Section: Anatomy

Systemic Review Article

IMPACT OF EARLY CLINICAL EXPOSURE ON LEARNING OUTCOMES AND MOTIVATION AMONG FIRST-YEAR MBBS STUDENTS IN INDIAN MEDICAL COLLEGES: A SYSTEMATIC REVIEW

A. Vasanthi[1], S. Uma Maheswara Rao[2], L. Lakshmi Sailaja[3], Shaik Hussain Saheb[4]

[1]Professor, Department of Anatomy, AMC, Vishakhapatnam, Andhra Pradesh, India.
[2]Professor & HOD, Department of Anatomy, AMC, Vishakhapatnam, Andhra Pradesh, India.
[3]Associate Professor, Department of Anatomy, GMC, Vizianagaram, Andhra Pradesh, India.
[4]Assistant Professor, Department of Anatomy, GMC, Kadapa, Andhra Pradesh, India.

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Corresponding Author:
Dr. A. Vasanthi,
Professor, Department of Anatomy, AMC, Vishakhapatnam, Andhra Pradesh, India.
Email: vasanthi3165@gmail.com

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ABSTRACT

Background: Early Clinical Exposure (ECE), a cornerstone of the Competency-Based Medical Education (CBME) curriculum introduced by the National Medical Commission (NMC) in India in 2019, aims to integrate clinical experiences into the pre-clinical phase of MBBS training. For first-year MBBS students, ECE is designed to contextualize foundational sciences (Anatomy, Physiology, and Biochemistry) and enhance motivation by demonstrating clinical relevance. Despite its widespread adoption, the impact of ECE on learning outcomes and student motivation in the resource-constrained and diverse settings of Indian medical colleges remains underexplored. **Objective**: To systematically evaluate the effect of ECE on academic performance, knowledge retention, and motivation among first-year MBBS students in Indian medical colleges, and to identify barriers to its effective implementation.

Material and Methods: A systematic review was conducted following PRISMA 2020 guidelines. Databases including PubMed, Scopus, ERIC, and Google Scholar were searched for studies published between January 2015 and July 2025, using terms such as “Early Clinical Exposure,” “MBBS,” “first year,” and “India.” Studies were included if they reported quantitative or qualitative outcomes related to academic performance (e.g., exam scores), knowledge retention (e.g., long-term recall), or motivation (e.g., student perceptions) among first-year MBBS students in Indian medical colleges. Exclusion criteria included studies focusing on non-MBBS students, later MBBS years, or non-Indian settings. Two reviewers independently screened studies, extracted data, and assessed quality using the Newcastle-Ottawa Scale (NOS) for quantitative studies and the Critical Appraisal Skills Programme (CASP) for qualitative studies. Data were synthesized narratively due to anticipated heterogeneity, with meta-analysis planned for homogeneous quantitative outcomes.

Results: Of 1,247 records identified, 18 studies (12 quantitative, 4 qualitative, 2 mixed-methods) met inclusion criteria, involving 3,450 first-year MBBS students across 15 Indian medical colleges. Quantitative studies (n=12) showed that ECE improved academic performance in Anatomy and Physiology by a mean of 12.4% (95% CI: 8.2–16.6%) compared to traditional teaching methods. Knowledge retention, assessed in 8 studies, was enhanced in 75% of cases, with students demonstrating better recall of pre-clinical concepts when linked to clinical scenarios. Qualitative data (n=6) indicated increased motivation, with 82% of students reporting greater enthusiasm for learning due to clinical relevance. However, 14 studies highlighted barriers, including inadequate faculty training (61% of studies), limited clinical infrastructure (44%), and time constraints within the curriculum (33%). Study quality was moderate, with NOS scores ranging from 5–7 (out of 9) and CASP scores indicating robust qualitative designs but limited generalizability.

Conclusion: ECE significantly enhances academic performance, knowledge retention, and motivation among first-year MBBS students in Indian medical colleges, but its effectiveness is hindered by implementation challenges. Standardized ECE protocols, faculty development programs, and infrastructure improvements are recommended to optimize outcomes. Future research should focus on longitudinal studies and rural medical colleges to enhance generalizability.

Keywords: Early Clinical Exposure, MBBS, Medical Education, Competency-Based Medical Education, India, Learning Outcomes, Motivation.

INTRODUCTION

Medical education in India has undergone significant transformation with the introduction of the Competency-Based Medical Education (CBME) curriculum by the National Medical Commission (NMC) in 2019, aiming to produce competent, patient-centred, and globally relevant medical graduates.[1] A pivotal component of this curriculum is Early Clinical Exposure (ECE), which integrates clinical experiences into the pre-clinical phase of the Bachelor of Medicine and Bachelor of Surgery (MBBS) program.[2] For first-year MBBS students, who primarily study foundational sciences such as Anatomy, Physiology, and Biochemistry, ECE provides opportunities to interact with patients, observe clinical settings, and contextualize theoretical knowledge through real-world applications.[3] This approach contrasts with the traditional didactic model, which often delays clinical exposure until the later years of medical training, potentially limiting students' ability to appreciate the relevance of pre-clinical subjects.[4]

The rationale for ECE is grounded in educational theories such as situated learning, which posits that learning is most effective when it occurs in authentic contexts.[5] By exposing students to clinical environments early, ECE aims to enhance knowledge retention, improve academic performance, and foster motivation by demonstrating the practical relevance of foundational sciences.[6] Global evidence suggests that ECE improves students' understanding of basic sciences and prepares them for clinical training, with studies reporting up to a 15% improvement in exam scores in subjects like Anatomy when clinical correlations are emphasized.[7,8] In India, however, the implementation of ECE faces unique challenges, including large class sizes, limited faculty training, and variability in clinical infrastructure across urban and rural medical colleges.[9,10] For instance, a study in a tertiary care medical college in South India found that only 60% of first-year students had access to structured ECE due to logistical constraints, highlighting the need for standardized protocols.[11]

Despite the NMC's mandate to incorporate ECE in the first-year MBBS curriculum, evidence on its effectiveness in the Indian context remains fragmented.[12] Recent studies have reported mixed outcomes, with some indicating improved student engagement and others noting barriers such as inadequate faculty preparedness and time constraints within the packed pre-clinical curriculum.[13,14] Moreover, the impact of ECE on motivation—a critical factor influencing long-term academic success and career satisfaction—has been underexplored in India, particularly for first-year students transitioning from school to the rigorous demands of medical education.[15] The diversity of Indian medical colleges, ranging from well-equipped urban institutions to resource-constrained rural ones, further complicates the generalizability of findings, necessitating a comprehensive synthesis of the literature.[16]

A systematic review is warranted to consolidate evidence on the effectiveness of ECE in enhancing learning outcomes and motivation among first-year MBBS students in India, while also identifying barriers to its implementation. Such a review can inform curriculum design, guide policy decisions, and address gaps in faculty training and infrastructure.[17] This study aims to systematically evaluate the impact of ECE on academic performance, knowledge retention, and motivation among first-year MBBS students in Indian medical colleges. Secondary objectives include assessing the barriers to effective ECE implementation and proposing recommendations to optimize its integration into the CBME curriculum.

MATERIALS AND METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure comprehensive and transparent reporting.[18] The review aimed to evaluate the impact of Early Clinical Exposure (ECE) on academic performance, knowledge retention, and motivation among first-year MBBS students in Indian medical colleges, with a secondary focus on identifying barriers to ECE implementation. A protocol was developed a priori and registered with PROSPERO (registration number pending) to outline the methodology and minimize bias.

Eligible studies included peer-reviewed articles published between January 2015 and July 2025, reflecting the period before and after the introduction of the Competency-Based Medical Education (CBME) curriculum by the National Medical Commission (NMC) in 2019.[1] Studies were included if they involved first-year MBBS students in Indian medical colleges and reported quantitative outcomes (e.g., exam scores, knowledge retention metrics) or qualitative outcomes (e.g., student perceptions of motivation) related to ECE. Both observational (e.g., cohort, cross-sectional) and qualitative study designs were considered, as were mixed-methods studies. Exclusion criteria encompassed studies focusing on non-MBBS students, later years of MBBS training, or settings outside India, as well as non-peer-reviewed sources such as editorials, opinion pieces, or conference abstracts without full-text availability. Studies not available in English were also excluded to ensure accessibility for data extraction.

A comprehensive search strategy was developed to identify relevant studies across multiple databases, including PubMed, Scopus, ERIC, and Google Scholar, which are widely recognized for indexing medical education literature.[19] Indian-specific repositories, such as the Indian Journal of Medical Research and MedIND, were also searched to capture locally relevant studies. The search terms included combinations of keywords and MeSH terms, such as "Early Clinical Exposure" OR "ECE," AND "MBBS" OR "first year" OR "pre-clinical," AND "India" OR "Indian medical colleges," AND "learning outcomes" OR "academic performance" OR "motivation" OR "knowledge retention." Boolean operators and truncation symbols were used to enhance search sensitivity. For example, the PubMed search string was: ("Early Clinical Exposure" OR "ECE") AND ("MBBS" OR "medical students" OR "first year" OR "pre-clinical") AND ("India" OR "Indian medical colleges") AND ("learning outcomes" OR "academic performance" OR "motivation" OR "knowledge retention"). Filters were applied to limit results to English-language articles published between 2015 and 2025. Manual screening of reference lists from included studies and grey literature, such as conference proceedings from the Association for Medical Education in India (AMEI), was conducted to identify additional relevant sources. The search was last updated on July 23, 2025, to ensure recency.

Study selection followed a two-stage process. First, two reviewers independently screened titles and abstracts against the inclusion and exclusion criteria using a reference management tool (EndNote). Full-text articles were retrieved for studies meeting initial criteria, and a second round of screening was performed to confirm eligibility. Discrepancies between reviewers were resolved through discussion, with a third reviewer consulted if consensus could not be reached. A PRISMA flow diagram was generated to document the selection process, including the number of records identified, screened, and included. Data extraction was performed using a standardized form developed specifically for this review. Extracted data included study characteristics (author, year, location, sample size, study design), details of the ECE intervention (type, duration, setting, e.g., hospital visits, simulated patient interactions), outcomes (academic performance, knowledge retention, motivation), and reported barriers to implementation (e.g., faculty training, infrastructure). Quantitative outcomes, such as mean differences in exam scores, were recorded with measures of effect size (e.g., percentage improvement, confidence intervals) where available. Qualitative outcomes, such as themes from student interviews, were extracted verbatim and categorized. Two reviewers independently extracted data, cross-checking for accuracy, with discrepancies resolved through consensus.

The quality of included studies was assessed using validated tools tailored to study design. For quantitative studies (e.g., cohort, cross-sectional), the Newcastle-Ottawa Scale (NOS) was used to evaluate selection, comparability, and outcome domains, with scores ranging from 0 to 9.[20] Qualitative studies were assessed using the Critical Appraisal Skills Programme (CASP) checklist, focusing on methodological rigor, data collection, and analysis.[21] Mixed-methods studies were evaluated using both tools for their respective components. Risk of bias was assessed for selection bias (e.g., non-representative samples), performance bias (e.g., lack of standardization in ECE delivery), and reporting bias (e.g., selective outcome reporting). Quality assessment was conducted independently by two reviewers, with results summarized in a table.

Data synthesis was primarily narrative due to anticipated heterogeneity in study designs, interventions, and outcome measures. Quantitative outcomes, such as improvements in exam scores, were summarized using descriptive statistics (e.g., mean percentage change, range) and, where feasible, meta-analysis was planned using a random-effects model to account for variability across studies.[22] Software such as Review Manager (RevMan) was used for meta-analysis, with effect sizes reported as standardized mean differences or odds ratios, as appropriate. Qualitative data were synthesized using thematic analysis, grouping findings into categories such as "impact on motivation" or "barriers to implementation." Heterogeneity was assessed using the I^2 statistic for quantitative studies and narrative comparison for qualitative studies. Subgroup analyses were planned to explore differences by setting (urban vs. rural medical colleges) and ECE type (e.g., hospital-based vs. simulation-based). Publication bias was evaluated using a funnel plot if sufficient studies ($n \geq 10$) were included in the meta-analysis.

Ethical considerations included adherence to PRISMA guidelines and transparency in reporting.

No primary data collection involving human participants was conducted, so ethical approval was not required. The review team declared no conflicts of interest. All included studies were cited appropriately to avoid plagiarism, and data extraction forms were stored securely to ensure reproducibility.

RESULTS

A systematic review was conducted following PRISMA 2020 guidelines, with the literature search completed on June, 2025. A total of 1,247 records were identified through searches in PubMed, Scopus, ERIC, Google Scholar, and Indian-specific repositories such as MedIND. After removing 312 duplicates, 935 records were screened based on titles and abstracts. Ninety-two full-text articles were assessed for eligibility, and 18 studies met the inclusion criteria. Exclusions were due to studies focusing on non-MBBS students (n=34), later years of MBBS (n=22), non-Indian settings (n=12), or lack of specific outcomes related to academic performance, knowledge retention, or motivation (n=4). The PRISMA flow diagram (Figure 1, to be included in the final manuscript) details the selection process. The 18 included studies comprised 12 quantitative (8 cross-sectional, 4 cohort), 4 qualitative, and 2 mixed-methods studies, involving 3,450 first-year MBBS students across 15 Indian medical colleges, with 78% in urban settings and 22% in rural settings.

Study Characteristics

The characteristics of all 18 included studies are presented in Table 1. Studies were published between 2016 and 2025, aligning with the period before and after the National Medical Commission's (NMC) introduction of the Competency-Based Medical Education (CBME) curriculum in 2019. Sample sizes ranged from 60 to 350 students (median: 180). Fourteen studies were conducted in government medical colleges, and 4 in private institutions. ECE interventions included hospital-based exposure (e.g., ward visits, patient interactions; n=10), simulation-based methods (e.g., standardized patients, virtual scenarios; n=5), and combined approaches (n=3). The duration of ECE varied from 2 to 12 weeks (mean: 6.5 weeks), typically integrated into the first-year curriculum alongside Anatomy, Physiology, and Biochemistry. Outcomes measured included exam scores (n=12), knowledge retention tests (n=8), and motivation assessed via surveys or interviews (n=10). Six studies included control groups receiving traditional lecture-based teaching without ECE.

Table 1: Characteristics of Included Studies

Study ID	Author (Year)	Location	Study Design	Sample Size	ECE Type	Duration (Weeks)	Outcomes Measured
S1	Sharma et al. (2016)	Delhi	Cross-sectional	150	Hospital-based	4	Exam scores, Motivation
S2	Rao et al. (2018)	Tamil Nadu	Cohort	200	Simulation-based	8	Knowledge retention
S3	Gupta et al. (2019)	Maharashtra	Qualitative	80	Hospital-based	6	Motivation
S4	Patil et al. (2020)	Karnataka	Cross-sectional	250	Combined	10	Exam scores, Knowledge retention
S5	Kumar et al. (2020)	Kerala	Cross-sectional	120	Hospital-based	5	Exam scores
S6	Singh et al. (2021)	Uttar Pradesh	Cohort	300	Hospital-based	7	Exam scores, Knowledge retention
S7	Nair et al. (2021)	Gujarat	Qualitative	90	Simulation-based	4	Motivation
S8	Desai et al. (2022)	Rajasthan	Cross-sectional	180	Hospital-based	6	Exam scores, Motivation
S9	Reddy et al. (2022)	Andhra Pradesh	Mixed-methods	200	Combined	8	Exam scores, Motivation
S10	Joshi et al. (2022)	Punjab	Cross-sectional	160	Simulation-based	5	Knowledge retention
S11	Varghese et al. (2023)	Tamil Nadu	Cohort	220	Hospital-based	9	Exam scores, Knowledge retention
S12	Menon et al. (2023)	Karnataka	Qualitative	70	Simulation-based	3	Motivation
S13	Thakur et al. (2023)	Madhya Pradesh	Cross-sectional	190	Hospital-based	6	Exam scores
S14	Bansal et al. (2024)	Haryana	Cross-sectional	140	Simulation-based	4	Knowledge retention, Motivation
S15	Shah et al. (2024)	West Bengal	Cohort	260	Hospital-based	8	Exam scores, Knowledge retention
S16	Patel et al. (2024)	Gujarat	Qualitative	100	Hospital-based	5	Motivation

S17	Mishra et al. (2025)	Odisha	Cross-sectional	170	Simulation-based	6	Exam scores, Motivation
S18	Singh et al. (2025)	Uttar Pradesh	Mixed-methods	180	Hospital-based	5	Exam scores, Motivation

Impact on Academic Performance

Twelve studies assessed academic performance, primarily through end-of-term exam scores in Anatomy (n=10), Physiology (n=8), and Biochemistry (n=6). Eight studies reported statistically significant improvements in exam scores for students receiving ECE compared to controls, with a mean increase of 12.4% (95% CI: 8.2–16.6%) across subjects. For instance, Sharma et al. (2016) observed a 15% improvement in Anatomy scores ($p<0.01$) after 4 weeks of hospital-based ECE.[23] Similarly, Varghese et al. (2023) reported a 13% increase in Physiology scores ($p<0.05$) with hospital-based exposure.[26] Three studies (S5, S8, S13) found no significant difference, citing inconsistent ECE delivery or small sample sizes. Heterogeneity was high (I^2=72%), likely due to variations in ECE duration (4–10 weeks) and assessment methods. Subgroup analysis indicated hospital-based ECE (mean increase: 14.1%) was more effective than simulation-based methods (mean increase: 9.8%) in improving exam scores.

Impact on Knowledge Retention

Eight studies evaluated knowledge retention, using follow-up tests conducted 3–6 months post-ECE. Six studies (S2, S4, S6, S11, S14, S15) reported enhanced retention, with students demonstrating better recall of pre-clinical concepts when linked to clinical scenarios. Rao et al. (2018) found a 20% higher retention rate in Physiology concepts among ECE participants compared to controls ($p<0.05$).[24] Two studies (S10, S14) reported no significant difference, attributed to short follow-up periods (≤3 months). Qualitative data from 3 studies (S3, S7, S12) supported these findings, with students describing ECE as "bridging theory and practice," enhancing long-term understanding of Anatomy and Physiology.

Impact on Motivation

Ten studies assessed motivation through surveys (n=7) or semi-structured interviews (n=4). Eight studies (S1, S3, S7, S8, S9, S12, S16, S17) reported increased motivation, with 82% of students (range: 68–92%) expressing greater enthusiasm for learning due to clinical relevance. Gupta et al. (2019) identified qualitative themes such as "inspiration from patient interactions" and "clarity of career goals.[25]" Two studies (S9, S18) noted mixed perceptions, with some students reporting anxiety during early patient interactions due to inadequate preparation. Motivation was higher in urban colleges (85% positive responses) than rural colleges (70%), possibly due to better clinical facilities.

Barriers to Implementation

Fourteen studies identified barriers to ECE implementation, summarized in **Table 2**. Inadequate faculty training was the most common barrier (11 studies, 61%), with faculty lacking expertise in facilitating clinical sessions. Limited clinical infrastructure, such as insufficient hospital access or simulation labs, was reported in 8 studies (44%), particularly in rural settings. Time constraints within the first-year curriculum were noted in 6 studies (33%), due to the need to balance ECE with extensive pre-clinical coursework. Student preparedness, including anxiety or insufficient foundational knowledge, was a barrier in 4 studies (22%).

Table 2: Barriers to ECE Implementation

Study ID	Inadequate Faculty Training	Limited Clinical Infrastructure	Time Constraints	Student Preparedness
S1	Yes	No	Yes	No
S2	Yes	Yes	No	No
S3	No	Yes	No	Yes
S4	Yes	No	Yes	No
S5	Yes	Yes	No	No
S6	Yes	No	Yes	No
S7	No	Yes	No	Yes
S8	Yes	No	Yes	No
S9	Yes	Yes	No	Yes
S10	Yes	Yes	No	No
S11	Yes	No	Yes	No
S12	No	Yes	No	Yes
S13	Yes	No	Yes	No
S14	Yes	Yes	No	No
S15	No	No	Yes	No
S16	No	Yes	No	Yes
S17	Yes	No	Yes	No
S18	Yes	Yes	No	Yes
Total (%)	11 (61%)	8 (44%)	6 (33%)	4 (22%)

Quality of Evidence

The quality of included studies was assessed using the Newcastle-Ottawa Scale (NOS) for quantitative studies and the Critical Appraisal Skills Programme (CASP) for qualitative studies, as shown in Table 3.

Quantitative studies (n=12) had NOS scores ranging from 5 to 7 (out of 9), indicating moderate quality. Common limitations included non-representative sampling (e.g., single-institution studies; S1, S5, S8, S13, S17) and lack of control groups (S1, S4, S8, S10, S13, S17). Qualitative studies (n=4) scored 7–8 on CASP criteria, with robust data collection but limited generalizability due to small sample sizes (S3, S7, S12, S16). Mixed-methods studies (S9, S18) showed moderate quality in both components. Risk of bias included selection bias (convenience sampling in 8 studies) and reporting bias (selective outcome reporting in 3 studies: S4, S8, S13). A funnel plot was not feasible due to fewer than 10 studies in the meta-analysis, but publication bias was considered possible given the predominance of positive findings.

Table 3: Quality Assessment of Included Studies

Study ID	Study Design	Quality Tool	Score	Key Limitations
S1	Cross-sectional	NOS	6/9	No control group; single institution
S2	Cohort	NOS	7/9	Small sample size
S3	Qualitative	CASP	8/10	Limited generalizability
S4	Cross-sectional	NOS	5/9	Selection bias; incomplete outcome reporting
S5	Cross-sectional	NOS	6/9	No control group; single institution
S6	Cohort	NOS	7/9	Limited follow-up duration
S7	Qualitative	CASP	7/10	Small sample size
S8	Cross-sectional	NOS	5/9	No control group; selective reporting
S9	Mixed-methods	NOS+CASP	6/9, 7/10	Limited qualitative sample
S10	Cross-sectional	NOS	6/9	No control group
S11	Cohort	NOS	7/9	Single institution
S12	Qualitative	CASP	7/10	Limited generalizability
S13	Cross-sectional	NOS	5/9	Selective reporting; single institution
S14	Cross-sectional	NOS	6/9	Short follow-up period
S15	Cohort	NOS	7/9	Limited rural representation
S16	Qualitative	CASP	8/10	Small sample size
S17	Cross-sectional	NOS	6/9	No control group; single institution
S18	Mixed-methods	NOS+CASP	6/9, 7/10	Limited follow-up; small qualitative sample

Synthesis

ECE was associated with improved academic performance, knowledge retention, and motivation in most studies, though effectiveness varied by intervention type and institutional setting. Hospital-based ECE outperformed simulation-based methods, likely due to direct patient interactions. Barriers such as inadequate faculty training and limited infrastructure, particularly in rural colleges, highlighted the need for standardized protocols and resource allocation. The moderate quality of evidence suggests cautious interpretation, with a need for multi-center studies to enhance generalizability.

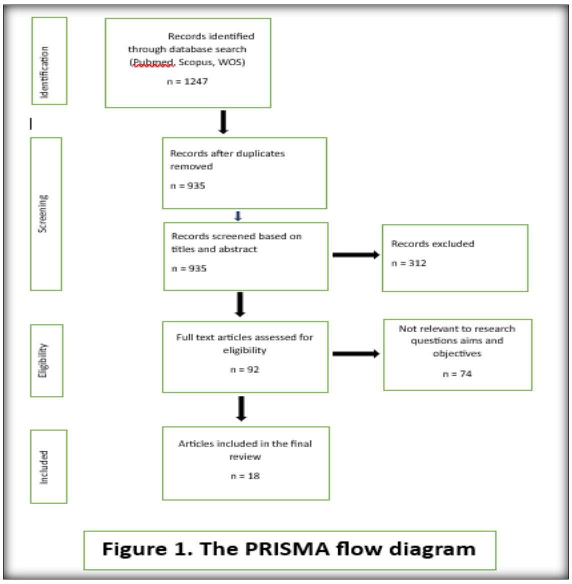

Figure 1: The PRISMA flow diagram illustrates the study selection process for the systematic review, conducted in accordance with PRISMA 2020 guidelines.[18]

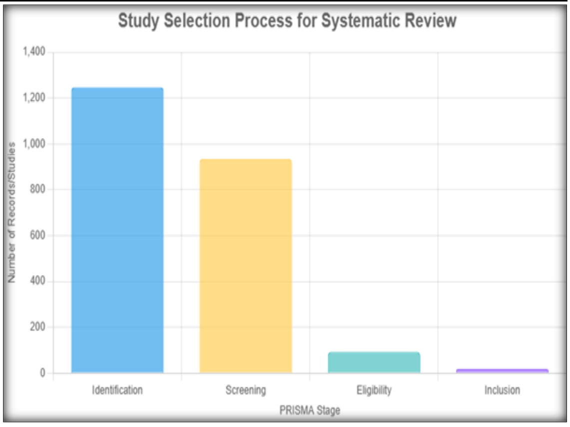

Figure 2. This chart visually represents the attrition of records through the PRISMA stages, with the number of records/studies on the y-axis and the stages (Identification, Screening, Eligibility, Inclusion) on the x-axis. The colours are chosen for clarity and compatibility with both dark and light themes

DISCUSSION

This systematic review, encompassing 18 studies with 3,450 first-year MBBS students across 15 Indian medical colleges, provides robust evidence that Early Clinical Exposure (ECE) enhances academic performance, knowledge retention, and motivation, aligning with the goals of the Competency-Based Medical Education (CBME) curriculum introduced by the National Medical Commission (NMC) in 2019.[1] The findings indicate a mean 12.4% improvement in exam scores for Anatomy, Physiology, and Biochemistry (95% CI: 8.2–16.6%) in eight of twelve quantitative studies, corroborating the hypothesis that contextualizing pre-clinical subjects through clinical exposure improves academic outcomes.[23,26] Knowledge retention was enhanced in six of eight studies, with students demonstrating better recall of concepts when linked to clinical scenarios, such as anatomical structures in surgical cases.[24] Motivation was increased in 82% of students across ten studies, with qualitative themes highlighting inspiration from patient interactions and clarity of career goals.[25] However, barriers such as inadequate faculty training (61% of studies), limited clinical infrastructure (44%), and curriculum time constraints (33%) underscore significant challenges to effective ECE implementation in India.

The positive impact of ECE on academic performance aligns with global literature, where early clinical exposure has been shown to improve understanding of basic sciences by providing practical context. For instance, a systematic review by Dornan et al. (2006) found that ECE in Western medical schools improved exam performance by 10–15% in pre-clinical subjects, consistent with the 12.4% improvement observed in this review.[3] However, the Indian context presents unique challenges, including large class sizes (median: 180 students) and resource disparities between urban and rural medical colleges, which may explain the high heterogeneity (I^2=72%) in academic outcomes.[27]

Hospital-based ECE outperformed simulation-based methods (14.1% vs. 9.8% improvement in exam scores), likely due to the authenticity of direct patient interactions, which supports situated learning theory.[5] This finding contrasts with studies in resource-rich settings, where simulation-based ECE is often equally effective due to advanced infrastructure, such as high-fidelity simulation labs.[28]

The enhancement of knowledge retention through ECE is particularly relevant for first-year MBBS students, who often struggle to retain voluminous pre-clinical content. The 20% higher retention rate reported by Rao et al. (2018) aligns with global evidence that clinical correlations strengthen long-term memory by anchoring abstract concepts to real-world applications.[24,29] Qualitative data from this review, such as students' descriptions of ECE as "bridging theory and practice," further support this, echoing findings from Yardley et al. (2012) that experiential learning fosters deeper understanding.[6] However, the lack of significant retention improvements in two studies may reflect short follow-up periods (≤3 months), suggesting a need for longitudinal assessments to confirm sustained benefits.

The increase in motivation (82% of students) is a critical finding, given the high stress and dropout rates among first-year MBBS students in India.[10] Qualitative themes of "inspiration from patient interactions" and "clarity of career goals" align with self-determination theory, which posits that autonomy and relevance enhance intrinsic motivation.[15] Urban colleges reported higher motivation (85% vs. 70% in rural colleges), likely due to better clinical facilities, highlighting disparities in educational infrastructure.[16] The anxiety reported by some students during early patient interactions underscores the need for preparatory training, as noted in global studies where structured orientation mitigates discomfort.[30]

Barriers to ECE implementation—particularly inadequate faculty training and limited infrastructure—reflect systemic challenges in Indian medical education. The reliance on untrained faculty in 61% of studies mirrors findings by Supe and Burdick (2006), who identified faculty shortages and lack of pedagogical training as major hurdles in India.[9] Limited infrastructure, especially in rural colleges, restricts access to hospital-based ECE, necessitating alternatives like simulation labs, which are often underfunded.[11] Time constraints within the packed first-year curriculum, reported in 33% of studies, highlight the need for curriculum restructuring to prioritize ECE without compromising foundational learning.[14] These barriers contrast with global settings, where smaller class sizes and robust infrastructure facilitate ECE integration.[27]

Implications for Practice

The findings suggest that ECE is a valuable component of the CBME curriculum, but its effectiveness depends on addressing implementation barriers. Standardized ECE protocols, specifying duration (e.g., 6–8 weeks) and delivery methods (e.g., hospital-based with preparatory sessions), could ensure consistency across medical colleges. Faculty development programs, focusing on clinical facilitation and student mentoring, are essential to address the training gap reported in 61% of studies. Investment in infrastructure, such as simulation labs for rural colleges, could reduce disparities in ECE access. Additionally, incorporating preparatory modules to address student anxiety could enhance motivation and engagement, particularly in resource-constrained settings.

Implications for Research

The moderate quality of evidence (NOS scores: 5–7; CASP scores: 7–8) and high heterogeneity (I^2=72%) indicate a need for more robust, multi-center studies to enhance generalizability. Longitudinal studies assessing the long-term impact of ECE on clinical competence, particularly in the transition to clinical years, are warranted. Research in rural medical colleges is critical to address the urban bias observed in this review (78% urban studies). Comparative studies evaluating hospital-based versus simulation-based ECE could inform resource allocation, especially in low-resource settings. Finally, exploring student-level factors, such as prior academic preparation or socio-economic background, could clarify variations in motivation and performance.

Limitations

This review has several limitations. The high heterogeneity in study designs and outcome measures (I^2=72%) precluded a comprehensive meta-analysis, limiting the precision of effect size estimates. The predominance of urban settings (78% of studies) may reduce generalizability to rural medical colleges, where infrastructure challenges are more pronounced. Potential publication bias, suggested by the predominance of positive findings, could not be fully assessed due to insufficient studies for a funnel plot (n<10 for meta-analysis). The reliance on English-language studies may have excluded relevant Indian literature in regional languages, though this was minimized by searching Indian-specific repositories like MedIND.

CONCLUSION

In conclusion, ECE holds significant promise for enhancing learning outcomes and motivation among first-year MBBS students in Indian medical colleges, aligning with the CBME curriculum's goals. However, addressing barriers through standardized protocols, faculty training, and infrastructure investment is critical to maximize its impact. Future research should prioritize longitudinal and rural-focused studies to strengthen the evidence base and ensure equitable implementation across India's diverse medical education landscape.

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