Editorial

Competency-based medical microbiology education in India – concept, goals and implementation

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A R T I C L E   I N F O

The scenario and approach to medical education keeps changing globally in pace with the changing healthcare needs and scientific advancements. Emergence of newer healthcare changes like Covid19, monkey pox, ever increasing antimicrobial resistance among pathogens necessitates rapid adoption of newer diagnostic methods and also appropriate curricular changes and educational methodologies in microbiology education at various levels. The National Medical Commission (NMC), the apex body regulating the medical education in India, has been introducing several changes in the curricula of undergraduate and postgraduate medical education, including in Medical Microbiology in India.[1]

1. Undergraduate Medical Microbiology Education

NMC has introduced Competency Based Medical Education (CBME) in MBBS since 2019.[2] NMC describes it to be more learner-centric, patient-centric, gender- sensitive, outcome-oriented and environment appropriate.[3] In CBME, learners are expected to achieve the predetermined competencies which include certain certifiable competencies that are skill-based and need to be performed at a certain predetermined proficiency for a minimum number of times before the student progresses to the next phase. The mandatory certifiable competencies in microbiology include essential staining and microscopic skills (Gram stain, acid fast stain, etc) and key infection prevention practices like hand hygiene, appropriate usage of personal protective equipment.[2–4]

The NMC advocates $2/3^{rd}$ of the teaching-learning by means of various methods of small-group teaching so as to provide problem solving skills, collaborative learning, self-directed learning, experiential learning opportunities to the students that are believed to be more engaging and effective. The Attitude, Ethics and Communication (AETCOM) competencies lay a great emphasis on collaborative and inter-disciplinary teamwork, professionalism, ethics, altruism and respect in professional relationships, etc.[5] AETCOM competencies in medical microbiology include respecting patient samples, confidentiality pertaining to laboratory testing, communication skills, etc.[3] Another hallmark of CBME is standardisation of assessment, major shift to formative or day-today assessment with feedback.[6] Along with the traditional assessment tools, newer assessment methods like OSPE/OSCE are used.[7] The sea change in microbiology curriculum is the shift from the previous organism-based approach to the syndrome-based approach. The microbiology concepts related to infectious diseases are now taught in a more real-life and clinically oriented approach. To better equip the learners to manage situations like Covid 19 pandemic, a dedicated module named 'pandemic module' is introduced which runs longitudinally across the phases and key concepts are

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taught by multiple subject experts including microbiology.[8] Students are also provided with first hand exposure to the laboratory workflow by means of electives and compulsory postings in the laboratories. The curriculum encourages the students to participate in research activities at the undergraduate level itself.[2,3,9]

The CBME curriculum has been revised in 2024, around 5 years after its initial introduction.[10] The new additional roles envisaged for Indian Medical Graduates (IMG) are – 'critical thinker' who has the ability to solve problems in professional life, and a 'researcher' who generates and interprets evidence to ensure effective patient care as well as contributes in the field of medical research and practice. The salient changes in microbiology curriculum now are emphasis on learning concepts of healthcare associated infections, infection prevention practices, antimicrobial resistance (AMR) and stewardship (AMS) in theory and practical sessions.[10]

2. Postgraduate Medical Microbiology Education[11]

The NMC has introduced CBME in postgraduate curriculum (MD Microbiology) since 2022. The preamble of the curriculum describes the curricular goals as "a microbiologist needs to develop clinical expertise in addition to technical expertise and be available more at the bedside to develop partnership with clinician in diagnosis and management of infectious disease cases. To fulfil these expectations, the program of MD Microbiology needs to shift focus to clinical aspects of microbiology, where a student is trained in the clinical setting and is able to contribute in the clinical management along with diagnosis, prevention and control of infectious disease. More emphasis on training in patient care setting with integration of concepts of microbiology in various clinical specialties through dedicated postings, ward rounds, case discussion etc." To chieve these goals, clinical postings (in broad specialties, intensive care units and super specialties) and district residency program of three months each are included in the MD curriculum to provide the students with adequate clinical exposure of different resource-settings and complexities. The pattern of assessment has been modified accordingly by including scenario-based problem-solving type questions in theory and clinical-case-based exercises (actual case or paper case) in the practical assessment to effectively assess the clinical microbiology competencies. A comprehensive List of competencies to be achieved in the area of AMR detection and control is provided in the curriculum. Training and skill acquisition related to clinical microbiology interpretation and support, IPC, AMR and AMS, collaborative research, public health epidemiology is highlighted. Dynamic e-logbooks are recommended to track the progress of the postgraduate students.

3. Challenges in Implementation

As several components of CBME are new, robust training of faculty in teaching-learning-assessment (TLA) methods are needed, which the NMC is trying to achieve with help of a network of institutional medical education units, regional and nodal centres by conducting medical education workshops of various levels.[12–14] Medical education is always a team work, acceptance of the curricular changes and dedicated efforts in implementing the same by all the faculty is a challenge. Existing minimum faculty requirement of NMC for a prescribed strength of students is felt as inadequate to implement CBME effectively. Frequent changes in some of the components by NMC makes it much more difficult. Novel TLA methods, impetus on small group teaching, implementation of several educational methodologies in addition to responsibilities like diagnostics, IPC activities, research activities make it much resource intensive for the microbiology faculty. The CBME goals of the NMC and implementation of the same by state health universities seem to be out of sync many times; There is a strong need for the NMC to take the universities into confidence, be assertive when needed, and for the universities to catch up with the national goals at the earliest to achieve the goals of CBME.

4. Novel Approaches in Teaching-Learning-Assessment

Unlike the traditional curricula, CBME curriculum envisages blend of several varieties and novel types of TLA methods. Many such methods (e-learning, dynamic e-logbook, etc) require appropriate technological support.[15] Learning management systems (LMS) can be of great help in systematic and reliable implementation of all the desired components of the curriculum. With some investment and faculty training, LMS can reduce teacher fatigue and ensure comprehensiveness in curriculum implementation. Technology can be effectively used to help teach and assess skill-based components at virtual skill laboratories, skill stations, etc. These can be of great use for the students to learn invasive and sensitive skills without the hassles of ethical complexities otherwise involved with learning on real patients.

It is encouraging to note that several teaching faculty are trying innovative methods and analysing the usefulness of novel technologies in making the learning and assessment engaging and effective. Methods based on artificial intelligence (AI) are being tried, and are increasingly gaining acceptance. It is interesting to note that two review articles on the same theme are published in this issue of the journal.[16,17] I encourage readers to gain useful insight by reading them. AI-based tools can help teachers in preparing teaching resources, conduct engaging interactive small group discussions and also help in conducting effective assessment. Web and mobile based applications

are now available along with textbooks which provide assistance by artificial intelligence for data search within the standard textbook, provide options like summary notes, review and assessment, references, etc. Interactive platforms like chatbots can make learning customised, meeting individual learning needs instantly and effectively. AI can also help in tracking students' academic progress, plan for repeat/remedial sessions and provide personalised feedback. AI can also aid in planning, conducting and publishing research. There are several ethical issues and challenges involved in usage of AI in diagnostics, research and medical education.[18] One needs to be aware of such issues and use AI in acceptable and ethical ways.

References

1. National Medical Commission Act. Available from: https://www.nmc.org.in/nmc-act/.
2. Medical Council of India. Competency based Undergraduate curriculum for the Indian Medical Graduate. New Delhi, India; 2018. Available from: https://www.nmc.org.in/wp-content/uploads/2020/01/UG-Curriculum-Vol-III.pdf.
3. National Medical Commission. Guidelines under Graduate Medical Education Regulation 2023. Available from: https://www.nmc.org.in/MCIRest/open/getDocument?path=/Documents/Public/Portal/LatestNews/GMER2023_compressed.pdf.
4. Medical Council of India. Skills Training Module for Undergraduate Medical Education program, 2019. Available from: https://www.nmc.org.in/MCIRest/open/getDocument?path=/Documents/Public/Portal/LatestNews/Skill%20!Module_23.12.2019%20(1).pdf.
5. Medical Council of India. Attitude Ethics and Communication (AETCOM) Competencies for the Indian Medical Graduate 2018. Available from: https://www.nmc.org.in/wp-content/uploads/2020/01/AETCOM_book.pdf.
6. Medical Council of India. Logbook Guidelines, Curriculum Implementation Support Program; 2019. Available from: https://www.nmc.org.in/information-desk/for-colleges/ug-curriculum/.
7. 2019.
8. Medical Council of India. Module on Pandemic Management; 2020. Available from: https://www.nmc.org.in/wp-content/uploads/2020/09/Pandemic-MGT-Module-UG.pdf.
9. Medical Council of India. Electives for the Undergraduate Medical Education Training Program; 2020. Available from: https://www.nmc.org.in/wp-content/uploads/2020/08/Electives-Module-20-05-2020.pdf.
10. Revised Guidelines for Competency Based Medical Education (CBME) Curriculum 2024. *National Medical Commission*;.
11. National Medical Commission. Post-Graduate Medical Education Regulations -2023. Available from: https://www.nmc.org.in/MCIRest/open/getDocument?path=/Documents/Public/Portal/LatestNews/MER.pdf.
12. Medical Council of India. Faculty development initiatives for the Undergraduate Medical Education Program: ten years' experience – status report; 2020. Available from: https://www.nmc.org.in/wp-content/uploads/2020/09/FDP-initiative-UG-Med-Education.pdf.
13. Medical Council of India. Curriculum Implementation Support Program (CISP I): First year Report; 2019. Available from: https://www.nmc.org.in/wp-content/uploads/2021/08/CISP_I_First_year_Report_2019_final_for_uploading11.09.2020-converted.pdf.
14. National Medical Commission. Curriculum Implementation Support Program (CISP II): Second Year Report; 2021. Available from: https://www.nmc.org.in/wp-content/uploads/2021/06/CISP-II-paper-17-05-2021.pdf.
15. Module on Online learning and assessment. *National Medical Commission*. 2020;p. 1–57.
16. Roy AD, Dasgupta S, Roy RD, Das D, Narayan KA. The use of generative artificial intelligence (AI) in teaching and assessment of postgraduate students in pathology and microbiology. *Indian J Microbiol Res*. 2024;11(3):1–7.
17. Gurajala S. Artificial intelligence (AI) and medical microbiology: A narrative review. *Indian J Microbiol Res*. 2024;11(3):1–7.
18. Franco D, Souza R, Mathew M, Mishra V, Surapaneni KM. Twelve tips for addressing ethical concerns in the implementation of artificial intelligence in medical education. *Med Educ Online*. 2024;29(1):2330250.

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