

A Systematic Review on Insights to Community Medicine and Clinical Research: Competency Training in Medical and Dental Education

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ABSTRACT

Background: Competency based training in medical and dental education has become important to train healthcare professionals to tackle clinical, cultural, and social aspects of healthcare. The innovations and developments in these training programs enabled a better understanding of healthcare and treatment planning. The purpose of this systematic review was to assess the implications of competency training in medical and dental curricula; more specifically, the incorporation of competency-based trainings with community medicine and research trials.

Methods: Using PRISMA criteria, the literature search was done in Google Scholar, ScienceDirect, and PubMed in articles published between 2020 and 2024. This review focused on competency-based education in medical and dental education, especially the intersection of competency-based education and community medicine and clinical research trials. Articles that were published in English and within the last five years were considered. Cross-referencing was done against other databases that ensured high-quality and comprehensive data. Studies that were related to non-healthcare students, without empirical evidence, or that were out of the scope were eliminated. The studies were evaluated by two independent reviewers, and the inter-rater reliability was calculated using Cohen's kappa coefficient. These reviewers screened the titles and abstracts of studies and then reviewed the full texts of studies for eligibility. Duplicate studies were removed using EndNote X9, and risk of bias was assessed using the Evidence Project risk of bias tool.

Results: Out of 94 articles, 15 were selected because they described training designs, outcomes, or difficulties in fulfilling the goals. The total number of participants was 4978 across medical and dental education. Competency training programs illustrated better results on healthcare competencies that included improved communication skills, enhanced cultural competence, and increased patient satisfaction. Hands-on training programs and the use of multimedia tools showed better outcomes as compared to the traditional methods. Challenges that were faced included differences in implementation, constraints in resources, and a lack of standardized assessments. The certainty of evidence showed moderate results for communication skills and patient satisfaction, and low to moderate results for the readiness in clinical trials and cultural competence due to variability in study design.

Discussion: Effective competency training curricula substantially enhanced the functioning of healthcare systems and results for patients. Variations in the implementation of competency training programs and the assessment methods used were the main reasons for heterogeneity. Inaccuracy was seen due to limitations in sample sizes in some studies and a lack of long-term follow-up in others, hence constraining the generalizability of the results. There should be improved structure and specification so that such techniques would be applied in routine across a wide range of establishments to create more systematically planned and effectively delivered training in diverse and complex settings.

Keywords: Competency-Based Education, Community Medicine, Clinical Research Trials, Medical Education, Dental Education, Patient-Centered Care.

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Competency based training in the medical and dental education has become a key element for the education of healthcare professionals to render modern patient care ¹. A diverse healthcare environment demanded that professionals should be provided with the skills to meet the clinical, social and cultural determinants of patient health ². Integration of community medicine and clinical research trials into the competency training program was essential for ensuring the readiness of healthcare professionals to respond to diverse patient populations. These innovative training models were designed to facilitate a deeper understanding of health and social factors affecting it. These models also enhanced healthcare delivery and contributed towards better clinical research in real-world settings ³. This training was customized with cultural competency so that healthcare professionals could practice effective communication with their patients from diverse cultural backgrounds ⁴. This training also helped to empower healthcare providers to offer personalized care that could respect cultural differences, which would contribute to increasing patient satisfaction levels, trust and adherence to the treatment plan ⁵. These training programs integrated clinical research trials, thereby allowing medical students to apply evidence-based clinical practices to help improve the outcomes, as well as the quality of healthcare overall ⁶.

Although the benefits were well recognized, there were several obstacles to the implementation of competency training programs that interlink community medicine and clinical research ⁷. These programs were hindered by variations in curriculum design, institutional support, and the lack of standardized training methods ^{8,9}. In addition, logistical issues such as restrictions on resources, time constraints, and the need for professional faculty training limited the degree of integration. These challenges made it hard to evaluate the direct

effects of such training on healthcare outcomes, and must therefore be addressed for future success ¹⁰.

This systematic review aimed to evaluate the effects of the integration of competency training in medical and dentistry education, with the focus on community medicine and clinical research trials. By synthesizing current research, this review assessed how these integrative training models promoted innovations in healthcare delivery, improved patient-centered care, and tackled challenges in clinical research.

METHODS

This systematic review adhered to the PRISMA guidelines 2020. It was conducted from June 2024 to September 2024. A systematic search across multiple databases retrieved 94 articles in total, which were published between 2020 and 2025. The studies were selected based on predetermined inclusion and exclusion criteria. The primary resources for the literature search were Google Scholar, Science Direct, and PubMed. Out of the total articles, 55% were sourced from Google Scholar, 35% from Science Direct, and 10% from PubMed. The search strategy included the following keywords: "competency training", "community medicine", "medical education", "dental education", "clinical research trials", and "healthcare diversity".

The focus of the articles was competency training in medical and dental education, particularly examining its intersection with community medicine and clinical research trials. The inclusion criteria also restricted that the article must be in the English language and must be to the last 5 years. To avoid the cases of inconsistency and incomplete data, the cross-referencing of the databases was made with consideration to ensure the accuracy and that no information was left out. Articles that did not meet the inclusion criteria, for instance, those that

involved non-healthcare students or had no empirical data, articles with inadequate data, and out of scope studies were omitted. The articles used in this review represented a global scope, with the highest number of articles coming from Asia, followed by America and Africa.

The studies were evaluated by two independent reviewers, and the inter-rater reliability was calculated using Cohen's kappa coefficient. These reviewers screened the titles and abstracts of studies and then reviewed the full texts of studies for eligibility. Duplicate records were removed using EndNote X9. Data extraction was done using a standardized form by the two independent reviewers. The primary outcomes that were assessed contained improvements in communication skills, levels of patient satisfaction, cultural competence, and readiness for clinical trials. Data was collected for all eligible studies. Comprehensive and validated measures were preferred when multiple outcome measures were available. The other variable data, which was extracted, contained: study characteristics, participant details, intervention types, and outcomes. Missing data was taken directly from the authors of the study, where necessary. A total of 86 articles were reviewed, and 15 of them were chosen for detailed analysis.

The risk of bias was assessed using the Evidence Project Risk of Bias tool. Missing data were taken from the study authors via contact, wherever necessary. However, no formal statistical methods or meta-analysis (such as funnel plots) were performed for the detection of reporting bias within the synthesis. Two independent reviewers evaluated each study and assessed selection, performance, detection, and attrition bias. Disagreements were resolved using discussion. For each outcome, the effect measures that were considered were mean difference for continuous variables and risk ratios for other categorical variables. Characteristics of interventions such as training focus, population, and study design were drawn in tabulated form and were compared against predefined groups for synthesis. Studies were categorized based on intervention types (e.g., communication skills training, clinical trial readiness, cultural competence) and were evaluated for the sake of alignment with the objectives of the review before inclusion in the final synthesis. Studies were grouped

based on intervention characteristics and compared against predefined criteria. The tabulated approach was used to present studies according to the relevant synthesis category.

Heterogeneity was handled using subgroup analysis. Although no sensitivity analysis was performed, GRADE framework was used to assess certainty for body of given evidence. Factors like study design, risk of bias, inconsistency in results, indirectness, and imprecision were evaluated to check the certainty.

These articles explored the efficiency of competency training, the challenges faced during the implementation of such programs, and the variations in the practice of healthcare across the regions.

RESULTS

Database searches identified 94 records, of which 8 were duplicates. A total of 86 records were screened, and 69 were assessed for retrieval. Fifty-four studies in total were excluded (n=18 out of scope, n=21 insufficient data, n=15 not research articles). The final review included 15 studies that met the inclusion criteria. The flow diagram of the study selection process is summarized in the PRISMA flow diagram (**Figure 1**). The included studies encompassed a variety of populations and geographic regions. 75% of these studies were conducted in Asia, 20% in the Americas, and 5% in Africa. The study designs included longitudinal (6), cross-sectional (5), and survey-based (4) designs. The studies focused on communication skills, interprofessional education, cross-cultural competence, and clinical trial readiness. Study characteristics and outcomes were detailed in **Table 1**. All the research articles included were published in the last five years (from 2020 to 2024).

Several studies were excluded despite thematic relevance. For example, Smith et al., 2022 focused on competency training in non-healthcare fields, Garcia et al., 2021 lacked empirical data, Chen et al. (2023) provided insufficient participant and intervention details, and Johnson et al., 2020 was an opinion piece without research-based evidence. These exclusions ensured that only empirical studies with adequate data and relevant scope were included in the synthesis.

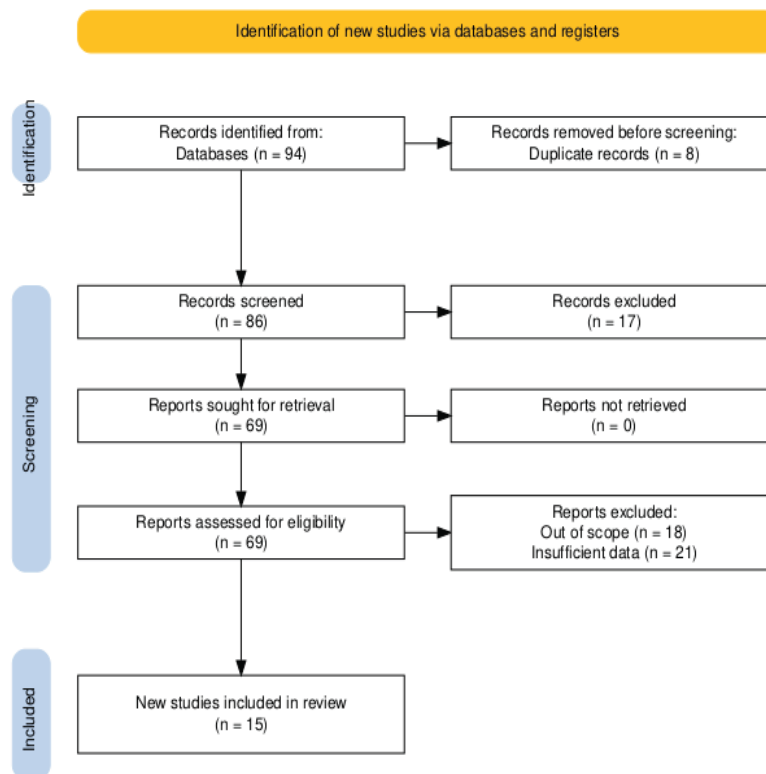


Fig. 1: PRISMA Model Demonstration of Selection and Elimination of Studies for Review Process Under the Inclusion Criteria.

The risk of bias was evaluated by the Evidence Project Risk of Bias tool. Most of the studies had moderate risk value due to some variability in study designs and reporting. High risk was identified in studies where control groups were absent or data were not complete. Measures to address these biases were applied inconsistently across studies and were noted accordingly. The studies showed positive impacts of competency training, such as improved communication skills, enhanced cultural competence, and an increase in the rate of patient satisfaction. Some challenges were underscored that including variability in implementation, resource constraints, and lack of standardized methodologies. New methods like hands-on training and multimedia tools showed improvement in results compared to traditional theoretical methods.

The certainty of evidence for communication skills, patient satisfaction, and effectiveness of hands-on training was moderate. While for clinical trial readiness and cultural competence, it was low to moderate due to variability in study designs and measurement tools. Low certainty was seen for long-term healthcare outcomes due to a lack of longitudinal studies. Hence, standardized methods and rigorous assessments are required to strengthen future evidence.

Table 1: Summary Table for Studies Listed According to Inclusion Criteria.

Authors & Year (Region)	Study Design (Population N)	Training Focus	Confounders Addressed	Outcomes Measured	Key Findings	Innovations & Challenges Highlighted
Faizin, 2023 (Indonesia) ¹¹	Quantitative cross-sectional study (N=185 students (142 medical, 43 dentistry))	Interprofessional education readiness	Gender, field of study	Readiness for collaboration, teamwork, and communication in community medicine interventions	65.36% readiness for collaborative practice; no significant differences between medical and dentistry students, supporting IPE implementation	Emphasized the need for broader IPE training to prepare students for community-based care practices

Lu et al., 2020 (Taiwan) ¹²	Multistage survey study (N=1567 medical students, 122 clinical teachers)	Cross-cultural care competence (CCC)	Gender, education stage, and institutional differences	Perceived preparedness, skills, and educational environment gaps for treating diverse groups	Students perceived gaps in CCC training as they advanced; insufficient curriculum coverage on cultural diversity led to perceived unpreparedness	Highlighted curriculum gaps in cultural diversity training; proposed targeted modules to address unmet needs
Lee et al., 2020 (Global: Sub-Saharan Africa, Latin America) ¹³	Survey-based study (N=35 clinical investigators)	Clinical trial competency and training needs	Geographic region differences, self-perceived competence vs. relevance	Role-relevance and self-competence in 9 domains	Low competence in data management, informatics, and community engagement; ethical considerations scored highest for competence and relevance	Identified regional disparities in clinical trial training; suggested resource-sharing and tailored interventions
Sulena et al., 2024 (India) ¹⁴	Survey-based study (N=60 faculty, 32 administrators, 580 students)	CBME implementation and challenges	Faculty training levels, infrastructure adequacy, and student awareness	Perceptions of CBME reforms, challenges, and proposed solutions	Lack of trained faculty and infrastructure; students valued integrated teaching and electives	Proposed faculty development programs and resource optimization to enhance CBME effectiveness
Febbraro et al., 2023 (Canada) ¹⁵	National questionnaire study (N=41 respondents: residents, fellows, new-to-practice physicians)	Medical oncology clinical trials and CBME impact	Training variability, region-specific resources	Competence, preparedness, and willingness for clinical trial roles	Most trainees rated competence and preparedness as poor; willingness to participate in trials remained high	Addressed the need for standardized competency-based training in oncology clinical trials
Sankar et al., 2020 (India) ¹⁶	Questionnaire-based cross-sectional study (N=296: medical undergraduates, residents, doctors)	Knowledge, attitude, and perception of clinical trials	Sampling bias, response rate	Mean knowledge, attitude, and perception scores;	Good knowledge and positive attitudes towards clinical trials, but negative perceptions about	Suggested targeted education and sensitization programs to improve perceptions of local clinical trials
Hsiao et al., 2020 (Taiwan) ¹⁷	Randomized controlled trial (N=96: final-year medical students)	Interactive multimedia eBook for clinical competency training	Variability in baseline OSCE scores, user interface issues	OSCE scores (mock and national); cognitive learning gain; user satisfaction feedback	Enhanced OSCE scores correlated with better confidence, problem-solving abilities, and better doctor-patient relationship outcomes	Demonstrated multimedia tools' potential to improve competency outcomes; addressed user interface challenges
Dieck-Assad et al., 2021 (Mexico) ¹⁸	Quantitative study (N=197, TEC undergraduates)	Emergency First Response (EFR) Competency	Variations in training approach, duration, and regional disparities	Certification grade, capstone project outcomes	High performance in EFR competency post-training. Students demonstrated significant skills in CPR, bandages, etc., and developed innovative emergency response tools.	Showcased innovation in emergency response training tools; emphasized practical application of EFR skills
Shukla et al., 2022 (India) ¹⁹	Interventional study (N=57, MBBS undergraduates)	Research Methodology Skills	Prior knowledge of research methodology	Pre and post-test scores, learning gain	Research training significantly improved understanding of methodology. Learning gain was 59.1%. Classroom environment and mentorship played key roles.	Highlighted mentorship and interactive environments as critical for research methodology training

Sng et al., 2023 (Singapore) ²⁰	Cross-sectional study (N=264 dental students)	Management of medically compromised patients	Education type: theory vs. experiential learning	Confidence in acute/emergency care, MCQ scores	Theory-only training is insufficient for managing acute/emergency medical conditions. Experiential learning increased confidence and competence.	Advocated for experiential learning methods to better prepare students for emergency care scenarios
Mills et al., 2021 (USA) ²¹	Cross-sectional survey (N=285; responses=124, 43.5%)	Community of Practice (CoP) in dental education	Gender, academic year, prior cohort training data	Perceptions of CoP on knowledge-building, preparedness for practice, and professional development	CoP effectively supports knowledge sharing, readiness for clinical practice, and professional networking	Proposed CoP as a scalable model for fostering professional collaboration and practice readiness
Khan et al., 2021 (Pakistan) ²²	Cross-sectional study (N=110; response rate=73%)	Undergraduate dental curriculum	Comparison between final-year students and house officers	Satisfaction with education quality, clinical training preparation for independent practice	Only 23% were satisfied with the education quality; 25% felt prepared for independent practice	Indicated need for curricular reforms to better align education with independent practice demands
Jawade et al., 2021 (India) ²³	Cross-sectional online survey study (N=300 interns)	Research opportunities and challenges	Gender, age, institution, and education level	Knowledge, attitude, and practice regarding research; interest in future research	Research skills are seen as critical; students face barriers like a lack of knowledge and stress in the research processes	Emphasized the importance of reducing research barriers and promoting skill-building initiatives
Chawin Suwanchatchai et al., 2024 (Thailand) ²⁴	Single-group pre-post interventional study (N=193 students: 152 medical, 41 health promotion)	Enhancing collaborative competencies through CBIPE	Gender, cultural integration in community settings	IPE competencies (ICCAS Thai version), student satisfaction	Significant improvement in IPE skills; high satisfaction; time limitations for some activities noted	Highlighted time constraints as a challenge to implementing community-based IPE programs
IE Yarhere et al., 2023 (Nigeria) ²⁵	Cross-sectional survey study (N=238 educators) and qualitative panel discussion (6 experts)	Improving teaching competencies to scale up student output	Barriers to certification, brain drain impacting teaching	Educator perceptions on teaching certification, panel insights on improving teaching strategies	15.5% of educators had certification; the majority supported faculty development but opposed mandatory certification; short courses were preferred for skill enhancement	Suggested short courses and certification reforms to address faculty development challenges

Table 2 showed the assessment of risk of bias using the Evidence Project Risk of Bias Tool. The studies were categorized as responses, No (high risk of bias), NR (Not Reported) or Yes (low risk of bias). The cohort (Yes) was defined in many studies, but lacked random assignment and selection process (No). Only few studies reached an 80% follow-up rate or ensured baseline equivalence. The table is a structured overview by which methodological rigor is assessed in studies.

Table 2: Risk of Bias Assessment of Individual Studies

Authors & Year (Region)	Study Cohort	Control or Comparison Group	Pre/Post Intervention Data	Random Assignment of Participants to the Intervention	Random Selection of Participants for Assessment	Follow-up Rate of 80% or More	Comparison Groups Equivalent on Sociodemographic	Comparison Groups Equivalent at Baseline on Disclosure
Faizin, 2023 (Indonesia) ¹¹	Yes	No	No	No	No	No	No	No
Lu et al., 2020 (Taiwan) ¹²	Yes	Yes	Yes	No	No	Yes	No	No
Lee et al., 2020 (Global: Sub-Saharan Africa, Latin America) ¹³	Yes	No	No	No	No	No	No	No

Sulena et al., 2024 (India) ¹⁴	Yes	Yes	Yes	No	No	No	No	No
Febbraro et al., 2023 (Canada) ¹⁵	Yes	Yes	No	No	No	No	No	No
Sankar et al., 2020 (India) ¹⁶	Yes	No	Yes	No	No	No	No	No
Hsiao et al., 2020 (Taiwan) ¹⁷	Yes	Yes	Yes	No	No	No	No	No
Dieck-Assad et al., 2021 (Mexico) ¹⁸	Yes	Yes	No	No	No	No	No	No
Shukla et al., 2022 (India) ¹⁹	Yes	No	Yes	No	No	No	No	No
Sng et al., 2023 (Singapore) ²⁰	Yes	Yes	Yes	No	No	No	No	No
Mills et al., 2021 (USA) ²¹	Yes	Yes	Yes	No	No	No	No	No
Khan et al., 2021 (Pakistan) ²²	No	No	No	No	No	NA	NA	NA
Jawade et al., 2021 (India) ²³	No	No	No	No	No	NA	NA	NA
Chawin Suwanchatchai et al., 2024 (Thailand) ²⁴	Yes	Yes	Yes	No	No	No	No	No
IE Yarhere et al., 2023 (Nigeria) ²⁵	Yes	Yes	No	No	No	No	No	No

Yes: Indicates the presence of the specified characteristic, No: Indicates the absence of the specified characteristic, NA: Not applicable, NR: Not reported.

DISCUSSION

The objective of this systematic review was to determine the effects of competency training programs in medical and dental education primarily focusing upon the integration of these training programs with community medicine and clinical research trials. This review aimed to determine whether such training programs could enhance healthcare providers' potential to deliver effective care to diverse populations. The findings suggested that competency training programs, especially the ones that focus on communication and interpersonal skills, significantly improved healthcare delivery²⁶. These programs increased healthcare providers' understanding of the diversity of cultures and improved their ability to communicate effectively with patients from various ethnic backgrounds, which ultimately enhanced patient satisfaction and clinical outcomes²⁷. Studies by researchers indicated that readiness for collaboration through interprofessional education was a critical factor in improving the delivery of healthcare in community settings. These programs were found to improve communication, nourish empathy, and create more patient-centered care models in other studies as well,^{11,24}.

Furthermore, researchers supported the notion that competency training helped in bridging the gaps in communication between healthcare providers and patients, reducing unevenness in the domain of healthcare^{12,16}. By understanding diverse beliefs and practices that were related to health, these programs not only addressed technical aspects of healthcare but also improved interpersonal relationships

between healthcare providers and patients belonging to diverse cultural backgrounds. These findings were consistent with the general improvements observed in healthcare settings where competency-based training was a part of the curriculum^{28,29}.

Despite the results of this review, the studies also highlighted that the effectiveness of these training programs varied, depending on several factors such as duration of the training, the specific topics covered, and the mechanism of delivery^{30,31}. For example, it was found that structured mentorship and immersive learning experiences helped in improving clinical trial competency and research knowledge among trainees significantly. These findings suggested that hands-on, experience-based learning and consistent long-term training were much more effective than short-term theoretical training^{13,15}. However, a study showed that there was still variability in the implementation of these programs that caused inconsistent outcomes concerning patient recovery and attitudes of healthcare providers¹⁹.

Moreover, some other factors which might have influenced the efficacy of these training programs included baseline competency of the participants, their previous experiences and the resources available for the program^{32,33}. As indicated by a recent study, the institutional commitment and training support played a significant role in success of these initiatives. Institutions that prioritized diversity and inclusion tended to see more positive outcomes

from these general competency training programs²⁵. Moving forward, some studies that were reviewed pointed out that there was no standardized method for evaluating the impact of competency training³⁴. For instance, while some longitudinal studies reported improvements in healthcare outcomes as well as patient satisfaction, the short-term studies didn't show much improvement^{18, 23}. This lack of standardization complicated the comparison among the results across different studies and therefore emphasized the need for more rigorous, comparable research designs to better understand the actual impact of competency training on healthcare outcomes.

In addition, the role of engaging, learnable, and welcoming training methods could not be overstated. It was demonstrated that hands-on experiences such as problem-solving activities in the real world significantly enhanced the effectiveness of training programs, which lead to greater retention of competency skills and improved the relationship between healthcare provider and patient^{17,20}. Interactive training programs that were longer in length showed better efficacy in helping healthcare providers to internalize the principles of competence. This ultimately contributed to attaining more empathetic care, resulting in better patient outcomes^{35,36}. However, there were some challenges in scaling these programs, especially in regions where resources were limited. It was also highlighted that the infrastructure needed to support comprehensive training programs was lacking, particularly in low-resource settings²¹. In such scenarios, competency training might not be prioritized, which hindered its effectiveness in addressing healthcare-related problems. Additionally, "to make competency-based education a priority" must be a part of government policy so that systematic inequalities in healthcare delivery systems can be tackled³⁷.

Ethical considerations also arose during the assessment of competency training programs. Critics argued that competency measured by standardized tests and self-assessments might not be able to adequately capture the complexities of individual biases, systematic inequities and structural challenges within healthcare systems³⁸. These concerns highlighted the need for more comprehensive frameworks for evaluation that considered not only the immediate influence of training but also the long-term effects on healthcare systems and patient care³⁹. This review also showed some limitations, such as restricted use of the database, differences in study designs, and a lack of standardized assessment tools. The drawbacks can be polished further to make the review process smooth

Innovative approaches as shown in studies towards competency training introduced dynamic, learn-

er-centered strategies which were designed to address key gaps in medical and dental education. These strategies adhered to the interactive digital tools, experiential learning methods, and collaborative frameworks to enhance professional growth among trainees. By prioritizing hands-on experiences, targeted interventions, and adaptable training models, these advancements served the multiple needs of learners and populations equivalently⁴⁰.

In the end, competency training in medical and dental education showed significant potential in improving healthcare delivery and patient outcomes. However, to take benefits from such programs completely, future research should focus on developing standardized evaluation methods, making longitudinal studies compulsory and incorporating diverse populations so that more comprehensive understanding can be taken from the role of competency in healthcare. Healthcare institutions must prioritize competency training programs as a core component of their mission to improve patient care and reduce disturbances in the medical field.

CONCLUSION

Competency based training programs had core value in enhancing medical and dental education and communication, culture, and evidence-based practice. These programs improved patient care and comfort by strengthening the extent to which various populations' needs could be met and ultimately, by enhancing their healthcare providers' capabilities. The future needs should lay in developing long-term, realistic programs that would integrate the students into the environment of their practice and encourage an international outlook for improving the functioning of health care organizations across the world.

LIST OF ABBREVIATIONS

CBME: Competency-Based Medical Education
CMA: Comprehensive Meta-Analysis
CCC: Cross-Cultural Care Competence
CoP: Community of Practice
CBIEP: Community-Based Interprofessional Education
IPE: Interprofessional Education
OSCE: Objective Structured Clinical Examination
EFR: Emergency First Response

CONFLICT OF INTEREST

None

AUTHORS' CONTRIBUTIONS

All participants participated equally as per ICMJE.

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