Original Article

Competency-based undergraduate curriculum implementation in anesthesiology—A survey-based comparison of two models of training

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Abstract

Background and Aim: Imparting the knowledge and skills of Anesthesiology to undergraduates can be challenging. Competency Based Undergraduate (CBUG) Curriculum for the Undergraduate medical students introduced by the Medical Council of India (MCI) aims to improve the quality of the Indian Medical Graduate (IMG). The Department of Anesthesiology and Critical Care of our college redrafted the training program and brought it in-line with the CBUG Curriculum beginning February 2019. A questionnaire based survey was conducted to assess the efficacy, satisfaction levels and the perception of the students towards the new competency based curriculum. The aim was to assess the students perception of the competency based curriculum and to evaluate two slightly different approaches to the implementation of the curriculum.

Material and Methods: Two groups of undergraduate medical students belonging to the 6th and 8th term, underwent two different models of teaching. The 8th term students had already completed their theory classes based on the older curriculum a year ago when they were in 6th term. However, their clinics and tutorials were modelled as per the new CBUG Curriculum. The current 6th term students had their first exposure to Anesthesiology and their theory, tutorials and clinics were scheduled in the same term, simulation based training was added, the operation theatre rotation was held in the mornings at 0730hrs and the intensive care unit rounds were held in the evenings. There was no difference in the theory classes taken for the two batches, however the clinics were different. After both the batches finished their rotation, they were given the survey questionnaire to assess their perception of the model of CBUG Curriculum that they were exposed to.

Results: The results of the survey revealed that about 80% of the students in both groups preferred that theory classes and practical training should be conducted in parallel in 6th term. About 60% students in both groups felt that early morning clinics 0800hrs were better than mid-morning clinics at 1100hrs as they get to see and do more procedures. 66%-82% students in both groups felt that the practical training in the OT, ICU and skills lab were very helpful or extremely helpful. The most important aspect of Anesthesiology rotation was "learning basic life saving skills and simulation based learning" according to 85% students in both groups. Nearly 80% students in both groups felt that the training in Anesthesiology should be allotted more time and more weightage in undergraduate training. 72% students in 6th term and 63% students in 8th term felt more confident of handling emergencies after their Anesthesiology rotation.

Conclusion: The new curriculum was extremely well received by the students of both groups. The model used for 6th term students comprising of teaching theory and practical in the same term and having early morning clinics, was found to be superior as compared to the model used to teach 8th term students where there was a gap of one year between theory and practical teaching and the clinics were held midmorning.

Keywords: Competency Based Undergraduate Curriculum, Undergraduate training, Anesthesiology

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Introduction

Recently the Medical Council of India (MCI) has introduced the new Competency-Based Undergraduate (CBUG) Curriculum for undergraduate Medical students that stresses on their acquiring knowledge, skills and attitudes that will make them competent doctors. The CBUG curriculum has been implemented across the country for the new batch of MBBS starting Aug 2019.

CBUGC provides an outcome-based strategy where various domains of teaching including teaching learning methods and assessment form the framework of competencies. CBUGC encourages problem-based learning and deemphasizes compartmentalization of disciplines in order to achieve horizontal and vertical integration.[1] It clearly defines what competencies a medical student is expected to have and what is the expected level of competence; It also defines the domain of learning for every competency—Knowledge, Skill, Attitude or Communication that determines what teaching learning method and assessment method would be most suitable to cover and assess a particular topic. There is introduction of modules on Attitudes, Ethics and communication that were missing in the older curriculum.[1]

Anesthesiology is covered in volume 3 of the MCI document as part of surgery and allied subjects and it has been allotted 10 topics and 46 competencies [Appendix 1]. There are horizontal and vertical integrations with subjects like Anatomy, Physiology, Pharmacology, General Medicine, and General Surgery. The details of the curriculum are available online at https://www.mciindia.org/CMS/wp-content/uploads/2019/01/UG-Curriculum-Vol-III.pdf.

Material and Methods

This study was performed at the Department of Anesthesiology and Critical Care at a Government Medical College in India after getting ethical clearance from the Institutional Ethics Committee. In order to implement the new CBUG curriculum, the department completely rewrote the training program. Although the new curriculum is to be implemented for the batch joining MBBS from August 2019 this department decided to start early, with the students currently undergoing Anesthesia rotations. The revised training program of Clinics, Theory and Tutorials, along with the competencies covered by each topic, are attached as Appendices 2-4 respectively.

The new curriculum concentrates more on skill acquisition. The time spent in the simulation lab and the ICU was increased accordingly. The OT time was changed for one group of students from 1100 hrs to 0730 hrs in the morning, so they would have a greater chance of witnessing procedures as well as getting the chance to perform simple procedures like starting intravenous lines, inserting nasogastric tubes, mask holding and insertion of supraglottic airway devices and performing intubations under supervision.

The ICU clinics started with a round of all the patients and a brief summary of the clinical history. Then one patient with a paradigmatic disease, such as Acute Respiratory Distress Syndrome or Septic Shock was discussed in detail, with an emphasis on how the imaging and laboratory findings had been used to guide clinical decision-making. Interested students were encouraged to come in the evenings to join the intensivist on detailed rounds. Substantial time (Two and a half hours per session) was spent in the simulation lab. Interested students were given additional time to practice their cardiopulmonary resuscitation and intubation skills.

As this curriculum revision was implemented after the current 8th term had already finished their theory classes about a year ago, while they were in 6th term, we had two groups of students who had different experiences of the new curriculum. One group of students was the senior batch in 8th Term, for whom theory classes and practical rotations were conducted in different terms and OT rotations were held at 1100 hours instead of 0730 hours. The second group of students was the junior batch in 6th Term, for whom theory and practical rotations were conducted in the same term and OT rotations were held instead at 0730 hours instead of 1100 hours. In order to assess which of these models was preferred and to gauge the student's level of satisfaction with the CBME curriculum, an anonymous questionnaire was distributed to both groups at the end of their rotations [Appendix 5].

Questionnaire Design

The questionnaire was designed by the study authors and was modelled on the pattern of Kirkpatrick model of curriculum assessment which assesses curriculum efficacy on four levels- Reaction, learning, Behavior, and Results. The questions were designed to elicit the satisfaction levels and specific preferences of the students. It was administered after both the batches had completed their anesthesiology rotations. The survey was conducted on the day of an internal examinations in order to ensure maximal attendance in an examination environment. There were 133 respondents in both 8th and 6th term. Our college has an intake of 135 students per year.

Table 1: Summary of the survey results in a tabular form

	6th term	8th term
Q-1: In which term should Anesthesiology theory classes be held?		
6th term	68%	48%
7th term	8%	13%
8th term	21%	27%
9th term	2%	12%
Q-2: In which term should Anesthesiology Practical rotations be held?		
6th term	70%	45%
7th term	14%	12%
8th term	16%	36%
9th term	1%	7%
Q-3: Should theory and Practical rotations be held in the same term?		
Yes	82%	77%
No	18%	23%
Q-4: At what time of the day should the Practical rotation be held?		
0800 hrs	58%	57%
1100 hrs	42%	43%
Q-5: What did you find the most useful part of your training in Anesthesiology?		
Theory Classes	1%	2%
Simulation Training	30%	53%
Learning Basic Life Saving Skills	54%	33%
Understanding Practical Concepts	15%	13%
Q-6: How do you rate the practical training in Anesthesiology in the OT, based on the new Competency-Based Medical Education?		
Not at all Helpful	1%	2%
Not So Helpful	2%	1%
Somewhat Helpful	22%	35%
Very Helpful	52%	40%
Extremely Helpful	24%	22%
Q-7: How do you rate the practical training in Anesthesiology in the ICU, based on the new Competency-Based Medical Education?		
Not at all Helpful	2%	1%
Not So Helpful	2%	2%
Somewhat Helpful	22%	29%
Very Helpful	49%	36%
Extremely Helpful	26%	32%
Q-8: How do you rate the simulation-based training in the skills lab for airway management, Basic Life Support, and Advanced Life Support?"		
Not at all Helpful	0%	3%
Not So Helpful	7%	3%
Somewhat Helpful	22%	12%
Very Helpful	40%	38%
Extremely Helpful	31%	44%
Q-9: Should more time and weight be given to Anesthesiology in UG training?		
Yes	79%	76%
No	21%	24%
Q-10: Has the Anesthesiology rotation made you more confident of handling emergencies?		
Yes	72%	63%
No	28%	37%

Results

In this retrospective observational study, all data from the questionnaire were tabulated in Microsoft Excel and analyzed using the Pivot Table Function. A Chi Squared Test was performed for merged data. 133 students of 6th term and 133 students of 8th term gave their feedback through the questionnaire (98% response rate). The Summary of the survey is given in Table 1. The outcome-based results are given in Table 2.

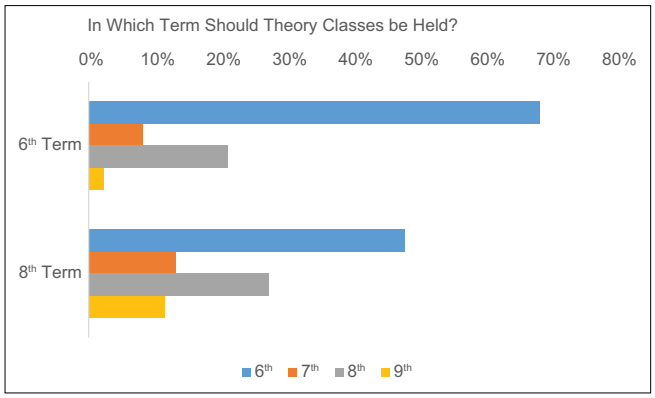

Figure 1: In which term should theory classes be held?

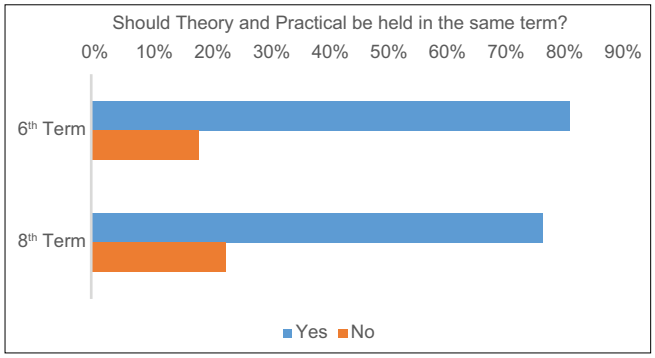

Figure 3: Should Theory and Practical be held in the same term?

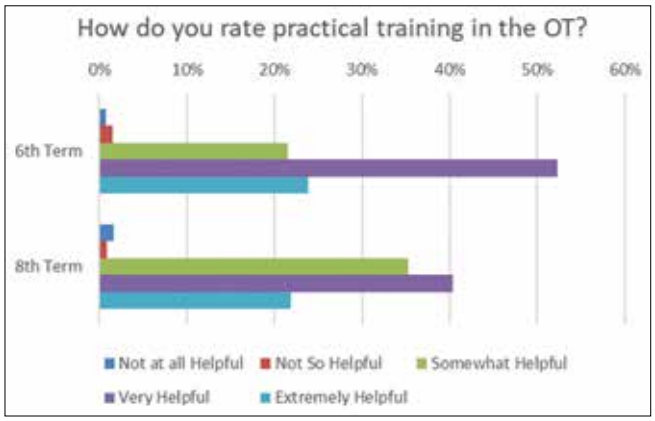

Figure 5: How do you rate Practical Training in the OT?

The results of the survey revealed that about 80% of the students in both groups preferred that theory classes and practical training should be conducted in parallel in 6th term [Figure 1-3]. About 60% students in both groups felt that early morning clinics 0730 hrs were better than mid-morning clinics at 1100 hrs as they get to see and do more procedures [Figure 4]. 66%-82% students in both groups felt that the practical training in the OT, ICU and skills lab were very helpful or extremely helpful [Figures 5-7]. The most important aspect of Anaesthesia rotation was "learning basic life saving skills and simulation-based learning" according to 85% students in

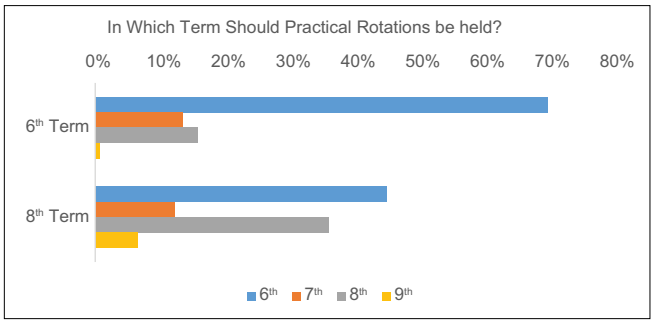

Figure 2: In which term should Practical Rotations be held?

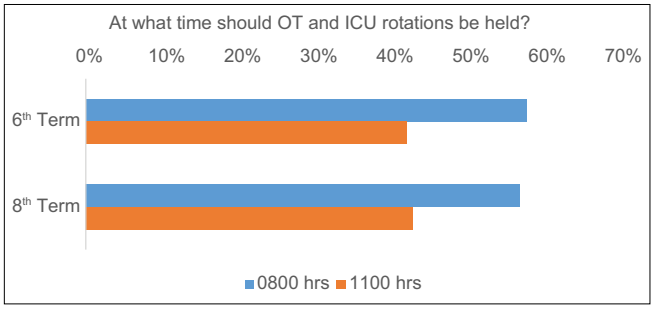

Figure 4: At what time should OT and ICU rotations be Held?

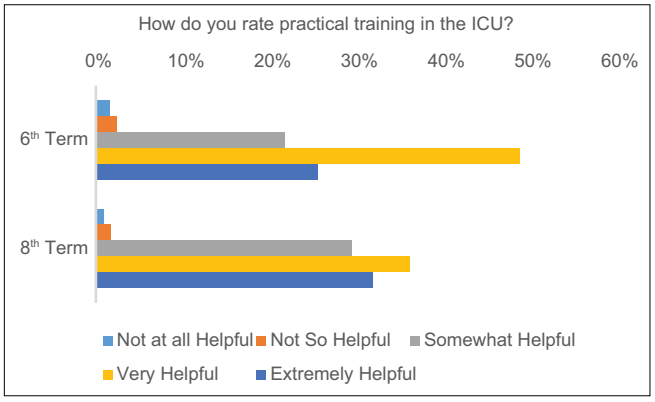

Figure 6: How do you rate Practical Training in the ICU?

both groups [Figure 8]. Nearly 80% students in both groups felt that the training in Anaesthesiology should be allotted more time and more weightage in undergraduate training [Figure 9]. 72% students in 6th term and 63% students in 8th term felt more confident of handling emergencies after their Anaesthesiology rotation [Figure 10].

The model used for 6th term students comprising of teaching theory and practical in the same term and having early morning clinics, was found to be superior as compared to the model used to teach 8th term students where there was a gap of one year between theory and practical teaching and the clinics were held midmorning.

Amongst both the groups there was a high degree of enthusiasm for practical hands-on training in the operation theatre and the Intensive Care Unit, as well as simulation-based training.

Table 2: Outcome-based Summary of survey results

Q No	Outcome assessed	6th term group (%)	8th term group (%)
1	Theory classes should be held in 6th term	68	48
2	Practical/clinics should be held in 6th term	70	45
3	Theory and practical should be held in the same term	82	77
4	OT clinics should be at 0800hrs	58	57
5	OT rotation was extremely or very helpful	76	66
6	ICU rotation was extremely or very helpful	75	68
7	Simulation lab sessions were extremely or very helpful	71	82
8	Learning basic life-saving skills and simulation-based training was the most useful part of Anesthesiology rotation	84	86
9	Anesthesiology should be given more time and weightage in UG training	79	76
10	Feel more confident of handling emergencies after Anesthesiology rotation	72	63

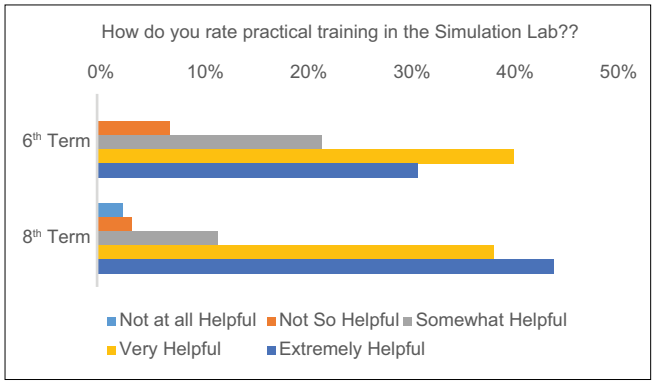

Figure 7: How do you rate Practical training in the simulation lab?

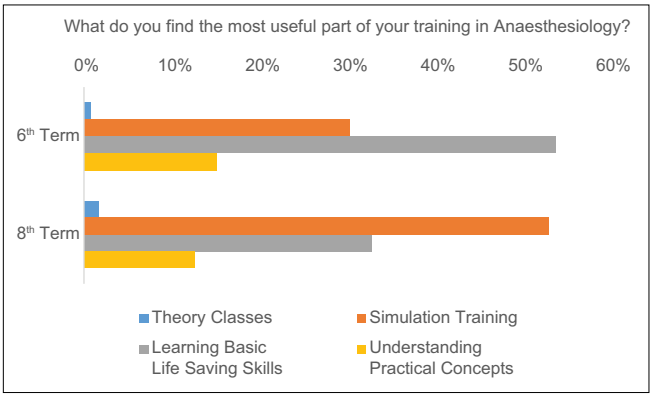

Figure 8: What do you find the most useful part of your training in Anesthesiology?

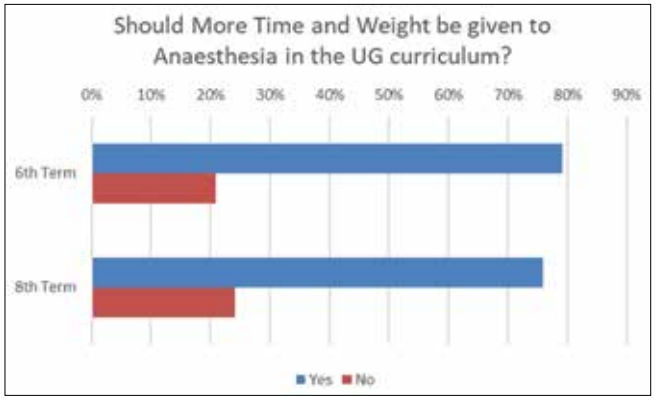

Figure 9: Should more time and weight be given to anesthesia in the UG Curriculum?

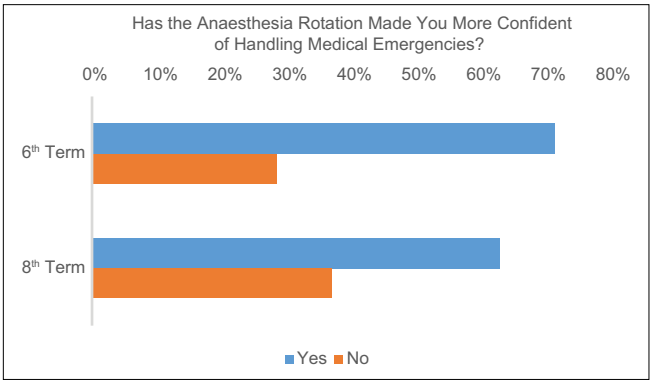

Figure 10: Has the Anesthesia rotation made you more confident of Handling Medical Emergencies?

The new CBME curriculum of the MCI in general was extremely well received and the feedback pointed the way towards widespread adoption of the curriculum.

Discussion

Teaching Anesthesia to undergraduate students has always been challenging. The subject receives much less academic time than many other subjects and its importance in examinations is minimal. This leads to the general feeling among undergraduates that Anesthesia is a subject that one can safely ignore.

Adlakha *et al.* conducted a questionnaire-based survey amongst 336 undergraduate medical students. They found that 81% of students were not satisfied with teaching methods due to lack of coordination between different departments

and lack of problem-based learning. Sixty-five per cent of students did not find the classroom environment conducive to learning due to large sizes of teaching batches and inadequate maintenance of infrastructure.[2]

Some subjects have traditionally, been more difficult to teach to undergraduates, than others and anesthesia has suffered due to pre-formed prejudices.[3,4] There are, highly effective methods of overcoming these hurdles, including increasing the student's involvement in the practical aspects of patient care in the OT and ICU and increasing time spent in simulator-based training.[5]

One of the striking features that emerged in the survey and in our conversations with students, is the deep hunger which undergraduates have for practical knowledge.[6] Even the simplest procedure performed under supervision such as starting an intravenous line or inserting a nasogastric tube leaves an indelible impression. By moving to the OT, the ICU and the simulation lab, and by stressing the acquisition of practical knowledge and skills more than theory lectures, anesthesia can be made a very exciting subject.

It may also be seen from this study that relatively small changes in the way the curriculum was implemented such as the time of the day for reporting to the OT and conducting theory and practical training in the same term, can make large changes in the efficacy of teaching.

Pedagogy carries its own terminology with it. A review characterized "competence" as referring to the skills and knowledge a person possesses, whereas competency refers to mastery of a subset of knowledge or skills required to perform a job. A competency is divided into a series of milestones that enable the acquisition of the skills to be measured and evaluated. Competency-based knowledge is classically divided into three domains the cognitive domain (intellectual capability); the affective domain (attitude, feelings, emotions, and behavior; frequently emphasized for communication); and the psychomotor domain reflecting manual skills.[7] The emphasis here is on ensuring the achievement of prespecified outcomes rather than just on ensuring minimum attendance. This being the case, to acquire a specific skill such as endotracheal intubation, a medical student would spend as much time as was required in the skills lab practicing on a mannequin till he or she could satisfy the observer.

There has been some criticism of the competency-based training, in that it takes away the agency of a general practitioner or a family physician, but it seems to us that the solution to this is to specifically target those parts of the curriculum which are of greatest relevance to the general practitioner.[8]

In case of Anesthesia, this would include a greater emphasis on teaching resuscitation and handling emergencies and critically ill patients rather than the minutiae of how to give an anesthetic. A study conducted in Australia and New Zealand on developing expert consensus on developing a new curriculum for UG training in anesthesiology also concluded that the focus should be on general perioperative medicine, pain management and critical care skills for which Anesthesiologist are the best faculty.[9]

It is important to be conscious of the drawbacks of this form of learning. One of the points that we received from a number of students, was a perception that the other group, which had rotated before or after them, had more hands-on training or more interesting cases. It is the nature of case based and patient centered learning that there will be some heterogeneity in the learning experience, and this has been reported from other researchers as well.[10]

A review of competency-based Anesthesia education from an American perspective identified certain key challenges for successfully implementing a competency-based curriculum for anesthesiology. These included unpredictable time spent on acquiring a given skill, which would provide logistical challenges.[11] To an extent, this challenge can be overcome by keeping the skills lab open during nonacademic hours, thus giving students the opportunity to practice on their own time. Other options include on-line assessments which do not require all students to be present at the same time. The second challenge which flows from the first challenge is an excessively fluid curriculum, which lacks the structure of traditional methods, and hampers slower learners who may get burdened by an ever-increasing load of assignments not completed in time. Student and teacher acceptance of the new method of teaching may also be a challenge, but in our experience, the levels of enthusiasm from both parties indicated that this may not be a significant factor.

The study has numerous weaknesses. It evaluates satisfaction levels without assessing whether increased satisfaction was accompanied by increased skill acquisition. However, it was felt that evaluating the satisfaction levels of the students for the new course would be valuable, as this curriculum will be implemented all over the country. There was no control group which had been trained by the previous method, so we could only compare differences between two implementations of the new curriculum, not between the old and new curriculum.

As this is a study carried out in a single Medical College, one may not be able to generalize the findings to other Medical Colleges. However, some principles of general importance may be generally true for all Anesthesia departments. These include, but are not limited to:

1. Increasing the time spent in practical training in the OT, ICU and simulation lab.
2. Limiting classroom time.
3. Getting the students to witness and perform basic clinical procedures under supervision, and at the same time emphasizing the importance of patient safety in our daily practice.[12]
4. Using the ICU to communicate the broad range of roles Anesthesiologists perform in the hospital.
5. Emphasizing the importance of acquiring practical and cognitive skills in handling generic emergencies.
6. Preparing a library of Virtual Patients (such as a case of Breathing difficulty, Road traffic accident with Polytrauma, a case of Chest pain, etc.,) for simulation-based training.[13]

Other researchers have also advocated clerkships during Medical College that gives students a much better idea of what a career in anesthesiology entails.[14]

The study has numerous weaknesses. It evaluates satisfaction levels without assessing whether increased satisfaction was accompanied by increased skill acquisition. However, it was felt that evaluating the satisfaction levels of the students for the new course would be valuable, as this curriculum will be implemented all over the country.

Conclusion

Competency-Based Medical Education undergraduate curriculum was used to impart practical training to two different batches of medical students using two different models of teaching. The new curriculum was extremely well received by the students of both groups.

The new curriculum given by the Medical Council of India has the potential to improve practical training of undergraduate medical students in the subject of Anesthesiology. It has the potential to enable Anesthesiology departments to teach life-saving cognitive and procedural skills, which will be invaluable to the young Indian Medical Graduates. However, it requires faculty development and training for successful implementation of the new curriculum.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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APPENDIX 1

THE NEW CBUG CURRICULUM FOR ANESTHESIOLOGY

TOPICS COVERED IN ANESTHESIOLOGY AS PER

MCI COMPETENCY-BASED UNDERGRADUATE CURRICULUM

The Competency-based undergraduate curriculum of MCI that has been implemented with effect from August 2019, has allotted 10 topics and 46 competencies to Anesthesiology.

The 10 topics are:

1. Anesthesiology as a specialty
2. Cardiopulmonary Resuscitation
3. Pre-operative evaluation and medications
4. General Anesthesia
5. Regional Anesthesia
6. Post-Anesthesia recovery
7. Intensive care Management
8. Pain and its management
9. Fluids
10. Patient safety

The details of the competencies, domain and level of expertise are given in the MCIs CBME curriculum document. This document is available online (open access) and Anaesthesiology is covered in Volume III, page No 145-154.

Appendix 2

Appendix 2 Training Program :CLINICS		
TOPIC	**Competencies covered**	**venue**
Preoperative evaluation and Intraoperative evaluation	AS 3.1 to AS 3.6	OT
Airway management- Mask holding, supraglottic airways and Intubation	AS 4.2	OT
Induction and maintenance of General Anesthesia Monitoring patients under Anesthesia	AS 4.3, AS 4.4, AS 4.5	OT
Contents of the crash cart and their use Equipment in the Post anesthesia care unit Recognition and management of common emergencies faced in the PACU	AS 6.1, AS 6.2, AS 6.3	OT
Regional Anesthesia- including principles, techniques, drugs, and adjuvant agents used in Spinal and Epidural Anesthesia and Brachial Plexus block, peripheral nerve blocks	AS 5.1 to AS 5.6	OT
Day care and Anesthesia outside the operating room WHO surgical safety checklist	AS 4.6, AS 4.7	OT
Introduction to the Intensive Care Unit- Functioning of an ICU, criteria for admission and discharge, principles of monitoring	AS 7.1, AS 7.2, AS 7.5	ICU
Basic setup of a of a Ventilator	AS 7.4	ICU
Fluid therapy and resuscitation in shock	AS 9.3	ICU
Assessment and Management of Unconscious patient	As 7.3	ICU
Patient safety in OT and ICU Hazards of incorrect patient positioning Common medical and Medication errors in Anesthesia Role of communication in patient safety	As 10.1 to AS 10.4	OT/ICU
Establish IV access and CVC access in a simulated environment Establish IV access on real patients	AS 5.5, As 5.6	Simulation lab ICU/OT

Appendix 3

Appendix 3 Training Program : Theory classes	
TOPIC	**Competencies covered**
Introduction to Anaesthesia—Evolution as a modern specialty Prospects of Anesthesiology as a CAREER Principles of Ethics as related to Anesthesiology	AS 1.1, 1.2, 1.3,1.4
Pharmacology—Drugs used in induction and maintenance of General Anesthesia Principles and Practice of GA Monitoring under GA	AS 4.1, AS 4.3, AS 4.5
Anatomy of the airway and Implications for GA Airway management	AS 4.2
Regional Anesthesia - Techniques, Indications, Principles Anatomy relevant to peripheral nerve blocks and neuraxial blocks Pharmacology of drugs used in Regional Anesthesia	AS 5.1 to 5.6
Preoperative evaluation—How to work up a patient for surgery-history taking, examination, Investigations, preop instructions	AS 3.1 to AS 3.6
Post Anesthesia recovery- PACU, Monitoring, and resuscitation Crash cart and its contents Recognition and management of common complications faced in the recovery room	AS 6.1 to AS 6.3
Day Care Anesthesia and Anesthesia outside the Operating Room	AS 4.6, AS 4.7
Intensive Care Unit—Functioning of an ICU, criteria for admission and discharge, principles of monitoring	AS 7.1, AS 7.2, AS 7.5
Pain—Physiologic principles and management Pain management in palliative care	As 8.1 to AS 8.5
IV fluid therapy Blood products and their use in the perioperative period	AS 9.3, AS 9.4
Patient safety	AS 10.1 to AS 10.4

Appendix 4

Appendix 4 Training Program —Tutorials

Topic	Competencies covered	Venue
BLS - Adult, Child, and Infant AED and Defibrillator - overview/demonstration	AS 2.1	Simulation lab
Advance life support -Pulseless Arrest, Bradycardia, PEA, Asystole, Tachycardia	AS 2.2	Simulation lab
Advance life support - Acute Coronary Syndrome, Stroke	AS 2.2	Simulation lab
Managing an Unconscious Patient and Airway management Securing IV and CVC access	AS 4.2, AS 7.3, AS 9.1, AS 9.2	Simulation lab
Basics of ventilators and other equipment used in ICU Principles of Monitoring in ICU	AS 7.4, AS 7.5	ICU
How to manage a case of trauma Transport of a critically Ill patient	Topics Relevant to service	ICU and Critical Care Ambulance
Working up a patient for surgery ABG analysis and troubleshooting	AS 3.1 to AS 3.6	OT ICU
Sepsis & ARDS	Topics Relevant to service	ICU
Assessment and Management of Polytrauma	Topics Relevant to service	Simulator lab and ICU

Appendix 5

SURVEY QUESTIONNAIRE

SURVEY AMONGST TWO BATCHES OF UNDERGRADUATE MEDICAL STUDENTS REGARDING TRAINING IN ANESTHESIOLOGY

TERM: 6th/8th

1. Which term do you think the theory classes in Anesthesiology should be held?
   a. 6th
   b. 7th
   c. 8th
   d. 9th

2. Which term do you think the Anesthesiology OT and ICU rotations should be held?
   a. 6th
   b. 7th
   c. 8th
   d. 9th

3. Do you think holding the theory and clinics in the same term is better than holding it in two different terms?
   a. Yes
   b. No

4. Should the OT and ICU rotations be held at 0800hrs or at 1100hrs?
   a. 0800hrs
   b. 1100hrs

5. How do you rate the practical training in Anesthesiology in the Operation Theatre based on the new Competency Based Medical Education?
   a. Extremely helpful
   b. Very helpful
   c. Somewhat helpful
   d. Not so helpful
   e. Not at all helpful

6. How do you rate the practical training in Anesthesiology in the Intensive care unit based on the new Competency Based Medical Education?
   a. Extremely helpful
   b. Very helpful
   c. Somewhat helpful
   d. Not so helpful
   e. Not at all helpful

7. How do you rate the simulation based training in the skills lab for airway management, Basic Life Support and Advanced Life Support?
   a.Extremely helpful
   b.Very helpful
   c.Somewhat helpful
   d.Not so helpful
   e.Not at all helpful

8. What do you find the most useful part of your training in Anesthesiology?
   a.Theory classes
   b.Simulation based training in BLS, ACLS and airway management
   c.Learning basic life saving skills in the OT and ICU on real patients
   d.Understanding practical concepts of patient management in the OT and ICU

9. Do you think Anesthesiology training should be given more time and weight in the undergraduate curriculum?
   a.Yes
   b.No

10. After completing your Anesthesiology clinical rotation do you feel more confident of handling medical emergencies?
    a.Yes
    b.No

11. Please write any additional comments, suggestions or ideas for UG training in Anesthesiology on the back of this page.