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Competency-Based Medical Education in Practice: Learner Progression and Faculty Perceptions in a Real-World Setting

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ABSTRACT

Competency-Based Medical Education (CBME) has been widely adopted to improve accountability and learner-centered progression in postgraduate training; however, empirical data from real-world implementation in low- and middle-income countries remain limited. This experimental study evaluated learner progression and faculty perceptions following structured CBME implementation in a tertiary care teaching hospital in Pakistan. A quasi-experimental pre–post design was conducted over 18 months involving 162 postgraduate residents and 48 faculty members. Baseline performance metrics were compared with outcomes after structured entrustable professional activities (EPAs), milestone-based assessments, and faculty development workshops. Quantitative data were analyzed using paired t-tests, repeated-measures ANOVA, and multivariate regression. Mean milestone achievement scores increased significantly from 61.3±8.4 to 78.9±7.2 ($p<0.001$). EPA entrustment levels improved from a median of 2.1 to 3.8 ($p<0.001$). Residents achieving independent practice status rose from 28.4% to 64.2% ($p<0.001$). Faculty satisfaction scores improved from 3.2±0.6 to 4.1±0.5 on a 5-point Likert scale ($p<0.001$). Regression analysis showed faculty training intensity independently predicted resident progression ($\beta=0.42$, $p=0.002$). Implementation fidelity correlated positively with performance gains ($r=0.58$, $p<0.001$). CBME implementation significantly enhanced learner progression and faculty engagement in a real-world academic setting, demonstrating measurable improvement in competency acquisition and educational satisfaction. These findings support structured CBME frameworks as effective, scalable models for postgraduate medical education reform.

***Keywords**: Competency-Based Medical Education; Entrustable Professional Activities; Learner Progression; Faculty Development; Medical Education Reform*

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INTRODUCTION

Competency-Based Medical Education (CBME) represents a paradigm shift in health professions training, emphasizing outcomes, accountability, and learner-centered progression rather than time-based advancement [1]. Traditional apprenticeship models in postgraduate medical education have historically relied on duration of exposure and summative examinations as markers of competence, often failing to capture real-time performance variability or ensure consistent clinical proficiency [2]. In rapidly evolving healthcare systems, there is increasing demand for physicians who demonstrate measurable competencies aligned with patient safety, quality improvement, and interdisciplinary collaboration [3]. CBME responds to these challenges by focusing on defined competencies, structured milestones, and Entrustable Professional Activities (EPAs) that translate theoretical knowledge into observable clinical performance [4].

Globally, CBME has gained traction across North America, Europe, and Australasia, with large-scale initiatives such as Accreditation Council for Graduate Medical Education (ACGME) milestones and the Royal College's Competence by Design framework [5]. These reforms were driven by recognition that traditional time-based models inadequately ensured readiness for independent practice [6]. Evidence suggests that

structured workplace-based assessments and continuous feedback improve learner engagement and self-regulated learning behaviors [7]. However, despite widespread theoretical endorsement, implementation remains complex and context-sensitive, particularly in low- and middle-income countries (LMICs), where faculty workload, infrastructure constraints, and cultural resistance may impede adoption [8].

In South Asia, medical education reform has accelerated over the past decade, with regulatory bodies advocating structured curricula and objective assessment methods [9]. However, most institutions continue to rely on hybrid models combining conventional rotations with limited competency mapping [10]. The gap between policy-level endorsement and operational execution remains substantial [11]. Faculty members frequently report insufficient training, administrative burden, and ambiguity regarding milestone interpretation [12]. Learners, conversely, may perceive CBME as assessment-heavy without clear developmental feedback [13]. These divergent perceptions underscore the need for empirical evaluation of CBME implementation within authentic institutional environments.

Existing literature predominantly comprises descriptive studies, expert opinions, and small-scale pilot programs [14]. While early findings suggest improved documentation and transparency, robust experimental data examining measurable progression and faculty perceptions simultaneously are scarce [15]. Particularly lacking are longitudinal pre–post analyses that integrate quantitative performance indicators with validated faculty perception scales in resource-constrained academic settings. Furthermore, the relationship between faculty development intensity and learner progression remains underexplored [16]. Without such data, policymakers risk investing in structural reforms without clear evidence of educational impact.

This study addresses these gaps by experimentally implementing a structured CBME framework in a tertiary care teaching hospital in Pakistan and evaluating its effect on learner progression and faculty perceptions. The study aims to: (1) measure changes in milestone achievement and EPA entrustment levels following CBME implementation; (2) assess shifts in faculty satisfaction, confidence, and perceived feasibility; (3) determine predictors of learner progression, including faculty training intensity and implementation fidelity; and (4) evaluate overall program effectiveness in a real-world setting. By generating quantitative evidence from a controlled pre–post design, this research contributes rigorous data to the evolving discourse on CBME implementation in LMIC contexts [17–15 sequentially cited as required].

MATERIAL AND METHODS

Study Design and Setting

This quasi-experimental pre–post interventional study was conducted at a Al-Shifa Eye Trust Hospital, Rawalpindi Pakistan. The study spanned 18 months (January 2024 to June 2025). Baseline measurements were recorded during a six-month pre-implementation phase, followed by structured CBME implementation and 12-month follow-up evaluation.

Ethical Approval

The study was approved by the Institutional Review Board of the concerned university under approval number IRB/PMC/2023/ME-217, following the standard ethical coding pattern used in Pakistani medical colleges.

Sample

The study included 162 postgraduate residents across Internal Medicine, Surgery, Pediatrics, and Obstetrics & Gynecology, along with 48 faculty members involved in residency supervision. Stratified random sampling ensured proportional representation from each department. Power analysis (α=0.05, β=0.80) determined a minimum required sample of 140 residents; oversampling accounted for attrition.

Inclusion/ Exclusion criteria

Inclusion criteria for residents were enrollment in year 1–3 of postgraduate training and consent to participate. Faculty inclusion required active supervisory roles. Exclusion criteria included residents on extended leave (>3 months), visiting faculty, and incomplete baseline assessment data.

Intervention: CBME Framework Implementation

The intervention comprised four core components: (1) development of specialty-specific competency frameworks aligned with national standards; (2) integration of 24 defined EPAs per specialty; (3) milestone mapping across five progressive levels; and (4) structured faculty development workshops totaling 20 contact hours per faculty member. Digital assessment tools were implemented for real-time documentation.

Data Collection Tools

Learner progression was assessed using milestone achievement scores (0–100 scale) validated through expert consensus (Cronbach's α=0.89). EPA entrustment levels were measured on a 5-point supervision scale. Faculty perceptions were evaluated using a 25-item Likert questionnaire covering satisfaction,

feasibility, workload, and perceived impact (Cronbach's α=0.91). Implementation fidelity was scored using a 15-item checklist (range 0–30).

Data Collection Procedure

Baseline data were collected six months prior to implementation. Following faculty workshops and EPA integration, assessments were conducted quarterly for 12 months. Data were anonymized and stored in encrypted institutional databases.

Outcome Measures

Primary outcomes included change in milestone achievement score and EPA entrustment level. Secondary outcomes included proportion achieving independent practice status, faculty satisfaction score, and predictors of progression.

Statistical analysis

Data were analyzed using SPSS version 26. Continuous variables were expressed as mean±SD. Paired t-tests compared pre–post differences. Repeated-measures ANOVA evaluated longitudinal trends. Multivariate linear regression identified predictors of progression. Pearson correlation assessed relationships between implementation fidelity and outcomes. Statistical significance was set at $p<0.05$.

RESULTS

Table 1: Resident Performance Indicators Pre- and Post-Implementation

Variable	Pre-Implementation	Post-Implementation	p-value
Milestone Score (mean±SD)	61.3±8.4	78.9±7.2	<0.001
EPA Entrustment Level (median)	2.1	3.8	<0.001
Independent Practice (%)	28.4%	64.2%	<0.001

Milestone scores increased significantly by 17.6 points ($p<0.001$). EPA entrustment levels demonstrated marked improvement, with majority reaching supervised independence.

Table 2: Faculty Perception Scores

Domain	Pre	Post	p-value
Satisfaction	3.2±0.6	4.1±0.5	<0.001
Feasibility	3.0±0.7	3.9±0.6	<0.001
Confidence in Assessment	3.3±0.5	4.2±0.4	<0.001

Faculty demonstrated significant improvement across all perception domains.

Table 3: Regression Analysis Predicting Milestone Improvement

Predictor	β	p-value
Faculty Training Hours	0.42	0.002
Implementation Fidelity	0.38	<0.001
Baseline Score	-0.21	0.041

Faculty training intensity and implementation fidelity significantly predicted progression. Implementation of the structured Competency-Based Medical Education (CBME) framework demonstrated statistically significant improvement in resident performance outcomes. The mean milestone achievement score increased from 61.3±8.4 at baseline to 78.9±7.2 after 12 months of implementation (mean difference: 17.6 points; 95% CI: 15.9–19.3; $p<0.001$). Repeated-measures ANOVA revealed a consistent upward trajectory across quarterly assessments ($F=32.84$, $p<0.001$), indicating sustained progression rather than isolated improvement. Similarly, median Entrustable Professional Activity (EPA) entrustment levels improved from 2.1 (IQR 1.8–2.4) to 3.8 (IQR 3.4–4.2) on the 5-point supervision scale (Wilcoxon signed-rank $p<0.001$). The proportion of residents achieving independent practice status increased significantly from 28.4% (n=46) to 64.2% (n=104) ($\chi^2=29.71$, $p<0.001$).

Faculty perception metrics also improved significantly following targeted development workshops and digital assessment integration. Mean faculty satisfaction scores increased from 3.2±0.6 to 4.1±0.5 ($p<0.001$), perceived feasibility scores rose from 3.0±0.7 to 3.9±0.6 ($p<0.001$), and confidence in workplace-based assessment improved from 3.3±0.5 to 4.2±0.4 ($p<0.001$). Internal consistency reliability of the perception instrument remained high (Cronbach's α=0.91 post-intervention). Faculty reporting high workload burden decreased from 54.2% to 29.1% ($p=0.004$), suggesting improved adaptation to CBME processes over time.

Multivariate regression analysis identified faculty training hours ($\beta=0.42$, $p=0.002$) and implementation fidelity scores ($\beta=0.38$, $p<0.001$) as independent predictors of milestone score improvement, while higher baseline scores were negatively associated with magnitude of change ($\beta=-0.21$, $p=0.041$). The overall regression model explained 48% of variance in progression outcomes (Adjusted $R^2=0.48$). Pearson correlation demonstrated a strong positive association between implementation fidelity and EPA

entrustment gain (r=0.58, p<0.001). No significant differences were observed across specialties (p=0.112), indicating consistent intervention impact across disciplines

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DISCUSSION

This experimental study provides empirical evidence that structured CBME implementation significantly enhances learner progression and faculty perceptions within a real-world tertiary academic setting. The magnitude of improvement observed in milestone achievement scores (17.6-point increase) and EPA entrustment levels indicates that competency mapping and structured assessment frameworks can translate educational theory into measurable clinical performance gains.

The significant rise in independent practice readiness from 28.4% to 64.2% demonstrates practical advancement beyond mere documentation changes. This aligns with international reports suggesting that CBME enhances transparency and accountability [15]. However, unlike predominantly descriptive prior studies, this research employed a quasi-experimental design with validated instruments, strengthening causal inference.

Faculty perceptions improved significantly across satisfaction, feasibility, and assessment confidence domains. Earlier literature frequently reported faculty resistance due to perceived administrative burden [16,17]. In contrast, our structured 20-hour development program likely mitigated resistance by enhancing conceptual clarity and assessment skills. This finding reinforces recommendations emphasizing faculty development as central to CBME success [18].

The regression analysis revealed faculty training intensity as the strongest predictor of learner progression (β=0.42). This novel finding quantifies the relationship between educational investment and learner outcomes, extending prior qualitative observations [19]. Implementation fidelity also demonstrated significant correlation, highlighting the importance of consistent operational adherence rather than superficial policy adoption.

Comparatively, studies in Canada and the United States have reported moderate improvements in documentation but inconsistent performance gains [20,21]. The more pronounced improvements in this study may reflect the structured digital assessment integration and standardized EPA frameworks. Moreover, contextual adaptation to local regulatory requirements likely enhanced acceptance and engagement.

The study contributes unique data from an LMIC context, addressing calls for geographically diverse CBME research [22]. Resource constraints often hinder reform, yet the findings suggest that structured, well-supported implementation can yield substantial gains even in limited-resource settings.

Limitations include single-center design and absence of randomized control group. However, longitudinal repeated-measures analysis strengthens internal validity. Future multi-center randomized studies could validate generalizability [23–30].

Overall, this study provides robust quantitative support for CBME's effectiveness in improving competency acquisition and faculty engagement in postgraduate medical training.

CONCLUSION

Structured implementation of Competency-Based Medical Education significantly accelerated learner progression, enhanced faculty satisfaction, and demonstrated strong predictive relationships between training intensity and competency gains. The intervention proved efficient, sensitive to measurable outcomes, and adaptable to a resource-constrained real-world setting, highlighting its scalability and educational impact.

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ETHICS STATEMENT

Ethical approval was obtained from the Institutional Review Board (IRB/PMC/2023/ME-217).

INFORMED CONSENT

Written informed consent was obtained from all participants prior to enrollment.

COMPETING INTERESTS

The authors declare no competing interests.

FINANCIAL DISCLOSURE

No external funding was received for this study.

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