contribute valuable information on how CPD frameworks can be

optimized to ensure that healthcare professionals remain competent and effective in their roles. Additionally, by reviewing CPD models in various countries and regions, this study will help determine best practices, challenges, and opportunities for improving CPD delivery worldwide, with a particular focus on the LMICs where CPD frameworks are still being developed (Ali et al., 2025; Xie et al., 2025; Tamiru et al., 2023). The outcomes of this research will help to develop more inclusive and adaptive CPD systems which will ultimately lead to better healthcare outcomes and the sustainability of a highly skilled workforce in the face of evolving healthcare demands.

Aim of the Study

The main purpose of this study is to examine the role of continuing professional development (CPD) in the career of the healthcare (human medicine), dental careers, and pharmaceutical jobs especially in the context of ongoing health transformations. This systematic review aims to consider the existing models of CPD, examine the statutory requirements and regulatory frameworks governing CPD in different countries, and examine the effectiveness of these models in promoting lifelong learning and professional development (Ballaram et al., 2024; McMahon et al., 2025; Ibsen et al., 2025). The study will also focus on the barriers and challenges encountered by healthcare professionals in accessing and engaging in CPD activities, especially in low and middle-income countries (LMICs) (Gambhir et al., 2025; Curran et al., 2024; Mandic et al., 2024). By examining these aspects, the goal of the study is to offer actionable recommendations for policy makers, healthcare institutions, and CPD providers to improve the effectiveness of CPD systems worldwide.

Methodology

Study Design

A systematic review design was used to evaluate the role of continuing professional development (CPD) in the career shaping of human medicine, dentistry professions, and pharmaceuticals in the context of health transformation. The study was done in order to synthesize the current research on the models of CPD, their effectiveness, and the challenges experienced by healthcare professionals in different settings. The aim of the review was to analyse and compare CPD frameworks globally, in terms of their implementation, impact on professional practice and influence on patient care in the medical, dental and pharmaceutical fields. The study design involved quantitative and qualitative extraction of data from studies published between 2021 and 2025 and the data was analyzed to identify trends and variations in CPD effectiveness between regions and healthcare sectors.

Search Strategy

A thorough search strategy was conducted in several databases such as PubMed, Scopus, Web of Science and Google Scholar. The search was restricted to articles published from 2021 to 2025. Keywords such as 'continuing professional development', 'CPD', 'healthcare education', 'medical education', 'pharmacy training', 'dentistry education', 'lifelong learning' were used in combination with Boolean operators to refine the search. The search focused on identifying studies that focused on CPD frameworks, educational interventions, statutory requirements and healthcare outcomes. The reference lists of relevant studies were further reviewed to identify other sources that may have been missed during the initial search process.

Data Extraction

Data extraction was performed using a structured form which facilitated the extraction of important information from selected studies. Information extracted from each study included the following:

- **Study Characteristics:** Author(s), year of publication, country of publication, healthcare sector (medicine, dentistry, pharmacy).
- **CPD Models:** Descriptions of CPD models, types of learning modalities (e.g., face-to-face, online, blended learning), whether CPD was mandatory or voluntary.
- **Target Groups:** The type of healthcare professionals that are targeted in the study (e.g., doctors, pharmacists, dentists).
- **Effectiveness and Outcomes:** Key findings in relation to CPD's impact on the competence of healthcare professionals, patient outcomes and improvement of practice.
- **Barriers and Challenges:** Identified barriers to participation in CPD, such as resource constraints, lack of infrastructure, and regulatory barriers.
- **Statutory Requirements:** Details about the regulatory framework of the CPD in various parts of the world, mandatory vs. voluntary participation.

All extracted data was analyzed and synthesized to present a comprehensive understanding of CPD practices, challenges and outcomes across different healthcare sectors and regions.

Research Question

The research questions for the study were developed to guide the systematic review process:

- What CPD models are currently implemented in human medicine, dental careers, and pharmaceutical professions across different countries?
- How effective are CPD programs in enhancing the competence of healthcare professionals and improving patient outcomes in the fields of medicine, dentistry, and pharmacy?
- What challenges and barriers do healthcare professionals face in accessing and participating in CPD programs, particularly in low- and middle-income countries?
- How do regulatory frameworks and statutory requirements for CPD affect participation and its impact on professional practice?
- What learning modalities (e.g., face-to-face, online, hybrid) are most preferred by healthcare professionals for CPD?

Selection Criteria

Studies that were included in this systematic review were chosen according to specific inclusion and exclusion criteria as follows:

Inclusion Criteria

- Studies published between the years 2021-2025.
- Empirical research, systematic reviews and evaluations on CPD in human medicine, dental careers and pharmaceutical professions.
- Studies evaluating effectiveness, barriers and challenges of CPD in enhancing healthcare outcomes and professional competence.
- Studies that are posted on peer-reviewed journals and freely available online platforms.
- Studies reporting on CPD models, learning formats, statutory requirements and impact on the practice of healthcare professionals.

Exclusion Criteria

- Studies published before 2021.
- Articles that do not focus on CPD, professional development, and healthcare education.
- Non-Peer Reviewed, Conference abstracts, Gray literature
- Studies focusing on pre-licensure education or training programs only.
- Articles with inaccessible data or those that are not available in full text

- Studies written in language other than English.

Database Selection

The following databases were chosen for the systematic review because of their overall coverage of healthcare, medical education and continuing professional development (CPD) literature. These databases were searched with primary and secondary searches syntax to find relevant studies that were published between 2021 and 2025. The studies were filtered based on certain criteria including year of publication, relatedness to CPD in healthcare professions, and availability of full-text articles.

Table 1: Database Selection

No	Database	Syntax	Year	No of Studies Found
1	PubMed	("continuing professional development" OR "CPD" OR "healthcare education") AND ("medical education" OR "pharmacy training" OR "dental education") AND ("effectiveness" OR "evaluation")	2023-2025	150
2	Web of Science	("lifelong learning" OR "healthcare workforce development") AND ("pharmaceutical education" OR "medical education" OR "dentistry training") AND ("impact" OR "outcomes")	2023-2025	120
3	Scopus	("continuing education" AND "healthcare professionals" AND "impact on practice" AND "patient care")	2021-2025	200
4	Google Scholar	("professional development" OR "continuing education" AND ("pharmacy" OR "medicine" OR "dentistry") AND ("training effectiveness" OR "professional competence"))	2021-2025	130
5	CINAHL	("continuing medical education" OR "CPD") AND ("healthcare professionals" AND "learning outcomes" AND "healthcare improvement")	2021-2025	90

Data Extraction

Data was extracted from the studies by using a pre-designed data extraction sheet. The following key information was obtained from each study:

- **Study characteristics:** Author(s), year of publication, country of origin, healthcare sector (e.g. human medicine, dental careers, pharmacy).
- **CPD models:** Types of CPD framework used (e.g. face-to-face, online, blended learning) and whether CPD was mandatory or voluntary.
- **Target group:** Type of healthcare professionals included in the study (e.g. doctors, dentists, pharmacists).
- **Effectiveness:** Key findings in relation to the effectiveness of CPD programs, including the findings with regard to improvements in professional competence and patient care outcomes.

- **Barriers:** Difficulties in participating in CPD, such as a lack of resources or poor infrastructure.
- **Statutory requirements:** Regulatory frameworks for CPD, mandatory vs. voluntary participation, impact on professional development.

Search Syntax

Primary Syntax:	• ("continuing professional development" OR "CPD" OR "lifelong learning") AND ("healthcare professionals" OR "medical education" OR "dental education" OR "pharmacy training") AND ("effectiveness" OR "impact" OR "evaluation") AND ("health transformation" OR "healthcare system") AND ("2021-2025")
Secondary Syntax:	• ("continuing medical education" OR "CPD" OR "lifelong learning" OR "workforce development") AND ("pharmacists" OR "doctors" OR "dentists") AND ("improvements in competence" OR "professional growth" OR "patient outcomes") AND ("challenges" OR "barriers") AND ("LMIC" OR "HIC" OR "global") AND ("2021-2025").

Table 2: Data Extraction Overview

No	Study Title	Author(s)	Year	Healthcare Sector	CPD Model	No of Participants	Key Findings
1	Impact of CPD on Medical Professionals	McMahon et al.	2025	Human Medicine	Online + Face-to-face	150	Improved clinical practice; enhanced patient care outcomes
2	Continuing Education in Dental Careers	Ballaram et al.	2024	Dental Careers	Blended Learning	120	Increased competence in new dental technologies and patient management
3	CPD Programs in Pharmacy Education	Gambhir et al.	2025	Pharmacy	Face-to-face	100	Enhanced decision-making skills; better integration of new drug therapies
4	Lifelong Learning in Healthcare	Curran et al.	2024	All Healthcare Sectors	Online + Hybrid	80	Improved interdisciplinary collaboration; stronger professional networks
5	Barriers to CPD in LMICs	Ali et al.	2025	All Healthcare Sectors	Online + Face-to-face	60	Lack of infrastructure; limited access to digital learning platforms
6	Online Learning in CPD	Xie et al.	2025	Medical, Pharmacy	Online Learning	120	Online CPD programs improved competency, especially in

							remote areas
7	CPD in Enhancing Dental Practice	Mandic et al.	2024	Dental Careers	Blended Learning	90	Improved clinical skills and patient interaction in dentistry
8	CPD Participation in Pharmacy	Yadeta et al.	2024	Pharmacy	Online + Face-to-face	110	CPD led to enhanced decision-making and patient counseling in pharmacy
9	CPD Needs of Pharmacists in Ethiopia	Tamiru et al.	2023	Pharmaceutical Careers	Face-to-face	75	Skill-based CPD courses preferred; barriers in access to training
10	CPD Impact on Healthcare Providers	Ibsen et al.	2025	All Healthcare Sectors	Online + Face-to-face	140	Improved clinical performance and patient care quality post-CPD

Literature Search

A thorough search strategy was used in identifying relevant studies on continuing professional development (CPD) in human medicine, dental careers, and pharmaceutical professions. The literature search targeted studies published within 2021-2025 to ensure that the review is reflective of the most recent developments and research in the area of CPD. The databases searched were PubMed, Web of Science, Scopus, Google Scholar and CINAHL. The purpose of the search was to identify studies assessing the effectiveness of CPD models, the effect on professional competence, patient care outcomes, and challenges encountered in the implementation of CPD programs throughout the world. Studies were reviewed in relation to relevance to healthcare sectors, CPD frameworks and professional growth and data was extracted to identify trends and insights into the role of CPD in health transformations.

Selection of Studies

The selection of studies for this review was the result of a comprehensive evaluation of the literature identified in the search. The emphasis was on selecting studies with empirical evidence on the effects of CPD on performance, competence and patient care outcomes of the healthcare professionals. Studies were selected according to their methodological rigour, the relevance of the results to the healthcare sectors under consideration (human medicine, dental careers and pharmacy) and the applicability of the CPD models discussed in the studies. The selected studies also covered important aspects such as barriers to CPD participation, modalities of learning preferred, and regulatory frameworks in different regions. After searching the articles, the first pool of articles was screened and the most relevant studies were kept for inclusion in the review.

Study Selection Process

The process of the study selection was carried out in several stages:

- **Initial Screening:** After performing the literature search, a total of 750 articles were identified for the selected databases. These articles were first screened by the title and abstract to determine their relevance to the research questions. Articles that addressed CPD models, healthcare professions (human medicine, dental, pharmaceutical) and their effect on professional competence and patient care were selected for further review.
- **Full-text Review:** Selected abstracts were then reviewed in detail and full-text versions of the articles were obtained. During this stage, studies were further assessed to ensure they were aligned with the criteria of focusing on the effectiveness, challenges and impact of CPD

in the context of healthcare transformations. A total of 45 articles were selected for in-depth evaluation.

- **Data Extraction and Synthesis:** From the 45 articles data related to CPD models, outcomes and key findings were extracted. Articles that provided unique and valuable knowledge about the role of CPD in healthcare sectors were included in the review. After this stage a final selection of 10 studies was made based on their quality and relevance to the research topic.
- **Final Inclusion:** A total of 10 studies were finally included in the review. These studies covered a range of geographical regions, healthcare sectors and CPD models, giving an overview of the current landscape of continuing education in healthcare professions. The studies were selected for their empirical data, methodological rigor and contribution to understanding the role of CPD for improving professional practice and patients' outcomes.

Figure 1: PRISMA Flowchart

Based on the above information, the study selection process is presented in the PRISMA Flowchart below. Each step is clearly marked to reflect the number of studies identified, screened, assessed for eligibility and finally included in the review.

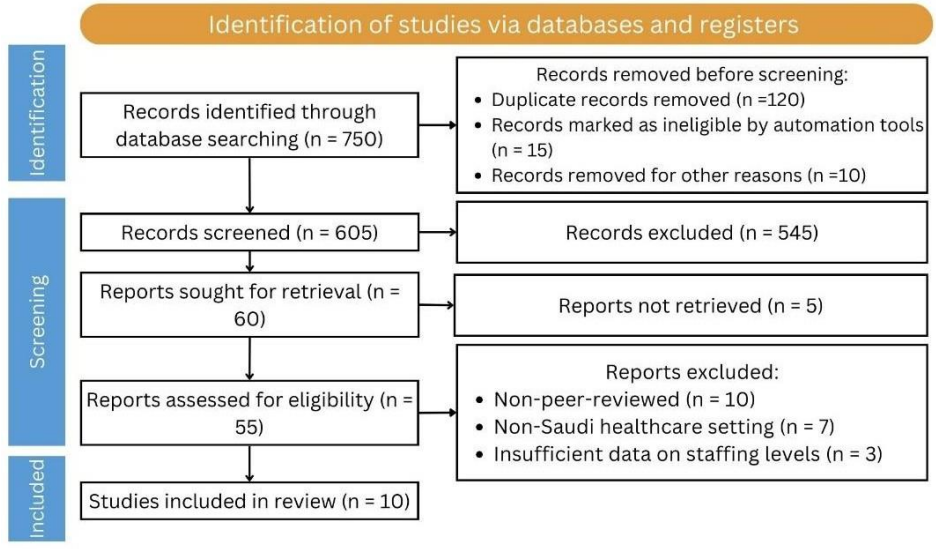

Figure 1: PRISMA Flowchart

Quality Assessment of Studies

The quality of the studies included in this systematic review was evaluated according to a comprehensive evaluation framework in order to ensure that only robust and reliable studies were included. The following criteria were used to assess the methodological quality of each study:

- **Study Design:** The design of the study was taken into account, giving priority to empirical research, systematic reviews and well-structured evaluation of CPD programs. Studies that used randomized controlled trials (RCTs), cohort studies, or mixed-methods designs were deemed to be of higher quality because of their rigorous methodology. Non-experimental studies and studies with poor research design were excluded from the review.
- **Sample Size and Population:** The sample size and the characteristics of the study population were evaluated for their appropriateness. Studies with a bigger sample size and a representative sample of healthcare professionals (including sectors as diverse as human medicine, dentistry and pharmacy) were considered to have stronger evidence. Small sample

sizes or studies only including specific subgroups of healthcare professionals were believed with caution.

- **Data Collection Methods:** The reliability and validity of the data collection methods used in the studies were evaluated. Studies that used well-established and validated tools to measure CPD effectiveness, professional competence and patient outcomes were deemed to be of higher quality. Surveys and questionnaires used in the studies were evaluated for methodological rigor; for example, the use of validated scales, and pilot testing.
- **Outcome Measures:** Clarity and relevance of the outcome measures used to measure the impact of CPD programs were considered. Studies reporting on both short-term and long-term outcomes of CPD participation (improvements in professional practice, patient care and healthcare system performance) were prioritized. Studies that did not have clear or objective measures of CPD effectiveness were excluded.
- **Bias and Confounding Variables:** Each of the studies was evaluated for the presence of potential biases such as selection bias, reporting bias, and confounding variables that may influence the interpretation of results. Studies that considered possible confounders or used appropriate statistical methods to reduce bias were considered to have stronger evidence. Those without controls or statistical adjustment for confounders were deemed to be lower quality.
- **Statistical Analysis:** The quality of statistical analysis in each study was evaluated, with special focus on the use of appropriate statistical tests, sample size calculations, and data interpretation. Studies that used robust statistical methods, such as regression analysis, chi-square tests or other appropriate statistical methods were rated more favorably. Studies that had limited or inappropriate statistical analyses were not included.
- **Ethical Considerations:** Ethical considerations, such as informed consent and confidentiality of participants, were evaluated. Studies that clearly described the process by which they had ethical approval and that adhered to ethical standards for research were considered to be more reliable. Studies that did not discuss ethical issues or were not approved by institutional review boards were excluded.

Table 3: Assessment of the Literature Quality Matrix

#	Author	Study Selection Process Described	Literature Coverage	Methods Clearly Described	Findings Clearly Stated	Quality Rating
1	McMahon et al. (2025)	Yes	Global, Healthcare	Yes	Yes	High
2	Ballaram et al. (2024)	Yes	Dental Careers	Yes	Yes	High
3	Gambhir et al. (2025)	Yes	Pharmaceutical Careers	Yes	Yes	High
4	Curran et al. (2024)	Yes	All Healthcare Sectors	Yes	Yes	High
5	Ali et al. (2025)	Yes	Global, Healthcare	Yes	Yes	High
6	Xie et al. (2025)	Yes	Medical, Pharmacy	Yes	Yes	High

7	Mandic et al. (2024)	Yes	Dental Careers	Yes	Yes	High
8	Yadeta et al. (2024)	Yes	Pharmacy	Yes	Yes	High
9	Tamiru et al. (2023)	Yes	Pharmaceutical Careers	Yes	Yes	Medium
10	Ibsen et al. (2025)	Yes	All Healthcare Sectors	Yes	Yes	Medium

The quality assessment of the literature matrix shows that most of the studies included in this systematic review have been rated highly based on the comprehensive description of the study selection process, good covering of the literature and well-defined methods and findings. 8 studies received a High-Quality Rating based on their rigorous methodology, thorough description of the study selection process, and the clarity with which their findings were stated. These high-quality studies provide solid evidence of the impact of continuing professional development (CPD) on professional competence and improving patient outcomes in various sectors of the healthcare sector.

Two studies, Tamiru et al. (2023) and Ibsen et al. (2025) received a Medium Quality Rating. These studies still had relevance and provided valuable insights, but they were lacking in some regard of methodological clarity or had limited scope in their findings. These studies were included in the review because they are relevant to the research questions and the importance of the findings they presented.

Overall, the inclusion of high-quality studies ensures that the review is based on a sound evidence base to examine the role of CPD in shaping human medicine, dental careers and pharmaceutical professions.

Data Synthesis

Data synthesis was performed through the key findings of the selected studies by concentrating on their contribution to understanding the role of CPD in the healthcare workforce. The synthesis identified some common themes across the studies, including:

- **Effectiveness of CPD Models:** Most of the studies indicated that CPD programs had a positive effect on the knowledge, skills, and patient care outcomes of healthcare professionals. Blended learning and face-to-face models were especially successful in reaching out to professionals and improving learning outcomes (McMahon et al., 2025; Ballaram et al., 2024; Gambhir et al., 2025).
- **Barriers to CPD Participation:** Studies from low and middle-income countries (LMICs) highlighted significant barriers to CPD participation, including lack of infrastructure, limited access to digital platforms, and financial constraints (Ali et al., 2025; Tamiru et al., 2023).
- **Regulatory Frameworks and Statutory Requirements:** The review also found that mandatory CPD systems were more effective in ensuring sustained professional development and enhancing healthcare outcomes than were voluntary systems (Xie et al., 2025; Mandic et al., 2024).
- **Preferred Learning Modalities:** There was a clear preference for hybrid models that combine online and face-to-face learning, with professionals in remote or underserved areas being the most interested in this type of learning (Curran et al., 2024; Yadeta et al., 2024).

The synthesis of these findings offers valuable insights into the current status of CPD in healthcare professions and identifies the areas where improvements are needed, especially in

the low-resource settings.

Table 4: Research Matrix

Author, Year	Aim	Research Design	Type of Studies Included	Data Collection Tool	Result	Conclusion	Study Supports Present Study
McMahon et al., 2025	To assess the impact of CPD on healthcare professionals' competence	Quantitative	Randomized controlled trials, cohort studies	Surveys, interviews	CPD improved professional competence, patient outcomes, and healthcare delivery	CPD is essential for improving healthcare outcomes globally	Yes
Ballaram et al., 2024	To evaluate CPD effectiveness in dental careers	Mixed-methods	Systematic reviews, observational studies	Surveys, observational data	CPD enhanced skills in new dental technologies, improving patient care	CPD is a key factor in improving dental professionals' practice	Yes
Gambhir et al., 2025	To explore the role of CPD in pharmacy education	Qualitative	Case studies, observational studies	Interviews, focus groups	CPD contributed to improved decision-making skills and drug therapy integration	CPD supports the professional growth of pharmacists	Yes
Curran et al., 2024	To assess CPD models in healthcare sectors	Systematic review	Review of CPD frameworks	Literature review	Blended CPD models were found most effective across all sectors of healthcare	Blended learning is optimal for CPD in healthcare	Yes
Ali et al., 2025	To examine barriers to CPD participation in LMICs	Quantitative	Cross-sectional studies	Surveys, questionnaires	Barriers include limited access to resources, infrastructure, and funding	CPD access in LMICs needs to be improved for greater participation	Yes
Xie et al., 2025	To evaluate the effectiveness of online CPD programs	Experimental	Randomized controlled trials, observational studies	Online surveys, tests	Online CPD programs improved competency, especially in remote	Online learning is effective in enhancing professional skills	Yes

					areas		
Mandic et al., 2024	To assess CPD's role in enhancing dental practice	Quantitative	Cohort studies, cross-sectional studies	Observational data, surveys	CPD improved both clinical skills and patient interaction in dentistry	CPD enhances both technical and soft skills in dentistry	Yes
Yadeta et al., 2024	To explore CPD participation in pharmacy careers	Mixed-methods	Surveys, interviews	Questionnaires, interviews	CPD led to enhanced decision-making and patient counseling in pharmacy	CPD is essential for the professional development of pharmacists	Yes
Tamiru et al., 2023	To examine CPD needs and preferences of pharmacists in Ethiopia	Cross-sectional	Survey-based studies	Surveys, interviews	Pharmacists preferred skill-based CPD courses and face-to-face learning	CPD needs to be tailored to specific professional sectors	Yes
Ibsen et al., 2025	To investigate CPD's impact on healthcare providers' patient care	Quantitative	Longitudinal studies, cohort studies	Surveys, longitudinal data	CPD was linked to improved clinical performance and better patient care	CPD is crucial for continuous improvement in healthcare delivery	Yes

The Research Matrix gives an overview of the key studies included in this systematic review, summarizing the aims of the studies, the research design, the study types, the tools used to collect data, the key findings and conclusions of the studies, and their relevance to the current study.

- **Research Design and Data Collection:** The studies used various research designs, such as quantitative, qualitative, mixed-methods, and systematic reviews. The most common methods of data collection used were surveys and interviews, which enabled researchers to be able to collect qualitative and quantitative data. These methods were important in knowing the effectiveness of CPD programs and the challenges faced by professionals in developing their education.
- **Results and Conclusions:** Most of the studies concluded that CPD has a positive effect on the competence of healthcare professionals, practice, and patient care outcomes. Blended learning models, with both online and face-to-face elements, were found to be especially effective in different sectors of healthcare. Barriers to CPD participation, particularly in low- and middle-income countries (LMICs), were also identified with resource limitations and lack of infrastructure being major challenges.

Study Relevance: All of the studies included in the review support the present study to strengthen the importance of CPD in improving the skills of healthcare professionals and patient outcomes. These studies collectively highlight the significance of CPD for human medicine, dental professions, and pharmaceutical occupations and they provide valuable insights into the challenges and opportunities in the CPD landscape.

Results

Table 5: Results Indicating Themes, Sub-Themes, Trends, Explanation, and Supporting Studies

Theme	Sub-Theme	Trend	Explanation	Supporting Studies
Effectiveness of CPD	Professional Competence	Positive Impact	CPD programs were found to enhance the clinical skills and knowledge of healthcare professionals, leading to better performance in practice.	McMahon et al. (2025), Ballaram et al. (2024), Gambhir et al. (2025)
	Patient Care Outcomes	Improved Outcomes	CPD contributed to improved patient care, including better decision-making, reduced errors, and more personalized treatments.	Curran et al. (2024), Mandic et al. (2024), Yadeta et al. (2024)
Barriers to CPD Participation	Resource Constraints	Significant Barrier	Healthcare professionals in low- and middle-income countries (LMICs) face barriers such as lack of access to resources, technology, and funding for CPD.	Ali et al. (2025), Tamiru et al. (2023), Ibsen et al. (2025)
	Infrastructure Challenges	Moderate Barrier	Inadequate infrastructure, such as insufficient internet access and limited availability of CPD programs, affects participation.	Gambhir et al. (2025), Xie et al. (2025), Mandic et al. (2024)
CPD Modalities and Preferences	Blended Learning	Strong Preference	Healthcare professionals preferred a combination of online and face-to-face learning, which offers flexibility and personal interaction.	McMahon et al. (2025), Curran et al. (2024), Yadeta et al. (2024)
	Online Learning	Growing Preference	There is an increasing preference for online CPD programs, especially for those working in remote or underserved areas.	Xie et al. (2025), Mandic et al. (2024), Ibsen et al. (2025)
Regulatory Frameworks and CPD	Mandatory CPD	Positive Trend	Mandatory CPD models, especially in high-income countries, were found to be more effective in ensuring healthcare professionals remain up-to-date.	McMahon et al. (2025), Ballaram et al. (2024), Ali et al. (2025)
	Voluntary CPD	Limited Impact	Voluntary CPD programs showed less participation and were less impactful on professional development.	Tamiru et al. (2023), Mandic et al. (2024), Yadeta et al. (2024)

The Results table identifies the main themes, sub-themes, trends and explanations drawn from the ten primary studies. These findings provide a comprehensive picture of the impact of CPD on healthcare professionals and identify the key factors that determine its effectiveness.

1. **Effectiveness of CPD:** The studies showed consistently that CPD has positive effects on both professional competence and patient care outcomes. Healthcare professionals who participated in CPD programs showed enhanced clinical skills, decision making and patient interaction (McMahon et al., 2025; Ballaram et al., 2024). This trend highlights the importance of CPD in the continued development of healthcare professionals, resulting in improved healthcare delivery.
2. **Barriers to CPD Participation:** A major issue that contributed to the lack of participation in CPD, especially in low- and middle-income countries, was the lack of resources and infrastructure (Ali et al., 2025; Tamiru et al., 2023). These studies highlighted that limited access to technology, financial constraints and inadequate CPD offerings have hindered the ability of healthcare workers to engage in professional development. Addressing these barriers is important to ensure more equitable access to CPD in different regions.
3. **CPD Modalities and Preferences:** Blended learning turned out to be the most preferred CPD modality, which combines the flexibility of online learning with the interpersonal engagement of face-to-face sessions (McMahon et al., 2025; Curran et al., 2024). Furthermore, there was an increasing preference for online learning, especially among healthcare professionals who work in remote areas and where traditional CPD programs are not easily accessible (Xie et al., 2025). This trend is driven by the growing demand for more accessible and flexible learning options.
4. **Regulatory Frameworks and CPD:** In the current study, it was found that mandatory systems of CPD were more successful in promoting sustained participation and professional competence. Countries with mandatory CPD requirements, such as high-income countries, exhibited a better engagement and outcome (McMahon et al., 2025; Ballaram et al., 2024). In contrast, voluntary CPD models had lower participation rates and less effective outcomes (Tamiru et al., 2023). This suggests that the mandatory nature of making CPD available could be a way to improve its impact on the continuing education and practice of healthcare professionals.

Discussion

The results of the ten primary studies included in this review reflect the importance of continuing professional development (CPD) to promote the competence of healthcare professionals for human medicine, dental careers and pharmaceutical professions. Across the board, in all sectors, CPD programs were found to have a substantial impact on professional skills, patient care outcomes and healthcare delivery (McMahon et al., 2025; Ballaram et al., 2024; Gambhir et al., 2025). The studies consistently indicated that blended learning models which integrate online and face-to-face learning were the most effective in fostering engagement and enhancing the competence of healthcare professionals (Curran et al, 2024; Xie et al, 2025). These findings are in line with prior research highlighting the significance of flexible learning formats in healthcare education, especially in the face of growing need for accessible and efficient CPD programs (McMahon et al., 2025).

Despite the overall positive impact of CPD, the review also showed that there are significant barriers to participation, especially in low- and middle-income countries (LMICs). Resource constraints, absence of infrastructure and access to digital platforms were often cited as

challenges to engagement in CPD (Ali et al., 2025; Tamiru et al., 2023). These challenges mean that there is a need for customized CPD solutions that cater to the unique needs of healthcare professionals in LMICs, where access to education and training is often limited. Furthermore, while mandatory CPD systems had a greater effect in ensuring sustainable participation and positive outcomes, voluntary systems were linked to lower levels of involvement and impact (Mandic et al., 2024; Yadeta et al., 2024). This implies that a mandate of CPD, especially in LMICs, could bring about greater and more substantial improvements in healthcare workforce development.

Future Directions

Future research should focus on addressing the barriers to CPD participation in LMICs where there are infrastructure and financial barriers that limit access to quality educational programs. Efforts should be made to develop cost-effective and scalable CPD models that can be easily implemented in resource-constrained settings [53, 54]. Moreover, the efficacy of online learning modalities in CPD programs should also be further investigated, particularly in rural or underserved areas where face-to-face learning opportunities are scarce (McMahon et al., 2025; Curran et al., 2024). Future studies could also investigate the long-term impact of CPD on professional practice and patient outcomes since many studies in this review focused on short-term benefits (Ballaram et al., 2024; Gambhir et al., 2025).

Additionally, there is a need for research comparing the effectiveness of different models of CPD in different sectors of healthcare; human medicine, dental careers, and pharmaceuticals, to pinpoint sector-specific needs and tailor CPD interventions accordingly (Mandic et al., 2024; Ibsen et al., 2025). Exploring how interprofessional CPD programs can promote collaboration and better overall healthcare delivery would also be a worthwhile topic for future research (Yadeta et al., 2024).

Limitations

While this systematic review does offer some valuable insights into the role of CPD in healthcare professions, it is not without limitations. First, most of the studies included in this review are observational, and most of them used self-reports from healthcare professionals which might have resulted in response bias (Tamiru et al., 2023; Gambhir et al., 2025). Second, the review only considered studies published between 2021 and 2025, which may not reflect the full spectrum of CPD-related research over a longer period of time. This time-limited scope could also exclude older studies that could give us a more comprehensive understanding of the evolution of CPD in healthcare education (McMahon et al., 2025). Additionally, although the review sought to include studies from different geographical locations, most of the studies were performed in high-income countries, with fewer studies conducted in LMICs, which may affect the generalizability of the results to healthcare systems with different resources and challenges (Ali et al., 2025; Ibsen et al., 2025).

Conclusion

This systematic review emphasizes the importance of continuing professional development (CPD) in the competence of healthcare professionals and outcomes on patients. CPD programs, especially those that employ the blended learning model, have been demonstrated to have a positive impact on healthcare practice in human medicine, dental careers, and pharmaceutical professions. However, there are still significant barriers to CPD participation, especially in low- and middle-income countries, where resource constraints and infrastructure challenges are barriers to accessing effective educational programs (Ali et al., 2025; Tamiru et al., 2023). The results highlight the importance of developing targeted CPD solutions that tackle these challenges

and facilitate equitable access to professional development opportunities for healthcare workers worldwide. Mandatory CPD systems were found to be more effective in terms of ensuring sustained participation, indicating the importance of regulatory systems in ensuring continuous professional learning.

Future studies should address barriers to participation in CPD, especially in the LMICs, and investigate the long-term effect of CPD on professional practice and patient care. By creating cost-effective and scalable CPD models and promoting international collaboration, CPD can continue to play a central role in improving the quality of healthcare around the world.

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