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Original Research Article

Design and evaluation of a competency-based pharmacology elective module on rational use of medicines for undergraduate medical students

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ABSTRACT

Background: Competency-Based Medical Education (CBME) emphasizes the development of practical prescribing competencies among undergraduate medical students. Traditional pharmacology teaching often provides limited opportunities for applied learning related to rational drug use. Elective modules introduced under CBME offer opportunities for competency-oriented experiential learning. Objectives were to design and evaluate a competency-based pharmacology elective module focusing on rational use of medicines among undergraduate medical students.
Methods: A prospective educational interventional study was conducted in the Department of Pharmacology at a tertiary care teaching institution. Undergraduate MBBS students who opted for the pharmacology elective participated in a structured two-week module incorporating interactive lectures, problem-based learning, case-based discussions, prescription writing exercises, reflective learning, and continuous formative assessment. Pre-test and post-test assessments were conducted to evaluate learning attainment. Student feedback was collected using a structured Likert-scale questionnaire and analysed using descriptive statistics.
Results: A total of 30 students participated in the elective module and all completed the program successfully. The module was implemented as per the planned schedule and all learning activities were completed. Student feedback demonstrated high satisfaction regarding module relevance (100%), effectiveness of teaching–learning strategies (100%), and usefulness of case-based discussions (100%). Most students reported improved understanding of rational prescribing principles and applied pharmacology concepts.
Conclusions: The competency-based pharmacology elective module was feasible, well accepted, and effectively implemented within the CBME framework. Structured experiential learning modules may serve as an effective strategy for strengthening rational prescribing competencies among undergraduate medical students.

Keywords: Competency-based medical education, Pharmacology elective, Rational use of medicines, Rational prescribing, Undergraduate medical education

INTRODUCTION

The rational use of medicines is a fundamental competency required of medical graduates to ensure safe, effective, and economical patient care. Irrational prescribing practices, including polypharmacy, inappropriate drug selection, incorrect dosing, and inadequate monitoring, remain prevalent and contribute significantly to adverse drug reactions, antimicrobial resistance, and increased healthcare costs. Strengthening prescribing competencies during undergraduate medical training is therefore essential for improving healthcare outcomes.[1]

In recent years, medical education in India has undergone a major transformation with the introduction of CBME by the National Medical Commission (NMC). CBME emphasizes outcome-oriented learning, integration of knowledge with clinical skills, reflective practice, and continuous assessment to prepare Indian Medical Graduates for real-world clinical responsibilities.[2] Within this framework, elective modules have been incorporated to promote self-directed, experiential, and context-specific learning beyond the core curriculum.[3]

Pharmacology, as a discipline directly linked to clinical decision-making, offers significant scope for competency-based teaching approaches. Core areas such as rational use of medicines, essential medicines concept, prescription writing, special population prescribing, and pharmacovigilance are particularly suited for interactive and applied learning strategies. However, traditional undergraduate pharmacology teaching often relies heavily on didactic methods, providing limited opportunities for students to develop practical prescribing skills.[4] Several studies have highlighted gaps between theoretical knowledge and real-world prescribing competence among medical graduates, underscoring the need for structured educational interventions.[5]

Although CBME has introduced elective postings as a means to enhance applied learning, there is limited published literature describing the design, implementation, and evaluation of structured pharmacology elective modules aligned with CBME principles in the Indian context.[6,7] Addressing this gap is crucial for optimizing curriculum implementation and ensuring that pharmacology education effectively supports rational prescribing competencies.

Therefore, the present study aimed to design and evaluate a competency-based pharmacology elective module focused on the rational use of medicines for undergraduate medical students.

METHODS

Study design

This was a prospective educational interventional study conducted as part of a competency-based pharmacology elective module.

Study setting and participants

The study was conducted in the Department of Pharmacology, D. Y. Patil Medical College, Kolhapur, Maharashtra, during the elective posting under the CBME curriculum.

Undergraduate MBBS students from Batch 2021 and 2022 who voluntarily opted for the Rational Use of Medicines elective) were included in the study. A total of 30 students participated and completed the module.

Development of the elective module

The elective module was designed according to CBME guidelines issued by the NMC. Learning objectives were mapped to relevant pharmacology competencies focusing on rational drug selection, essential medicines concept, prescription auditing, prescribing in special populations, and ethical aspects of pharmacotherapy.

Duration and structure of the module

The elective module was conducted over a period of two weeks with daily sessions from 2:00 pm to 5:00 pm. A structured timetable was prepared to ensure systematic coverage of module components. The module included interactive lectures, problem-based learning, case-based discussions, prescription writing exercises, reflective learning activities, and logbook documentation.

Teaching-learning methods

Learner-centered and experiential teaching strategies were employed, including interactive lectures, clinical case discussions, problem-based learning sessions, guided prescription writing exercises, and reflective assignments.

Teaching materials included PowerPoint presentations, standardized case scenarios, and structured activity worksheets.

Assessment strategy

A pre-test was conducted at the beginning of the module to assess baseline knowledge. Continuous formative assessments included MCQs, short-answer questions, case-based exercises, and prescription writing tasks.

A post-test was conducted at the end of the module to assess learning attainment. Logbooks were used to document student activities and reflections.

Student feedback

Student perceptions were collected using a structured questionnaire with Likert-scale responses evaluating content relevance, teaching methods, assessment strategies, and overall satisfaction.

Ethical considerations

Institutional Ethics Committee approval was obtained prior to study initiation. Written informed consent was obtained from all participants, and confidentiality of participant data was maintained throughout the study.

Statistical analysis

Data were analysed using descriptive statistics and presented as frequencies and percentages.

RESULTS

Participant demographics

A total of 30 undergraduate MBBS students enrolled in the competency-based pharmacology elective module on Rational Use of Medicines. All enrolled students completed the module successfully, resulting in a 100% completion rate (Table 1). All students successfully completed the module resulting in a 100% completion rate.

Implementation of the elective module

The elective module was implemented as per the planned schedule over two weeks without interruptions or deviations (Table 2). All teaching–learning sessions, formative assessments, reflective activities, and logbook documentation were completed as outlined in the module structure (Table 3).

Logbook completion and certification

All participating students maintained the prescribed logbooks documenting learning activities, prescription exercises, and reflective assignments. Logbook review demonstrated complete documentation and active engagement among all students. Based on satisfactory attendance and assessment participation, certification was awarded to all students upon module completion.

Table 1: Demographic profile of participating students, (n=30).

Characteristic	N	Percentage (%)
Batch		
2021	15	50
2022	15	50
Gender		
Male	14	46.7
Female	16	53.3
Total participants	30	100

Table 2: Structure of the competency-based pharmacology elective module.

Component	Description
Elective topic	Rational use of medicines
Target group	Undergraduate MBBS students
Duration	Two weeks
Daily schedule	2:00 pm-5:00 pm
Teaching material	PowerPoint modules, clinical case scenarios
Learning approach	Competency-based, student-centred
Documentation	Logbook and reflective assignments
Completion criteria	Attendance, assessments, logbook completion

Table 3: Teaching-learning methods and assessment tools.

Teaching-learning method	Assessment tool
Interactive lectures	MCQs
Problem-based learning	Short-answer questions
Case-based discussions	Case analysis
Prescription writing exercises	Written prescriptions
Reflective learning	Reflective writing
Continuous learning	Logbook review

Table 4: Student feedback on the elective module, (n=30).

Feedback parameter	Agree/strongly agree (%)
Relevance of module content	100
Clarity of learning objectives	93.3
Effectiveness of teaching–learning methods	100
Usefulness of case-based discussions	100
Helpfulness of prescription writing exercises	93.3
Appropriateness of assessment methods	93.3
Overall satisfaction with the module	100

Student feedback on the elective module

Student feedback revealed high levels of satisfaction regarding content relevance, teaching–learning strategies, and assessment methods. Most participants perceived improvement in understanding rational prescribing principles.

DISCUSSION

The present study demonstrates that a structured, competency-based pharmacology elective module focusing on rational use of medicines was feasible, well accepted and positively perceived by undergraduate medical students. The high completion rates, complete logbook participation, and favorable feedback indicate that experiential learning approaches effectively enhance applied pharmacology competencies within the CBME framework. Similar improvements in engagement and skill acquisition following CBME-oriented teaching strategies have been reported in recent pharmacology education studies.[8]

Educational interventions have consistently been shown to improve pharmacovigilance awareness and rational prescribing competencies. Structured training programs among healthcare students have demonstrated significant improvement in knowledge and attitudes toward adverse

drug reaction (ADR) reporting following focused educational interventions.[9] These findings support the present module's emphasis on applied learning strategies such as case-based discussions and practical prescription exercises.

Recent evidence also highlights persistent gaps in pharmacovigilance knowledge and reporting skills in the absence of structured teaching. Multi-centre assessments among undergraduate healthcare students have revealed limited practical competence in ADR reporting despite basic awareness of pharmacovigilance principles.[10] In contrast, studies indicate that structured educational approaches under CBME frameworks improve knowledge, attitudes, and practices related to pharmacovigilance, underscoring the positive educational impact of competency-based reforms.[11]

Beyond pharmacovigilance, competency-based approaches to rational prescribing have demonstrated measurable improvements in clinical prescribing skills. Training based on structured pharmacology education has been associated with enhanced rational drug selection among medical interns.[12] Similarly, competency-based personal drug (P-drug) selection exercises have strengthened rational medicine use skills among undergraduate students.[12]

The high satisfaction and perceived relevance reported by participants are consistent with educational research showing that learner-centred, experiential approaches promote deeper engagement and better skill retention compared to conventional didactic teaching. Inter-professional and applied pharmacology education interventions have further demonstrated improvements in prescribing competence and clinical decision-making abilities.[13]

However, sustaining long-term behavioral change remains a challenge. Observational studies indicate that although educational interventions improve knowledge and attitudes, continuous reinforcement is required to translate these gains into consistent real-world ADR reporting and rational prescribing practices.[14]

The use of reflective logbooks in the present module aligns with evidence supporting reflective learning as a tool for enhancing learner engagement and professional development.[15] Additionally, elective modules may help address CBME implementation challenges by providing focused, skill-oriented learning experiences within compressed curricula.[16]

The limitations of the present study include its single-center design, small sample size, and reliance on descriptive feedback without long-term follow-up. Future multi-institutional studies incorporating objective learning outcomes and longitudinal assessment are required to evaluate sustained impact on prescribing behavior and patient safety outcomes.

Overall, the findings support the integration of structured, competency-based elective modules within pharmacology education as an effective strategy to strengthen rational medicine use and applied clinical competencies among undergraduate medical students.

Implications for curriculum reform

The findings highlight the importance of integrating structured, competency-based pharmacology electives into undergraduate medical curricula. Embedding hands-on, experiential learning modules early in medical training can enhance prescribing competence, confidence, and clinical decision-making.

Linking theoretical knowledge with real-world applications, continuous formative assessment, and reflective practice can reinforce rational medicine use principles. Incorporation of such elective modules within CBME can help bridge existing gaps in traditional pharmacology teaching and promote a culture of safe, evidence-based prescribing among future physicians.

Limitations

The study was conducted at a single institution with a small sample size, which may limit the generalizability of the findings. Evaluation was primarily based on descriptive feedback and feasibility outcomes, without detailed statistical analysis of learning gains.

Additionally, long-term follow-up was not performed to assess retention of competencies or translation into clinical prescribing behavior. Future multi-center studies with larger cohorts and longitudinal evaluation are recommended to determine sustained educational and clinical impact.

CONCLUSION

The competency-based pharmacology elective module on rational use of medicines was successfully designed, implemented, and evaluated within the CBME framework. The module demonstrated high feasibility and acceptability, with active student participation, complete logbook documentation, and positive learner feedback. Experiential teaching strategies such as case-based discussions, prescription writing exercises, and reflective learning effectively supported the development of applied prescribing competencies.

Structured pharmacology elective modules can therefore serve as an effective educational approach to strengthen applied pharmacology competencies and promote rational medicine use among future physicians.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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