

Phase-wise Differences in Undergraduate Medical Students' Perceptions of Competency-Based Medical Education: A Cross-sectional Study with an Exploratory Qualitative Component

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Abstract

Introduction: Competency-Based Medical Education (CBME) has been implemented in undergraduate medical education in India to promote competency-oriented and learner-centred training. However, students' perceptions may vary across different stages of the MBBS curriculum. This study evaluated phase-wise differences in students' perceptions of major CBME components and explored students' open-ended feedback.

Methods: An institution-based cross-sectional study with an exploratory qualitative component was conducted among 468 undergraduate MBBS students across four academic phases at a government medical college in Uttar Pradesh, India. Data were collected electronically using a 31-item questionnaire, including 24 five-point Likert-scale items assessing Foundation Course, Early Clinical Exposure (ECE), Self-Directed Learning, AETCOM, integration, assessment and feedback, and attitudes and challenges related to CBME. Quantitative data were analysed using Mann–Whitney U, Kruskal–Wallis H, Dunn's post-hoc test with Holm adjustment, chi-square, and Spearman's correlation. Open-ended responses were categorized exploratorily.

Results: Participants included 124 Phase 1, 87 Phase 2, 110 Phase 3 Part 1, and 147 Phase 3 Part 2 students. Significant phase-wise differences were observed for ECE ($H=18.737$, $p<0.001$) and Attitude & Challenges ($H=8.406$, $p=0.038$), whereas overall CBME perception did not differ significantly across phases ($H=4.612$, $p=0.203$). Age and sex were not significantly associated with overall CBME perception or individual domains. Open-ended responses highlighted clinical exposure, curriculum structure, faculty guidance, assessment and feedback, infrastructure/technology, and positive experiences.

Conclusion: Overall CBME perceptions were broadly comparable across academic phases, while specific domains, particularly ECE, demonstrated phase-related variation. Phase-sensitive evaluation and students' contextual feedback may help inform ongoing CBME implementation.

Introduction

Competency-Based Medical Education (CBME) is an educational approach that emphasizes the achievement and demonstration of clearly defined competencies rather than the completion of a specified period of study [1]. CBME encompasses the development of knowledge, clinical skills, communication skills, professional attitudes, ethical values, and other attributes required for effective and patient-centered medical practice [2]. CBME aims to provide a structured learning environment with explicit learning outcomes, competency-based assessment, learner-centred education, and progressive development of professional responsibility [3].

In India, the National Medical Commission (NMC) introduced a competency-based undergraduate medical curriculum to prepare Indian Medical Graduates (IMGs) to become competent and responsible physicians [4]. The CBME framework defines key roles for the IMG, including clinician, leader, and member of the healthcare team, communicator, lifelong learner, and professional[5]. These roles are

supported by competencies encompassing scientific knowledge, clinical skills, communication, professionalism, ethics, teamwork, and lifelong learning [6]. Thus, CBME represents a shift from predominantly content-centred education towards an integrated approach that emphasizes the application of knowledge, skills, attitudes, and professional values in clinical and professional contexts[7].

The CBME framework involves several educational approaches, including early clinical exposure, integration of basic and clinical sciences, skill-based training, formative assessment, self-directed learning, professional development, and structured clinical training [8]. The undergraduate medical curriculum is structured in sequential steps, and learning experiences and competencies are built from the basic and preclinical sciences to the paraclinical and clinical learning [9]. Students across different phases encounter distinct academic requirements, learning contexts, assessment practices, and clinical experiences, which may influence their perceptions and experiences of CBME[10].

Successful implementation of a competency-based curriculum requires not only establishing a regulatory framework and developing a curriculum but also implementing the curriculum in the educational context and ensuring that it is accepted by the learners [11]. Students are stakeholders in medical education, and their perceptions can be used to gain valuable information about the relevance, clarity, feasibility, and perceived educational value of the curricular components [12]. Previous studies among Indian undergraduate medical students have reported positive perceptions of several CBME components, particularly early clinical exposure, the foundation course, AETCOM, and selected integrated learning activities[13]. However, difficulties have been reported with self-directed learning, completion of logbooks, workload related to assessment, and implementation of multiple competencies [14].

However, students' perceptions may vary based on their level of undergraduate preparation, clinical experiences, the level of competency-based preparation, and academic demands [15]. The existing literature has frequently focused on individual components of CBME, specific phases of the curriculum, or overall perceptions of CBME. Consequently, comparative evidence examining students' perceptions across different phases of the MBBS programme within the same institutional setting remains limited[16]. Therefore, a phase-wise assessment may provide useful insights into how students' experiences and perceptions change as they progress from foundational learning towards increasingly clinically oriented training[17].

This cross-sectional mixed-methods study aimed to evaluate and compare undergraduate medical students' perceptions of CBME across the four academic phases of the MBBS programme: Phase 1, Phase 2, Phase 3 Part 1, and Phase 3 Part 2. The study also explored students' open-ended responses to identify contextual factors related to their experiences with CBME.

Materials & methods

Study design and setting

An institution-based cross-sectional study incorporating an exploratory analysis of open-ended responses was conducted among undergraduate MBBS students enrolled in the competency-based medical education (CBME) curriculum at a B. R. D. Medical College, Gorakhpur, Uttar Pradesh, India. The study was conducted from June 1, 2025, to June 10, 2025. Students from four academic stages—Phase 1 (First Professional), Phase 2 (Second Professional), Phase 3 Part 1 (Third Professional Part 1), and Phase 3 Part 2 (Final Professional)—were eligible for participation. The study was designed to assess students' perceptions and experiences regarding major components of the CBME curriculum, including the Foundation Course, Early Clinical Exposure (ECE), Self-Directed Learning (SDL), Attitude, Ethics, and Communication (AETCOM), horizontal and vertical integration, and assessment and feedback.

Ethical considerations

Ethical approval was obtained from the Institutional Human Ethics Committee of the institute before the commencement of data collection (Approval No. 209/IHEC/2025, dated March 10, 2025). Electronic informed consent was obtained from all participants before participation.

Study population and sampling

The target population comprised MBBS students enrolled in the four academic phases of the undergraduate medical programme. Approximately 600 eligible students, with approximately 150 students from each academic phase, were invited to participate. A total of 468 students participated in the study, corresponding to an overall response rate of approximately 78.0%. All eligible students were invited to participate through the respective MBBS batch communication groups. Participation was voluntary, and students were informed that participation or non-participation would not affect their academic standing.

Inclusion Criteria

Students currently enrolled in Phase 1, Phase 2, Phase 3 Part 1, or Phase 3 Part 2 who had been exposed to at least one component of the CBME curriculum and provided informed consent were eligible for inclusion. Participants who did not provide an open-ended response were treated as non-responders.

Exclusion Criteria

Students were excluded if they were not enrolled in Phase 1, Phase 2, Phase 3 Part 1, or Phase 3 Part 2 of the MBBS programme during the study period; were on prolonged leave, absent, or otherwise unavailable during data collection; did not provide informed consent.

Development and pilot testing of the study instrument

Data were collected using a structured, self-administered questionnaire developed by adapting and contextualizing items from previously published studies assessing perceptions and implementation of CBME among medical students and faculty[18,19]. The questionnaire was subsequently modified to

reflect the local institutional context and the specific CBME components implemented at the study site. The revised questionnaire underwent expert review and pilot testing before the main survey. The questionnaire consisted predominantly of closed-ended items. Perceptions were assessed using a 5-point Likert scale, ranging from 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree). Higher scores represented greater agreement with the respective statements [20].

Pilot testing and content review

Prior to the main survey, the questionnaire was pilot tested among 10 MBBS students who were not included in the final study population. The pilot assessment was undertaken to evaluate the clarity, comprehensibility, sequence, and contextual relevance of the questionnaire items. The instrument was reviewed by two faculty members trained in Advanced Course in Medical Education (ACME) and the Member Secretary of the Institutional Human Ethics Committee (IHEC). Based on feedback obtained during pilot testing and expert review, minor modifications were made to the wording and sequencing of selected items to improve clarity, logical flow, contextual appropriateness, and alignment with institutional CBME practices. The revised questionnaire was used for the final data collection.

Questionnaire structure

The questionnaire comprised 31 items covering demographic characteristics, perceptions of major CBME components, attitudes and challenges related to CBME implementation, and an optional open-ended question. Twenty-four items used a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The assessed domains included foundation course, early clinical exposure, self-directed learning, AETCOM, horizontal and vertical integration, and assessment and feedback. Two additional Likert-scale items assessed overall satisfaction with CBME implementation and challenges in adapting to CBME. The final item was an optional open-ended question inviting students to provide suggestions or comments regarding CBME implementation.

Among the participants who provided open-ended responses, the responses were categorized into clinical exposure, curriculum structure, faculty guidance, assessment and feedback, infrastructure/technology, positive feedback, and uncategorized responses. Participants who did not provide an open-ended response were treated as non-responders and were not considered a qualitative response category.

Data collection procedure

The questionnaire was digitized using Google Forms. The electronic form began with an informed-consent statement presented in both English and Hindi. Only students who provided consent were permitted to proceed to the questionnaire. The survey link was distributed through the official WhatsApp groups of the respective MBBS batches. Data collection was conducted from June 1 to June 10, 2025, providing participants with a 10-day response window. Two reminders were issued during the data collection period to improve participation, while participation remained voluntary. No CBME guideline or

explanatory document was provided to participants before completion of the questionnaire. This approach was adopted to capture students' perceptions based primarily on their actual educational experiences and exposure to CBME components rather than on prior exposure to supplementary explanatory material.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 27 and OriginPro. Categorical variables were summarized as frequencies and percentages, and CBME perception scores using appropriate descriptive statistics and mean ranks. Associations between sex and MBBS phase were assessed using Pearson's chi-square test. Sex-wise differences in CBME domain scores were evaluated using the Mann–Whitney U test, with effect sizes reported as r . Differences across MBBS phases and open-response categories were assessed using the Kruskal–Wallis H test, followed by Dunn's post-hoc pairwise comparisons with adjustment for multiple testing where appropriate. Associations between age and CBME perception scores were examined using Spearman's rank correlation. All tests were two-tailed, and $p < 0.05$ was considered statistically significant.

Results

A total of 468 undergraduate medical students participated in this study. The distribution across the four MBBS phases was relatively heterogeneous, with the largest proportion from Phase 3–Part 2 (final year; 147, 31.4%), followed by Phase 1 (124, 26.5%), Phase 3–Part 1 (110, 23.5%), and Phase 2 (87, 18.6%). Overall, 305 (65.2%) participants were male and 163 (34.8%) were female. Most participants were aged 21–23 years (212, 45.3%), followed by 24–26 years (167, 35.7%), 17–20 years (67, 14.3%), and >26 years (22, 4.7%). Among the open-ended responses, 33 (7.1%) were categorized as relating to clinical exposure, 30 (6.4%) to curriculum structure, 12 (2.6%) to faculty guidance, 8 (1.7%) to assessment and feedback, 6 (1.3%) to infrastructure/technology, and 48 (10.3%) represented positive feedback. Thirty-five responses (7.5%) could not be categorized, whereas 296 (63.2%) participants did not provide an open-ended response (**Table 1**).

Sex Distribution Across MBBS Phases

The distribution of male and female students did not differ significantly across the four MBBS phases (Pearson's $\chi^2 = 1.506$, $df = 3$, $p = .681$). The proportion of male students ranged from 61.8% in Phase 3–Part 1 to 70.1% in Phase 2, while female representation ranged from 29.9% in Phase 2 to 38.2% in Phase 3–Part 1 (**Table 2**). Thus, the Sex composition was broadly comparable across the MBBS phases.

Sex Differences in CBME Perception

Mann–Whitney U tests showed no statistically significant differences between male and female students across any of the assessed CBME domains. Mean scores were broadly comparable between males and females for Foundation Course (15.97 ± 3.44 vs. 16.48 ± 2.55 , $p = .383$), Early Clinical

Exposure (15.81 ± 3.17 vs. 15.74 ± 2.69 , $p = .288$), Self-Directed Learning (15.32 ± 3.36 vs. 15.15 ± 3.03 , $p = .304$), AETCOM Module (15.82 ± 3.61 vs. 16.05 ± 3.12 , $p = .828$), Integration (16.57 ± 3.29 vs. 16.63 ± 2.62 , $p = .537$), and Assessment and Feedback (15.36 ± 3.72 vs. 15.44 ± 3.12 , $p = .803$) (**Figure 1**). Similarly, no significant Sex difference was observed for Attitude & Challenges (7.22 ± 1.78 vs. 7.17 ± 1.57 , $p = .424$). The corresponding effect sizes were small across all domains ($r = .010-.049$) (**Table 3**).

Phase-wise Variation in CBME Perceptions

Kruskal–Wallis analysis demonstrated significant phase-wise variation in the two CBME domains. Early clinical exposure differed significantly across MBBS phases ($H = 18.737$, $df = 3$, $p < .001$). The mean ranks were highest among Phase 1 students (272.77), followed by Phase 2 (244.69), Phase 3–Part 2 (220.28), and Phase 3–Part 1 (202.31), indicating differences in students' perceptions of Early Clinical Exposure across the four academic phases (**Table 4**). A statistically significant difference was also observed for Attitude & Challenges ($H = 8.406$, $df = 3$, $p = .038$), with mean ranks of 255.08, 249.90, 210.24, and 226.18 for Phase 1, Phase 2, Phase 3–Part 1, and Phase 3–Part 2, respectively.

In contrast, no statistically significant phase-wise differences were observed for Foundation Course ($H = 4.688$, $p = .196$), self-directed learning ($H = 6.167$, $p = .104$), AETCOM module ($H = 0.476$, $p = .924$), integration ($H = 1.916$, $p = .590$), or assessment and feedback ($H = 7.435$, $p = .059$). The overall CBME score also did not differ significantly across phases ($H = 4.612$, $df = 3$, $p = .203$) (**Figure 2**).

Post-hoc Dunn analysis with Holm adjustment showed significantly higher Early Clinical Exposure (ECE) scores in Phase 1 compared with Phase 3-Part 1 (adjusted $p < .001$) and Phase 3-Part 2 (adjusted $p = .007$), while the remaining phase-wise comparisons were not statistically significant. Although the Kruskal–Wallis test showed a significant overall difference in Attitude & Challenges across MBBS phases ($H = 8.406$, $df = 3$, $p = .038$) (**Table 5**), none of the pairwise comparisons remained statistically significant after Holm adjustment.

Association Between Age and CBME Perceptions

Spearman's rank-order correlation demonstrated no statistically significant association between age and any CBME perception domain. The correlation coefficients ranged from -0.088 to 0.038 . The correlation between age and Early Clinical Exposure was weak and not statistically significant ($\rho = -0.088$, $p = .057$). Similarly, no significant associations were observed for Foundation Course ($\rho = -.031$, $p = .505$), Self-Directed Learning ($\rho = .010$, $p = .826$), AETCOM Module ($\rho = .038$, $p = .413$), Integration ($\rho = -.046$, $p = .322$), Assessment and Feedback ($\rho = -.075$, $p = .103$), Attitude & Challenges ($\rho = -.037$, $p = .424$), or Overall CBME perception ($\rho = -.034$, $p = .459$) (**Table 6**) (**Figure 3**).

Consistent with the correlation analysis, Kruskal–Wallis testing across the four age categories showed no statistically significant differences in any CBME dimension or in the overall CBME score. The p values ranged from .063 for Early Clinical Exposure to .867 for Self-Directed Learning. For the Overall CBME

score, the difference across age categories was not statistically significant ($H = 1.262$, $df = 3$, $p = .738$) (**Table 7**).

Association Between Open-ended Response Categories and CBME Perceptions

The qualitative responses were further examined according to their predefined categories. No statistically significant differences were observed across the eight response categories for Foundation Course ($H = 7.395$, $p = .389$), Self-Directed Learning ($H = 2.579$, $p = .921$), AETCOM Module ($H = 6.620$, $p = .469$), Integration ($H = 5.481$, $p = .601$), Assessment and Feedback ($H = 7.250$, $p = .403$), Attitude & Challenges ($H = 12.497$, $p = .085$), or Overall CBME perception ($H = 8.184$, $p = .317$). However, a statistically significant difference was observed for Early Clinical Exposure across the open-response categories ($H = 22.619$, $df = 7$, $p = .002$). The highest mean rank was observed among students whose responses were categorized as Faculty Guidance (320.33), followed by Clinical Exposure (286.17), Curriculum Structure (279.63), Infrastructure/Technology (283.33), Positive Feedback (261.39), Uncategorized (240.20), Assessment & Feedback (232.31), and No Response (214.72) (**Table 8**). This finding indicates that ECE perception scores differed across the observed categories of open-ended responses. Because the open-ended question was optional and a substantial proportion of participants did not provide a response, these findings should be interpreted as exploratory.

The quantitative findings demonstrated that students' perceptions of CBME were largely comparable across Sex and age groups, whereas specific dimensions of CBME showed phase-related variation. The most pronounced phase-wise difference was observed for Early Clinical Exposure, followed by Attitude & Challenges. In contrast, the Overall CBME score did not differ significantly across MBBS phases. The qualitative component further identified Early Clinical Exposure as the only CBME domain showing a statistically significant association with open-response categories, providing complementary evidence that students' experiences and perceptions related to clinical exposure varied across the student response themes.

Discussion

This cross-sectional study aimed to evaluate the perception of competency-based medical education (CBME) among undergraduate medical students. The perceptions of individual components of the curriculum tended to differ across the MBBS phases rather than have a consistent pattern throughout the MBBS course. These differences were especially pronounced for early clinical exposure (ECE) and students' perspectives on challenges in the curriculum. The results of this study revealed that there were differences in the experience of students in CBME from the various components of CBME that they encountered during training.

The most notable finding was the phase-wise variation in students' perceptions of Early Clinical Exposure (ECE). This finding is similar to previous studies that emphasized clinical exposure as an essential part of competency-based medical education (CBME) [21]. Under-graduate medical students appreciated ECE as one of the most important components of the competency-based curriculum,

whereas self-directed learning, log books, and reflective activities were comparatively valued as important components in the competency-based curriculum [22]. Similarly, an Indian study reported that students perceived ECE as beneficial for stimulating interest and facilitating learning, and identified ECE and integrated teaching as important components of effective CBME implementation [23,24]. The differences observed in this study might be due to the different contexts of clinical learning throughout undergraduate education. Early Clinical Exposure (ECE) can be a connection between foundational biomedical knowledge and patient care for students starting medical college[25]. Once students reach more clinical stages, exposure becomes commonplace and changes perceptions. Therefore, attitudes towards ECE can differ at different levels and with different experiences. Previous studies conducted in India show that early exposures help improve understanding, communication, attitude, and empathy[2].

These findings do not suggest that ECE is more beneficial at one stage of its development than at another. Instead, they highlight that students' views on vary depending on the curriculum phase. This distinction is crucial for planning, as clinical exposure may shift between phases. During the initial phase, exposure might emphasize orientation, observation, communication, connecting basic sciences to patient care, and participation, while also supporting the development of clinical reasoning, procedural skills, and responsibility[26,27]. Qualitative data support this notion, indicating that perceptions of ECE are linked to clinical exposure, faculty support, and curriculum structure. This implies that clinical exposure is influenced by how the curriculum is organized, faculty interactions, and the teaching environment[28].

The educational significance of shifts in attitude and challenges across different phases is noteworthy. CBME is set to revolutionize not only the content but also the methods of learning, competency evaluation, feedback, and educational activities[29]. As competency demands evolve, perceptions may shift accordingly. The phase-specific variations noted here align with earlier Indian research highlighting implementation challenges such as time management, logbook completion, reduced self-study opportunities, workload, and juggling multiple competencies[30,31]. Expectations, assessment criteria, and daily responsibilities within the curriculum will differ across phases of the undergraduate program, as students' academic responsibilities, clinical tasks, and independent learning expectations evolve[32]. The findings suggest that simply gauging students' overall satisfaction should not be the sole metric for evaluating CBME implementation, as students may appreciate its philosophy but encounter practical issues[33]. Therefore, educators should receive more than just a general perception score; they should be informed about potential curriculum challenges at specific times, enabling them to make well-informed decisions for curriculum improvement.

When examining male and female students within the CBME domains, no notable differences were observed, indicating that within this school group, both Sexs perceived the curriculum similarly. The variation between phases did not highlight Sex disparities, as students were equally represented in each phase. However, the absence of a significant Sex difference does not imply that Sex never affects educational experiences[34,35]. Perceptions can be shaped by factors such as institutional culture, the learning environment, clinical opportunities, teaching methods, and personal experiences[36].

Consequently, for this specific group and institution, Sex was not a primary factor influencing perceptions of CBME.

Analysis of these findings indicates that the stage of education exerts a more pronounced influence on students' experiences compared to their chronological age, as no significant links were identified between age and perceptions of CBME. This distinction is crucial because the undergraduate sequence is particularly defined for MBBS students in conventional undergraduate programs. In this cross-sectional cohort, age was not significantly associated with CBME perception, whereas academic phase was associated with specific domains, particularly ECE and Attitude & Challenges. The results concerning the near-threshold association of the ECE should be approached with caution, as they might suggest a change in perceptions as students advance or enhance their academic achievements, but they only suggest to the reader that there could be an age-related association within this group[37,38].

In competency-based medical education (CBME), a notable observation is the consistent level of self-directed learning (SDL) across different phases. This uniformity underscores the reliance of competency-based education on SDL, as it necessitates that students identify their learning needs, select suitable resources, track their progress, and foster lifelong learning habits[39,40]. Research has shown that students often view SDL less favorably compared to structured teaching methods. For instance, Sharma and Chhatwal highlighted this sentiment, and another study raised concerns about the practicality of SDL in CBME assessments[41]. The absence of phase-specific variations suggests that SDL challenges may not be limited to a particular academic year but are more closely linked to the design, facilitation, monitoring, and assessment processes[42]. There is substantial evidence of diverse SDL approaches in health professions education, often shaped by perception[43]. This implies that merely assigning SDL tasks may not be sufficient; learners might require guidance on learning strategies, access to educational materials, faculty advice, specific learning objectives, and feedback to ensure SDL becomes an integral part of lifelong learning rather than an additional task in the curriculum.

There were no significant differences in terms of assessment and feedback by phase; however, the results were trending towards significance and may suggest that students view the same processes in relation to assessment and feedback across phases despite clinical responsibilities[44]. This is consistent with the literature, which states that assessment continues to be one of the challenges of implementing CBME. A systematic review of CBME assessment pointed to the following: formative assessment, feedback, workplace-based assessment, digital assessment, and implementation challenges, all of which focus on ways of assessing CBME that improve the engagement and self-regulated learning of learners, rather than summative assessment[45,46]. Studies have previously been conducted with Indian medical students in which there were concerns regarding the understanding of assessment and feedback, thereby highlighting it as an important point of concern for implementation. The results therefore indicate that assessment should be used as a dynamic part of CBME, where the expectations of competencies are correlated with the teaching of those competencies; the feedback to learners is provided in a timely manner; and student opportunities for feedback on their performance are applied longitudinally. Regular communication and integration throughout all phases.

Common perceptions of AETCOM and curricular integration span the phases and may be indicative of the longitudinal approach of such integration. The ultimate goal of AETCOM is to foster professional attitudes, ethical thinking, communication, and patient-centered behavior in undergraduate education. Previous Indian research has highlighted the importance of AETCOM, particularly in doctor–patient communication and professional development[45]. Likewise, integration is an important aspect of CBME, which brings together knowledge, skills, attitudes, and clinical applications.

The significance of integrating quantitative and qualitative evidence A major strength of this study is combining quantitative perception data with students' open-ended feedback. Structured surveys can show positive or negative views of curricular elements but may miss the experiences behind them[47,48]. Thematic analysis adds context on clinical exposure, faculty support, curriculum design, assessment and feedback, and infrastructure/technology. The ECE connection in open responses complements phase-specific quantitative findings, suggesting that differences in perceptions of clinical exposure may reflect broader experiences, including faculty support and curriculum organization. Indian clinical-learning research similarly indicates that structured clinical exposure can enhance academic understanding, social learning, and professional growth[28]. However, many participants did not provide open-ended responses; therefore, the thematic data represent only respondents and should be viewed as complementary, not complete. Implications for CBME implementation[49–51] These findings support evaluating CBME as a multidimensional, phase-sensitive curriculum. Although overall CBME perception did not differ, students may experience specific components differently across medical schools. ECE should span phases, and faculty development matters.

Strengths and limitations

The main strength of this study is the inclusion of students across major MBBS phases, enabling comparison across stages of medical education within one institution. Non-parametric analyses suited to perception data, combined with qualitative categorization of open responses, offer complementary perspectives on CBME implementation. Limitations should be acknowledged. The cross-sectional design cannot determine whether perceptions change over time, and phase differences may reflect cohort effects; longitudinal follow-up would assess developmental change. The single-institution setting may limit generalizability to colleges with different resources, faculty structures, and implementation practices. Voluntary open-ended responses and many non-responses may introduce response-selection bias. Perception measures reflect experiences, not direct measures of educational effectiveness or competency attainment.

Conclusion

Overall perceptions of CBME did not differ significantly across the four MBBS phases; however, specific curricular domains demonstrated phase-related variation. Early Clinical Exposure showed the clearest phase-wise difference, with higher perception scores among Phase 1 students than among students in later clinical phases, while the overall CBME perception score remained comparable across phases. The

exploratory analysis of open-ended responses further indicated variation in ECE-related perceptions, although these findings should be interpreted cautiously because participation in the open-ended component was optional. These findings suggest that evaluation of CBME should extend beyond a single overall perception score and include domain-specific, phase-sensitive monitoring of students' educational experiences. Longitudinal and multicentre studies are warranted to determine whether these differences reflect developmental changes, cohort effects, or differences in curriculum implementation.

Abbreviations

CBME – Competency-Based Medical Education

NMC – National Medical Commission

IMG – Indian Medical Graduate

MBBS – Bachelor of Medicine, Bachelor of Surgery

ECE – Early Clinical Exposure

SDL – Self-Directed Learning

AETCOM – Attitude, Ethics and Communication

ACME – Advanced Course in Medical Education

IHEC – Institutional Human Ethics Committee

SPSS – Statistical Package for the Social Sciences

Declarations

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Author contributions

R.K.S., S.G., and S.B. contributed to the conception and design of the study. R.K.S., A.K., and S.V. contributed to data collection and study implementation. R.K.S., A.K., and S.V. contributed to data analysis. R.K.S. and S.V. drafted the manuscript. S.G. and S.B. contributed to the critical revision of the manuscript. All authors reviewed and approved the final manuscript.

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Data Availability

The detailed datasets analyzed in the current study are available from the corresponding author upon reasonable request, subject to institutional and ethical restrictions.

Declaration

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

Ethics statement

The study was approved by the Institutional Human Ethics Committee of B.R.D. Medical College, Gorakhpur (Approval No. 209/IHEC/2025, dated 10 March 2025).

Consent to Participate

All research procedures were approved and conducted in accordance with relevant guidelines and regulations. By participating in this study, I confirm that I have been fully informed of its purpose and procedures and consent to participate voluntarily.

Consent for publication

Not applicable.

Declaration of Generative AI in Scientific Writing

During the preparation of this work, the authors used ChatGPT to enhance the readability and clarity of the English language. The authors take full responsibility for the integrity, accuracy, and originality of the publication.

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Tables

Tables 1 to 8 are available in the supplementary files section.

Figures

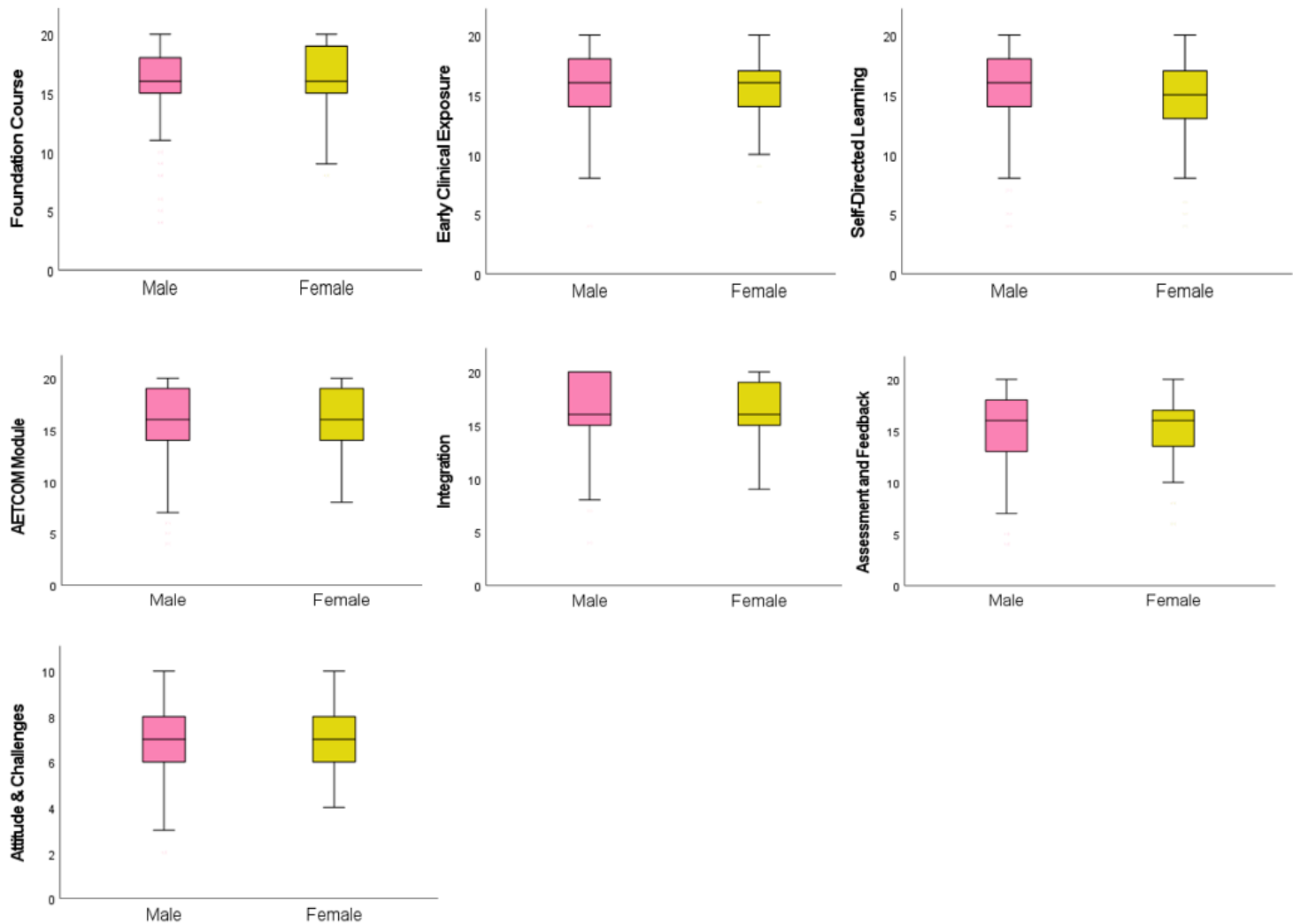


Figure 1

Gender-Wise Distribution of Scores Across CBME Scale Dimensions

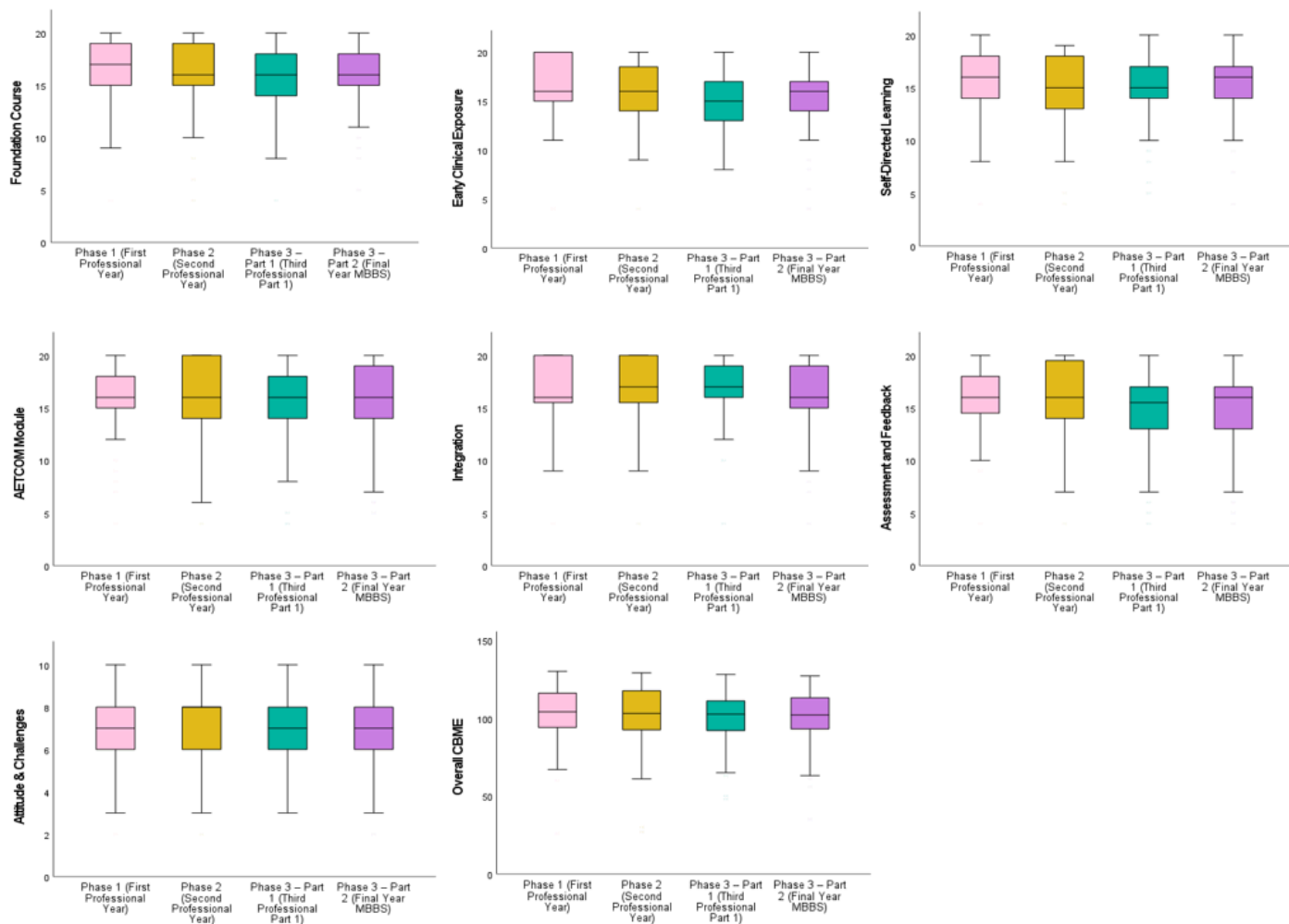


Figure 2

Phase-Wise Distribution of CBME Scale Dimensions Among Medical Students

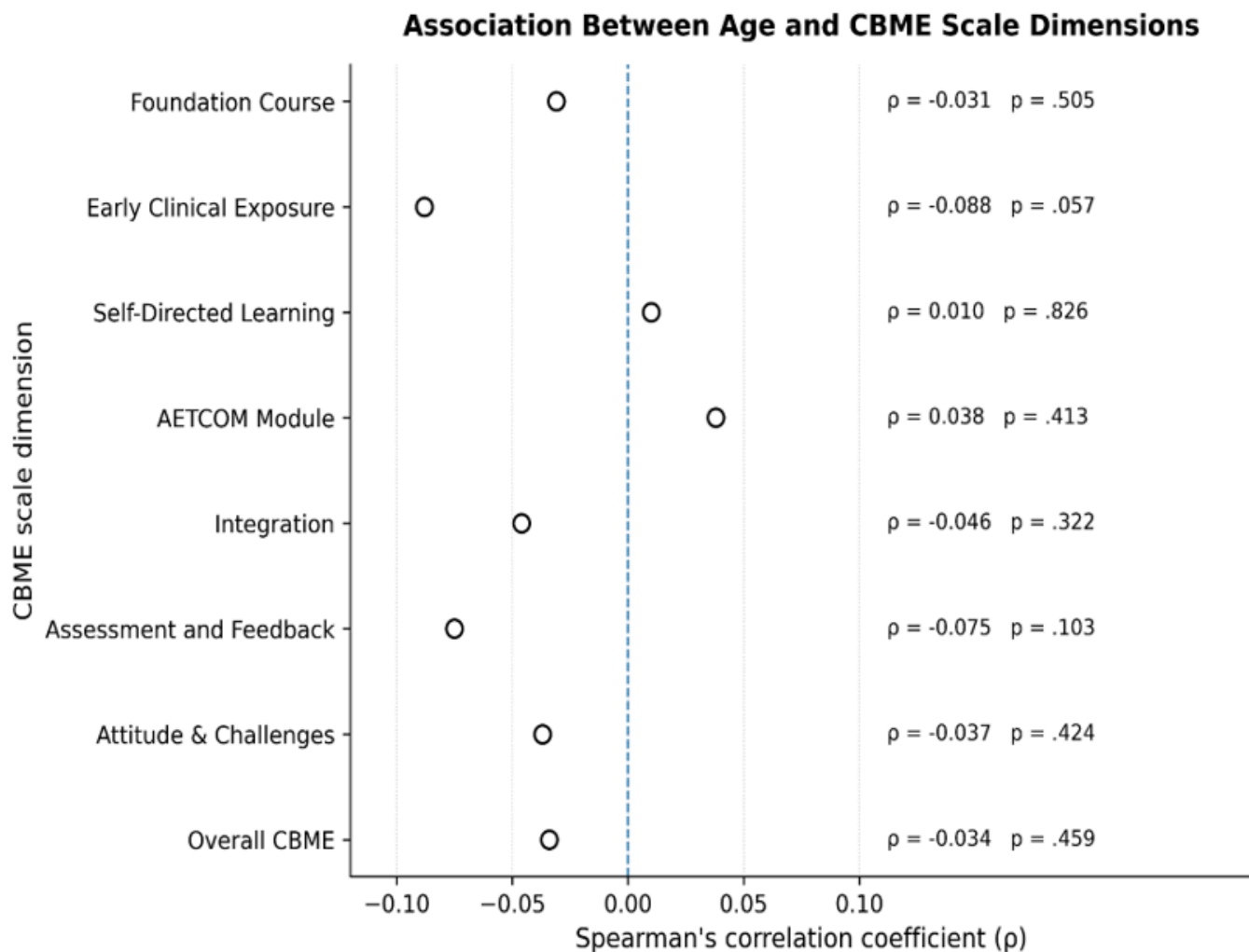


Figure 3

Spearman's Rank-Order Correlations Between Age and CBME Scale Dime

Supplementary Files

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- [Tables.docx](#)