ORIGINAL ARTICLE

Assessment of Knowledge, Attitude, and Practices Toward Competency-Based Medical Education Among Phase II MBBS Students in a Tertiary Care Teaching Hospital in Bihar, India

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ABSTRACT

Competency-Based Medical Education (CBME), introduced by the National Medical Commission (NMC), aims to develop Indian Medical Graduates who are skilled, ethical, and capable of continuous learning. The second phase of the MBBS course, which includes Pharmacology, Pathology, and Microbiology, plays an important role in bridging basic sciences with clinical skills. However, there is limited information regarding students' perceptions of CBME implementation in tertiary care teaching hospitals in Bihar, India. This cross-sectional study involved 100 Phase II MBBS students from a tertiary care teaching hospital in Bihar, India. Students with at least one year of CBME exposure were included through convenience sampling. A 34-item, pre-tested questionnaire was used to assess their knowledge, attitudes, and practices (KAP) regarding CBME. Data were analysed using descriptive statistics and chi-square tests. All students responded (mean age: 20.1 ± 0.8 years; 58% male). Awareness of Early Clinical Exposure was high (78%) but understanding of Mentorship (41%) and the Pandemic Module (32%) was lower. Although 68% preferred CBME to traditional methods, 78% reported increased stress, and 62% pointed to inadequate infrastructure. Only 35% regularly used logbooks for self-directed learning. Female students had higher knowledge scores ($p = 0.02$) and reported more stress ($p = 0.03$). Better engagement with self-directed learning was linked to a more favorable attitude ($p < 0.01$). Phase II MBBS students demonstrated moderate knowledge and generally favourable attitudes toward CBME, particularly regarding its clinical relevance and holistic approach. However, important gaps were identified in understanding specific CBME components and in the adoption of CBME-aligned learning practices, especially self-directed learning. Strengthening mentorship, faculty support, and structured learning opportunities may improve alignment between CBME objectives and student learning experiences.

KEY WORDS: Competency-Based Medical Education, Self-Directed Learning, Medical Students, Phase II MBBS, Undergraduate Medical Curriculum

Introduction

Medical education worldwide has increasingly transitioned from traditional, teacher-centered approaches toward competency-based frameworks that emphasize measurable learning outcomes, clinical performance, and professional development[1]. In India, the National Medical Commission (NMC) introduced Competency-Based Medical Education (CBME) for the undergraduate MBBS curriculum with the objective of producing Indian Medical Graduates who are clinically competent, ethical, communicative, and capable of lifelong learning[2, 3]. This reform represents a significant shift from the conventional knowledge-based curriculum to an outcome-oriented educational model that integrates knowledge, skills, attitudes, and professionalism[3, 4].

Phase II of the MBBS curriculum occupies a critical position in medical training, as it bridges the foundational sciences with clinical application through

Access this article online

Quick Response Code:

Website: jmsh.ac.in

Doi: 10.46347/jmsh.v12.i3.26.49

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subjects such as Pharmacology, Pathology, and Microbiology[4]. During this phase, students are expected to engage with several key CBME components, including Early Clinical Exposure (ECE), Attitude, Ethics and Communication (AETCOM) training, self-directed learning (SDL), integrated teaching, mentorship, and community-oriented learning activities[2, 5-8]. Successful implementation of these components is essential for achieving the intended competencies of the CBME curriculum.

Although CBME has been implemented nationwide, its effectiveness depends largely on how students understand, perceive, and engage with the curriculum. Student perspectives are particularly important because they directly influence learning behaviors, participation in curricular activities, and acceptance of educational reforms[9, 10]. Previous studies from different regions of India have reported varying levels of awareness, satisfaction, and adaptation among undergraduate medical students, while also highlighting challenges such as academic stress, infrastructure limitations, and difficulties in adopting self-directed learning strategies[14, 15, 17, 19, 20].

The implementation of CBME may be particularly challenging in resource-constrained settings where limitations in infrastructure, faculty development opportunities, and educational resources can affect curriculum delivery[14, 15, 17]. However, there is limited information regarding students' perceptions of CBME implementation in resource-constrained tertiary care teaching institutions. Understanding students' knowledge, attitudes, and practices (KAP) related to CBME can provide valuable insights into the strengths and gaps of current implementation strategies and help guide future educational interventions.

Therefore, the present study was undertaken among Phase II MBBS students at a tertiary care teaching hospital in Bihar, India, to evaluate their knowledge, attitudes, and practices regarding CBME implementation.

Objectives of the Study:

1. To assess the knowledge of Phase II MBBS students regarding key concepts and components of Competency-Based Medical Education.
2. To evaluate students' attitudes toward the implementation of the CBME curriculum.
3. To assess CBME-aligned learning practices among Phase II MBBS students.
4. To examine the association between students' knowledge, attitude, and practice profiles and selected demographic variables.

Methods

Study Design and Setting: This study employed a descriptive, cross-sectional design to assess the KAP related to CBME among Phase II MBBS students. The research was conducted at a tertiary care teaching hospital located in Bihar, India. The setting was selected to reflect a typical government-run medical institution operating within resource-constrained environments, characteristic of many Indian states implementing CBME.

Participants and Eligibility Criteria: The target population comprised all Phase II MBBS students enrolled at the aforementioned institution during the academic year of data collection. Eligible participants were those who had completed at least one full academic year (≥1 year) under the CBME curriculum. Students who were unwilling to participate or absent during the data collection period were excluded from the study. A total of 100 students met the eligibility criteria and were enrolled through convenience sampling.

Sample Size Determination and Sampling Technique: Although convenience sampling may introduce potential selection bias, it was deemed appropriate due to academic schedule constraints and the need for feasibility in recruitment. A post-hoc power analysis indicated that a sample size of 100 participants would yield 80% power to detect a 20% difference in KAP scores at a 5% level of significance ($\alpha = 0.05$), validating the adequacy of the chosen sample size for inferential analysis.

Ethical Considerations: Prior to data collection, ethical clearance was obtained from the Institutional Ethics Committee. All participants provided written informed consent. They were informed that participation was entirely voluntary and that refusal would not impact their academic evaluation or standing. To ensure confidentiality, all data were anonymized and used strictly for academic and research purposes.

Questionnaire Development and Description: A structured, pre-validated, self-administered questionnaire was used as the primary data collection instrument. The tool was designed to capture information across three key domains: demographic data, knowledge of CBME, attitudes toward its implementation, and practices related to CBME-recommended strategies. The questionnaire was divided into the following sections:

- **Section A** collected demographic information, including age and gender.

- **Section B** focused on the core KAP domains, consisting of 34 items in total:
  - The **Knowledge domain** included 13 items assessing understanding of CBME principles, specific terminologies relevant to Microbiology (MI), Pharmacology (PH), and Pathology (PA), rationale for semester reduction, objectives of AETCOM and ECE modules, the purpose of the Family Adoption Programme (FAP), concepts of vertical and horizontal integration, relevance of the Pandemic Module, and the structure and function of the mentorship system.
  - The **Attitude domain** comprised 11 items exploring preferences for CBME versus traditional curricula, perceived improvements in clinical preparedness and holistic development, stress perception, adequacy of infrastructure and faculty training, perceived faculty commitment to CBME, opinions on the academic implications of semester reduction, perceived clinical preparedness, utility of Foundation Course skills, and perceptions regarding the role of yoga and sports activities in stress reduction. Questions related to faculty preparedness and commitment toward CBME were included to assess students' perceptions of curriculum implementation. These items were intended to capture learners' experiences of faculty engagement and support during the teaching-learning process and were not designed to objectively evaluate faculty qualifications, training status, or competency in CBME implementation.
  - The Practice domain consisted of 10 items examining the frequency of engagement in core CBME strategies such as self-assessment through logbooks, participation in role-plays and AETCOM simulations, involvement in peer learning activities, dedication to SDL, usage of e-learning resources, initiative in doubt resolution, application of theoretical knowledge in ECE and FAP, reflection on ethical dilemmas encountered, participation in yoga/sports activities, and application of skills acquired during the Foundation Course.

Items in Sections B and C were scored using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with knowledge items focused on self-reported understanding rather than objective testing.

Instrument Validation and Pilot Testing: To ensure the validity and reliability of the tool, a two-phase process of expert review and pilot testing was undertaken. To ensure content validity, the questionnaire was reviewed by an expert panel comprising: Three (3) Medical Education Unit (MEU)-trained faculty members with formal certification in Medical Education Technology (Advanced Course in Medical Education [ACME]) and experience in CBME implementation; One (1) Professor of Pharmacology who was a member of the undergraduate curriculum committee and had experience in curriculum planning; and One (1) Professor of Microbiology who was a member of the undergraduate curriculum committee and actively involved in CBME-based teaching and assessment. The reviewers assessed the instrument for relevance, clarity, comprehensiveness, and alignment with CBME principles. The Content Validity Index (CVI) was computed as 0.85, indicating satisfactory content validity. Subsequently, the revised version of the questionnaire was pilot-tested on a sample of 15 Phase II MBBS students, who were excluded from the final analysis. The internal consistency of the tool was evaluated using Cronbach's alpha, which yielded a value of 0.78, confirming acceptable internal reliability.

Data Collection Procedure: Data were collected over a two-week period during scheduled non-teaching hours to minimize disruption to academic activities. Students were approached in small batches to ensure clarity of instructions and a conducive environment for response. The aim of the study, the structure of the questionnaire, and the response mechanisms were explained prior to distribution. Participants were encouraged to ask for clarification if they encountered any difficulties in understanding the items. Anonymity was maintained by having participants submit completed questionnaires in sealed drop boxes immediately after completion.

Statistical Analysis: Data from completed questionnaires were manually verified, coded, and entered into Microsoft Excel for analysis. Descriptive statistics were used to summarize and present the data. Categorical variables such as demographic characteristics and Likert-scale responses were expressed as frequencies and percentages. For the KAP domains, the distribution of responses across the five-point scale was calculated for each item. Domain-wise mean scores were computed to assess central tendencies and interpret overall trends in knowledge, attitude, and practice. The associations between KAP scores and demographic variables (e.g., gender) were analyzed using appropriate inferential statistics such as the Chi-square test. A significance threshold of $p < 0.05$ was adopted for hypothesis testing.

Results

Participant Characteristics:

All 100 distributed questionnaires were completed and returned, yielding a response rate of 100%. The mean age of the respondents was 20.1 ± 0.8 years. The gender distribution revealed a slight predominance of male participants (58%) compared to females (42%). This complete response ensured robust representation of Phase II MBBS students for the analysis of CBME-related knowledge, attitudes, and practices.

Table 1: Knowledge Domain Response (n=100)

Knowledge Item	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
1. Understand core CBME principles	3 (3)	12 (12)	20 (20)	50 (50)	15 (15)
2. Understand MI (Microbiology) terminology	5 (5)	18 (18)	35 (35)	35 (35)	7 (7)
3. Understand PH (Pharmacology) terminology	6 (6)	20 (20)	40 (40)	30 (30)	4 (4)
4. Understand PA (Pathology) terminology	4 (4)	15 (15)	36 (36)	38 (38)	7 (7)
5. Understand reason for semester reduction	2 (2)	8 (8)	18 (18)	55 (55)	17 (17)
6. Understand purpose of AETCOM	3 (3)	10 (10)	25 (25)	48 (48)	14 (14)
7. Understand objectives of ECE	2 (2)	5 (5)	15 (15)	60 (60)	18 (18)
8. Understand purpose of FAP	5 (5)	15 (15)	32 (32)	40 (40)	8 (8)
9. Understand Vertical/Horizontal Integration	4 (4)	14 (14)	24 (24)	45 (45)	13 (13)
10. Understand Pandemic module relevance	8 (8)	24 (24)	40 (40)	24 (24)	4 (4)
11. Understand Mentorship structure	7 (7)	22 (22)	30 (30)	35 (35)	6 (6)
12. FC Objectives	8 (8)	22 (22)	38 (38)	25 (25)	7 (7)
13. Sports as CBME element	12 (12)	28 (28)	32 (32)	20 (20)	8 (8)

Table 2: Attitude Domain Responses (n=100)

Attitude Item	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
1. Prefer CBME over traditional curriculum	5 (5)	10 (10)	17 (17)	50 (50)	18 (18)
2. CBME makes me a better clinician	2 (2)	5 (5)	11 (11)	55 (55)	27 (27)
3. CBME focuses on holistic development	3 (3)	7 (7)	15 (15)	50 (50)	25 (25)
4. CBME has increased my stress/academic load	2 (2)	5 (5)	15 (15)	55 (55)	23 (23)
5. Infrastructure is sufficient for CBME	10 (10)	52 (52)	20 (20)	15 (15)	3 (3)
6. Faculty are adequately trained for CBME	8 (8)	50 (50)	25 (25)	15 (15)	2 (2)
7. Faculty show commitment to CBME	7 (7)	25 (25)	16 (16)	45 (45)	7 (7)
8. Semester reduction helps learning	10 (10)	25 (25)	40 (40)	20 (20)	5 (5)
9. Feel more clinically prepared	5 (5)	15 (15)	30 (30)	35 (35)	15 (15)
10. FC skills utility	5 (5)	18 (18)	30 (30)	40 (40)	7 (7)
11. Yoga/sports reduce stress	3 (3)	10 (10)	15 (15)	52 (52)	20 (20)

Table 3: Practice Domain Responses (n=100)

Practice Item	Never n (%)	Rarely n (%)	Sometimes n (%)	Often n (%)	Always n (%)
1. Do self-assessment using logbook	15 (15)	25 (25)	25 (25)	30 (30)	5 (5)
2. Participate actively in role-plays/simulations	10 (10)	32 (32)	30 (30)	25 (25)	3 (3)
3. Utilize peer learning/group discussions	8 (8)	22 (22)	32 (32)	30 (30)	8 (8)
4. Spend time on SDL activities	20 (20)	25 (25)	30 (30)	20 (20)	5 (5)
5. Use online/e-resources for SDL	5 (5)	10 (10)	30 (30)	45 (45)	10 (10)
6. Take initiative to clarify doubts	3 (3)	12 (12)	30 (30)	40 (40)	15 (15)
7. Apply theory knowledge in ECE/FAP	4 (4)	10 (10)	26 (26)	45 (45)	15 (15)
8. Reflect on ethical dilemmas	5 (5)	18 (18)	25 (25)	40 (40)	12 (12)
9. Yoga/sports participation	28 (28)	32 (32)	25 (25)	12 (12)	3 (3)
10. Apply FC skills	22 (22)	35 (35)	28 (28)	12 (12)	3 (3)

Knowledge of CBME Concepts:

Students demonstrated a moderate overall level of self-reported knowledge regarding CBME principles, with a mean knowledge score of 3.2 ± 0.9. Female students reported significantly higher knowledge scores than male students (3.5 ± 0.8 vs. 3.0 ± 1.0; p = 0.02). Knowledge was highest for broadly implemented CBME components such as Early Clinical Exposure and curriculum rationalization, whereas comparatively lower levels of understanding were observed for the mentorship programme, Family Adoption Programme, and Pandemic Module. Detailed item-wise responses are presented in [Table. 1].

Attitudes Toward CBME Implementation:

The mean attitude score was 3.0 ± 1.1. Overall, students expressed favorable attitudes toward CBME, particularly regarding its clinical relevance and emphasis on holistic professional development. At the same time, many students reported concerns related to academic workload, infrastructure adequacy, and faculty preparedness for CBME implementation. Female students were significantly more likely than male students to report academic stress (p = 0.03). Notably, 78% of students perceived increased academic stress and workload during their CBME training, making this the most commonly reported concern among respondents. Detailed response distributions are shown in [Table. 2].

CBME-Aligned Learning Practices:

The mean practice score was 2.8 ± 0.8, indicating moderate adoption of CBME-recommended learning strategies. Students reported greater engagement with activities involving application of knowledge and clarification of doubts, whereas self-assessment through logbooks, structured self-directed learning, role-plays, and peer-learning activities were less consistently practiced. A significant positive association was observed between engagement in self-directed learning activities and favorable attitudes toward CBME (r = 0.32, p < 0.01). Detailed practice patterns are summarized in [Table. 3].

Despite moderate overall engagement with CBME-aligned practices, several learner-centered activities such as logbook-based self-assessment, self-directed learning, role-plays, and peer-learning exercises were inconsistently utilized. These findings suggest opportunities for strengthening structured implementation of active learning strategies within the CBME framework [Table. 3].

Discussion

This study provides a crucial snapshot of the initial experiences and perceptions of Phase II MBBS students navigating the CBME curriculum at a tertiary care teaching hospital in Bihar, India. The findings reflect both encouraging trends and persistent challenges in the early implementation of this ambitious reform. The moderate level of self-reported knowledge about core CBME principles aligns with earlier literature suggesting that students are aware of the overarching aims of the reform, particularly its learner-centric and outcome-driven approach[17]. The widespread recognition of Early Clinical Exposure (ECE) and the rationale behind syllabus rationalization are indicative of successful communication of some key components. However, the findings also highlight significant knowledge gaps regarding discipline-specific terminologies in Microbiology, Pharmacology, and Pathology, as well as insufficient understanding of structural innovations like the Family Adoption Programme (FAP), mentorship framework, and the Pandemic Module. This disparity between broad conceptual knowledge and limited familiarity with integrated components suggests that while students are exposed to the "what" of CBME, the "why" and "how" remain inadequately internalized[11]. The use of complex, jargon-laden terms such as "vertical integration" may act as a barrier to comprehension, particularly if not contextualized through concrete examples in day-to-day teaching. Faculty must adopt strategies to reinforce these concepts, ensuring that structural innovations are not simply named but explained and experienced meaningfully in the curriculum.

The preference expressed by a majority of students for CBME over the traditional curriculum is a promising indicator of student engagement with the reform. Students clearly value the perceived clinical relevance of CBME and its promise of holistic professional development. This finding resonates with the broader goals of the Indian Medical Graduate (IMG) framework, which envisions the production of competent, compassionate, and communicative physicians suited to the realities of India's healthcare landscape[2, 18]. However, this optimism was accompanied by concerns regarding academic burden and stress. In the present study, more than three-fourths of the students reported experiencing increased stress during their CBME training. Similar perceptions have been reported in previous studies evaluating CBME implementation among medical undergraduates[19]. However, the findings of the present study should be interpreted cautiously, as the cross-sectional design and absence of a comparator group do not permit causal inferences regarding the relationship between CBME and academic stress. The results therefore reflect students' perceptions and experiences during CBME implementation rather than evidence that the curriculum itself directly causes increased stress. These concerns were amplified by students' perceptions of insufficient infrastructure and inadequately trained faculty, indicating that institutional preparedness has not kept pace with curricular ambition. Moreover, divided opinions on semester reduction and

faculty commitment point to underlying skepticism about the effectiveness of current implementation strategies, and suggest a need for greater transparency, planning, and engagement between institutional leadership and learners.

The most critical gap observed in this study pertains to actual learning practices, especially SDL. Despite CBME's emphasis on SDL as a cornerstone of lifelong learning, students demonstrated suboptimal engagement with SDL strategies. While students showed a willingness to apply theoretical knowledge in ECE and FAP sessions and displayed initiative in seeking clarifications, the consistent use of SDL tools such as logbooks was notably deficient. The infrequent use of online resources in a structured manner and insufficient allocation of time to SDL suggest that students have not yet transitioned fully from passive recipients of information to active, self-regulating learners[10, 16]. This disconnect may hinder alignment with the intended competencies and learner-centered goals of CBME and underscores the need for explicit training in SDL, guided mentoring, and the institutional provision of structured SDL time within the academic calendar. The limited participation in role-plays, simulations, and peer-led learning further illustrates a broader challenge in operationalizing active learning strategies within the Phase II curriculum. These strategies are vital for the development of non-cognitive competencies such as communication, empathy, decision-making, and collaboration—skills integral to the formation of a well-rounded IMG[21]. Faculty play a pivotal role in scaffolding these methodologies by offering clear expectations, structured opportunities, and feedback-rich environments that promote engagement and reflective learning.

Several key recommendations arise from these findings. First, communication about CBME must go beyond surface-level announcements to include detailed contextualization of its rationale, structure, and clinical relevance. Particularly in the domains of discipline-specific integration and programmatic innovations such as mentorship and FAP, students require repeated, meaningful engagement that connects curricular theory to future clinical practice. Second, the curriculum must be critically evaluated to reduce unnecessary academic pressure. Institutions should consider adopting spaced learning models and integrated assessments to minimize overload, while also incorporating structured time management and wellness programs to support student well-being. The perception of faculty being ill-prepared for CBME delivery necessitates sustained faculty development programs, emphasizing not only content delivery but also the pedagogy of SDL, integrated teaching, simulation-based instruction, and the facilitation of AETCOM sessions[15, 16]. Infrastructure development must also be prioritized. Investments in simulation labs, IT resources, skills centers, and flexible learning spaces are essential for ensuring that CBME principles can be realized in practice. Furthermore, SDL should be scaffolded through curriculum-embedded objectives, curated learning resources, mentorship frameworks, and formative assessments using logbooks. Faculty must be trained not only to facilitate SDL but to mentor students in navigating it effectively.

The study also highlights the need for a more systematic and widespread incorporation of active learning strategies such as role-plays, simulations, case-based discussions, and peer learning. These should be woven into the formal teaching schedule and supported by faculty development in facilitation methods. Mentorship must be elevated from an informal relationship to a structured, longitudinal program wherein mentors receive formal training and are allotted dedicated time to guide students academically, professionally, and emotionally. Participation in wellness-related activities such as yoga and sports was reported to be low among the study participants, despite a majority acknowledging their potential role in stress reduction. This finding may suggest challenges in sustaining wellness-oriented practices during the demanding Phase II MBBS curriculum. However, the present study did not specifically investigate the reasons for non-participation, and therefore no conclusions can be drawn regarding the underlying causes. Further research is warranted to explore barriers to student engagement in wellness activities and to evaluate strategies that may promote student well-being within the CBME framework.

This study is not without limitations. Being a single-center study, the findings may not be generalizable to other medical colleges, particularly those operating under different administrative structures, faculty strengths, or infrastructure availability. The use of convenience sampling, although pragmatic, introduces the possibility of selection bias and may limit the representativeness of the results. As a cross-sectional design, the study captures only a snapshot in time; it does not account for the evolution of student perceptions or practices over the course of medical training. Moreover, the reliance on self-reported data introduces the risk of recall bias and social desirability bias. In addition, the knowledge domain assessed students' perceived understanding of CBME concepts rather than objectively measuring knowledge through formal testing. Consequently, the findings related to knowledge should be interpreted as indicators of self-reported awareness and understanding rather than actual competency or mastery of CBME principles. Finally, the scope of the study was confined to student perceptions; it did not evaluate the perspectives of faculty or assess actual competency attainment, which would provide a more comprehensive picture of CBME implementation efficacy. Additionally, responses regarding faculty preparedness and commitment reflected students' perceptions and should not be interpreted as objective

measures of faculty training, competency, or institutional readiness for CBME implementation.

Conclusion

The transition to CBME in India offers significant potential to shape clinically competent and compassionate physicians. This study reveals that while Phase II MBBS students understand and appreciate CBME's clinical focus, students reported challenges during CBME implementation, particularly related to perceived academic stress, infrastructure limitations, and suboptimal adoption of self-directed learning practices. To realize CBME's promise, reforms must address student experiences by easing academic burden, enhancing faculty capacity, and supporting SDL and peer learning. Continued dialogue, regular KAP assessments, and curriculum refinement are essential. Key priorities include faculty development, structured SDL frameworks, and infrastructure upgrades. Longitudinal evaluations should guide future improvements.

Disclosure

Acknowledgements:

We express our gratitude to all participating students and the institutional leadership for their cooperation and support.

Conflicts of Interest:

None declared.

Funding:

No external funding was received.

Data Availability Statement:

The authors confirm that the data supporting the findings of this study are available within the article.

Ethical Permission:

The conduct of the study was permitted by the Institutional Ethics Committee – IEC-MGMMC, vide approval no MGM/IEC-87/2023 dated 10 March 2023

Author Contributions:

All authors contributed to the study conception and design. Material preparation and data collection was performed by N.E, M.M, S.B., S.G, S.P, T.S., S.S., S.P. Data analysis were performed by N.E. and S.M. The first draft of the manuscript was written by S.M. and N.E. and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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How to cite this article: Era N, Mukherjee M, Mukherjee S, Basak S, Ganguly S, Pandit S, Singh T, Shyam S, Parashar S. Assessment of Knowledge, Attitude, and Practices Toward Competency-Based Medical Education Among Phase II MBBS Students in a Tertiary Care Teaching Hospital in Bihar, India. Journal of Medical Sciences and Health 2026; 12(3):253-260

Date of submission: 02.02.2026
Date of review: 03.03.2026
Date of acceptance: 13.06.2026
Date of publication: 19.08.2026