

# A Nationwide Survey of Critical Care Training in India

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## ABSTRACT

**Background:** The 3-year training in the critical care medicine (CCM) specialty is a relatively new recognized program in India. This program has been run at a few premier institutes across India over the past few years.

**Objective:** The present study aimed to get a critical appraisal of the 3-year training program in CCM from the initial 50 trained Indian intensivists, regarding their research, publications, and self-perceived clinical training adequacy in the various areas of the CCM.

**Methods:** This was a prospective cross-sectional study. The list of participants (initial trainees who completed the course between 2015–2021) was compiled by contacting the respective teachers of the institutes that were permitted and recognized by the competent national authority to run a 3-year training course in CCM in India. A questionnaire was developed with questions related to demographic details; self-reports about clinical training program adequacy measured on the Likert scale; and their research area, publications, and current job profiles. After receipt of institutional ethics

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committee approval, responses from the participants were collected through Google Forms, which were sent through e-mails.

**Results:** Responses were received from 51 of 62 participants. Among the 51, the majority were male (43; 84%), and their basic training was in anesthesiology (88%). All of them had conducted at least one mandatory research project; three-fourths were prospective observational. The main areas of research projects were cardiovascular (20%), followed by respiratory (18%), sepsis and infection (18%), and renal (14%). Only less than one-third reported being published in any PubMed-indexed journal, with most as a first authorship (93%). One-fourth to one-third of participants reported inadequate training in areas such as extracorporeal therapies and financial and administrative managerial skills in critical care, followed by cardiac and neurocritical care and research methodology. Eight (16%) underwent further training, including 6 from outside India.

**Conclusion:** The present study critically evaluated the 3-year training in the CCM from the perspective of trainees who completed the program in India; highlighting areas of inadequate training such as extracorporeal therapies and financial and administrative managerial skills. Participants reported concern about the training and allocated time for their research and getting it published in an indexed journal.

**Keywords:**

academies and institutes; academic training; capacity building; education; faculty, medical

The first description of training in intensive care is almost 4.5 decades old from Australia in 1979 (1). Subsequently, in 1987, diplomates of the American Board of Internal Medicine took the examination with a broad range of topics from the internal medicine domain of critical care medicine (CCM) (2). Later, in 2003, Europe started the Competency-based Training in Intensive Care Medicine in Europe (or, CoBaTrICE) program to make uniform training in the specialty (3).

In India, the Medical Council of India (now known as the National Medical Commission), which is the highest national regulatory body in the field of medical education, recognized CCM in 2010 as a superspecialty with a 3-year training program (4). Before this, the CCM training program was offered mainly as a 1- to 2-year certificate course

at a few centers, including by the National Board of Examination since 2002, the Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS) since 2005, and the Indian Society of Critical Care Medicine since 1998 (5, 6). However, critical care services have been available in India for almost a half century (from the early 1970s), mainly in the private sector. In 2002, the first department of CCM in the public sector was established at SGPGIMS, which is a university hospital (6).

In 2012, the first 3-year formal training program (doctorate of medicine; DM) in CCM was permitted by the Medical Council of India to start at Tata Memorial Hospital in Mumbai and the Sri Ramachandra Medical College in Chennai, followed by other premier institutes: in 2013, St. John Medical College in Bangalore and SGPGIMS in Lucknow; and,

in 2015, Christian Medical College in Vellore and All India Institute of Medical Sciences in New Delhi (7). In India, the National Medical Commission provides a broader curriculum guideline for the subject (8), and each academic institute is expected to implement and execute this through the respective departments. Until now, more than 50 trainees in India have completed DM courses successfully in the specialty of CCM.

As the field of CCM continues to evolve, medical institutions need to keep pace with the latest developments and offer comprehensive training programs to prepare trainees to become skilled and knowledgeable critical care physicians in the future. Because the DM in CCM is a relatively new training program in India, there is a lack of data, with regard to the effectiveness of the program and feedback from the trainees, that are essential for the improvement or restructuring of the program, if necessary, and to ensure that future trainees receive comprehensive and effective training in the field of CCM.

In the present study, we aimed to get a critical appraisal of the 3-year training program in the CCM from the initial 50 trained Indian intensivists regarding their research and publications, self-perceived clinical training adequacy as measured on a Likert scale in the various areas of the CCM, and their current job profiles.

## METHODS

This prospective cross-sectional study involves participants who completed a 3-year CCM training program in India. To gather participant details, we searched through the National Medical Commission website for academic institutes where DM courses in CCM are being conducted (7). There were only six institutes where more than 50 trainees

in total completed their DM courses in CCM from the initial pass-out batch in 2015 onward until 2021. To compile the list of participants and their contacts, we collected details by contacting the respective teachers of the institutes via e-mail.

A questionnaire was prepared with questions related to demographic details; self-perceived clinical training program adequacy; and participants' research area, publications, and current job profiles (*see* Table E1 in the data supplement). The questionnaire was initially developed by two teachers (D.K.B. and M.G.) and then later finalized with feedback from two other teachers (A.T.K. and B.K.). Each of the four teachers was from a different institute where DM courses in CCM were being conducted.

In a questionnaire, participants were asked about the basic specialty of their postgraduate degree. Self-perceived adequacies in various areas of critical care specialty were evaluated by rating various aspects of training on a Likert scale ranging from "0 = *no training*" to "1 = *some training*" and "2 = *well trained*." If less than 50% of trainees reported being well trained in a given aspect, then this was considered as an inadequacy of training in a particular area. We also sought information about whether they underwent any further training. The research activity was measured by the percentage of time dedicated toward research, area of the mandatory research project, need of funds, abstract presentation at a professional forum at the national or international level, full article publication with authorship and journal details, and having any extra publications to their credit. The professional settlement outcomes were assessed in terms of their current job profile, including academic faculty or nonacademic clinician,

employment at a government or a private hospital, and serving in their home state or another state.

After institutional ethics committee approval (Reference no. IEC-215/04.03.2022; RP 75/2022 dated March 29, 2022) was granted, 62 participants were contacted through e-mails inviting them to respond to the questionnaire through Google Forms. Because the survey was anonymous, nonrespondents could not be identified. Therefore, two reminder e-mails were sent at 1-month intervals to encourage participation, and subsequent students were contacted until we obtained at least 50 responses. To avoid duplication, we considered a single response from each e-mail address to which the invitation was sent. The data were then subjected to statistical analysis using Jamovi (The Jamovi Project 2022; Version 2.3). Continuous data were reported as mean  $\pm$  SD, and categorical data were reported as proportions.

## RESULTS

The survey questionnaire was sent to 62 eligible participants from six institutes in India (see Figure E1). We received responses from 51 participants who took the DM course in CCM.

### Demographic Details

The mean age of the participants was  $35 \pm 4.3$  years, and 84% were male. Most of the participants had a background of basic medical training in anesthesiology (88%), followed by internal medicine (8%) and pulmonary medicine (4%), before taking the DM course in CCM (Table 1).

### Research and Publications

In terms of research during training, completion of one research project was mandatory in all of the institutes except

one: SGP GIMS, in Lucknow, where completion of two projects was mandatory. Overall, three-fourths of the research projects were prospective observational projects (Table 2). The main areas of research were cardiovascular (20%), followed by respiratory (18%), sepsis and infection (18%), and renal (14%). Less than one-third of the participants got published in any PubMed-indexed journal, with most as a first authorship (93%). It is interesting to note that half of the participants reported publications other than their primary research project (Table 2).

### Self-perceived Adequacy of Clinical Training

One-third (32%) of the participants reported that there was no training in extracorporeal therapies, including extracorporeal membrane oxygenation (ECMO), whereas 36% of the participants reported that they did not have training for financial management of critical care, followed by administrative and management skills (24%), neurocritical care (8%) and research methodology (6%) (Table 3).

### Professional Outcome after 3-Year Training Program

After completing the DM (CCM) course, 8 (16%) participants underwent further training, including 6 from outside India. Regarding the current job profiles, incomplete responses were received from 4 participants. However, three-fourths of the participants were employed as academic faculty, mainly in private-sector hospitals (Table 1). Six (12%) stayed at their home institutions as academic faculty post-CCM training.

## DISCUSSION

The present study from India reveals that the majority of trainees who completed

**Table 1.** Participant details, including their current job profiles

Participant Details	Result or Response
General details	
Age, yr, mean $\pm$ SD	35 $\pm$ 4.31
Males, <i>n</i> (%)	43 (84.3)
Married, <i>n</i> (%)	48 (94.1)
Basic PG degree, <i>n</i> (%)	
Anesthesiology	45 (88)
Internal medicine	4 (7.8)
Pulmonary medicine	2 (3.9)
DM CCM training institute, city in India, <i>n</i> (%)	
AIIMS, New Delhi	24 (51.1)
SJMC, Bengaluru	7 (14.9)
SGPGIMS, Lucknow	6 (12.8)
TMH, Mumbai	8 (17)
Others	6 (4.2)
Place of PG training before joining DM CCM program, <i>n</i> (%)	
AIIMS, New Delhi	7 (13.7)
PGIMER, Chandigarh	8 (15.7)
SGPGIMS, Lucknow	2 (3.9)
TMH, Mumbai	2 (3.9)
Others	32 (62.8)
Undergone further training, <i>n</i> (%)	
Yes	8 (16)*
Current job profile, <i>n</i> (%)	
Serving home state	27 (52.9)
Hospital type	
Government	9 (17.6)
Private	39 (76.5)
Current position	
Academic faculty	36 (73.5)
Non-academic consultant	13 (26.5)

**Table 1. Continued.**

Participant Details	Result or Response
Current department	
Critical care medicine	47 (94)
Anesthesiology	3 (6)

*Definition of abbreviations:* AllMS = All India Institute of Medical Sciences; CCM = critical care medicine; DM = doctorate of medicine; PG = postgraduate; SGPGIMS = Sanjay Gandhi Postgraduate Institute of Medical Sciences; SJMC = St. John Medical College; PGIMER = Postgraduate Institute of Medical Education and Research; TMH = Tata Memorial Hospital.

Results are expressed as *n* (%) or mean  $\pm$  SD.

\*Six of them undergone further training from outside India.

3-year training in the CCM are anesthesiologists. At least one research project is mandatory during the course for DM in CCM; however, less than one-third of the trainees could publish their mandatory research work. According to participants, the self-perceived deficiencies in clinical training include areas such as extracorporeal therapies and financial and administrative managerial skills in critical care, followed by cardiac and neurocritical care and research methodology. After completing the course for DM in CCM, the majority joined academic faculty in private institutes where the 3-year training program has been started.

In India, CCM is a relatively new medical superspecialty recognized by the National Medical Commission. The 3-year course for DM in CCM was implemented not only to produce quality intensivists but also to generate academic faculty who can lead the teaching and training program further in academic institutes. The previous, one-two year programs, which were not recognized by the National Medical Commission, had limited clinical training and lacked adequate research exposure. To ensure that CCM doctors receive the best possible training, there is a need for high-quality residency programs that should be reviewed periodically.

In recent years, especially during and after the coronavirus disease (COVID-19) pandemic, there have been a lot of efforts, such as ECMO services, to strengthen the infrastructure and facility at tertiary care institutes throughout India to manage critically ill patients. Also, the National Medical Commission makes it mandatory for trainees to complete a research methodology course during the 3-year training program. Although administrative and managerial skills are not formally included in the syllabus, they are crucial for an intensivist who serves as a team leader managing a large team of resident doctors, nurses, physiotherapists, technicians, and nontechnical staff in an intensive care unit (ICU). Consequently, we incorporated these skills into our questionnaire on the basis of our experience, considering them important for the role.

In our study, it was noted that there were significantly more male trainees than female trainees. The percentage of female trainee intensivists varied across countries, with 41%, 33%, and 39% in Australia, the United States, and the United Kingdom, respectively. On the other hand, the percentage of female ICU consultants was notably lower in Australia, the United States, and the United Kingdom, with only 12%, 26%, and 20%, respectively (9–11). A study by

**Table 2.** Research projects and publications during participants' doctorate of medicine critical care medicine training

Participant Details	Result or Response
Number of compulsory projects, <i>n</i> (%)	
1	43 (86)
2	7 (14)
Percentage of time allotted to research, <i>n</i> (%)	
<25	15 (30)
25–50	32 (64)
>50	3 (6)
Type of study, <i>n</i> (%)	
Prospective observational	38 (74.5)
Randomized controlled trial	10 (19.6)
Retrospective	3 (5.8)
Area of research, <i>n</i> (%)	
Cardiovascular	10 (19.6)
Respiratory	9 (17.6)
Sepsis and infection	9 (17.6)
Renal	7 (13.7)
Endocrine	2 (3.9)
Neurology	2 (3.9)
Hematology	2 (3.9)
Nutrition	2 (3.9)
Others	8 (15.7)
CTRI or other registration, <i>n</i> (%)	40 (78.4)
Funded research, <i>n</i> (%)	4 (7.8)
Abstract presentation from thesis, <i>n</i> (%)	
International conference	16 (31.3)
National conference	15 (29.4)
Awards for abstract presentation, <i>n</i> (%)	9 (28.1)
Publication of thesis in PubMed-indexed journal, <i>n</i> (%)	
International	7 (13.7)
National	8 (15.6)

**Table 2. Continued.**

Participant Details	Result or Response
Authorship in publication of thesis, <i>n</i> (%)	
First	14 (93.3)
Second and corresponding	1 (6.7)
Publications other than thesis, <i>n</i> (%)	26 (52)

*Definition of abbreviation:* CTRI = Clinical Trial Registry of India.

Greenwood and colleagues highlighted that female patients with acute myocardial infarction who were treated by male doctors had higher mortality compared with male patients. This effect is minimized when male physicians have more female colleagues or have more experience in treating female patients (12). Another example of the results of gender imbalance is that because of less interaction between industry members and female gastroenterologists, the endoscopy hardware is made in such a way that it suits the bigger hands of male colleagues, leading to higher work-related musculoskeletal injuries among female gastroenterologists (13). The same situation might occur in critical care as well, with regard to instruments being more suited to male intensivists and the possible impact on the clinical outcomes of the patients. This highlights the need for initiatives to address gender imbalance at the earliest stage of medical education. With significantly fewer female trainees, the number of female ICU consultants will also be lower. Therefore, efforts must be made to encourage and support more women to pursue CCM and increase their representation in training programs.

There are various pathways to becoming an intensivist in India, including postgraduation in anesthesiology, emergency medicine, internal medicine, or pulmonary medicine. However, the

majority of trainees had a basic postgraduate degree in anesthesiology. Anesthesiologists prefer training in CCM, with one of the possible explanations being limited opportunities for superspecialization in their field, in comparison with those who were trained in internal medicine with choices in a wide variety of superspecializations that might be more in demand than CCM. On the other side, in India, graduates in emergency medicine and pulmonary medicine are significantly lower in numbers in comparison with anesthesiologist graduates.

In India, to make courses for DM in CCM more lucrative and inclusive for trainees in different postgraduate streams, there is a need to reevaluate the entry-level National Eligibility cum Entrance Test Super Specialty course (14). Currently, for admission into a course for DM in CCM, a student needs to qualify for a paper through the National Eligibility cum Entrance Test Super Specialty course test, which comprises questions from the internal medicine background only (which was not the case until recently), making it difficult as expected in the coming years for students from other streams, such as anesthesiology. For trainees from diverse backgrounds of postgraduate training to have equal opportunity for admission into a course for DM in CCM, there might be two sets of questions: one set from their



**Table 3.** Importance and adequacy of training in different areas of critical care during participants' doctorate of medicine critical care medicine course

Area of Critical Care	Importance of Training		Adequacy of Training		
	Very Important (%)	Somewhat Important (%)	Well Trained (%)	Some Training (%)	No Training (%)
Cardiac critical care	87.8	12.2	24	72	4
Pulmonary medicine and mechanical ventilation	100	0	94	6	0
Gastroenterology and hepatology	84	16	62	34	4
Critical care nephrology	94	6	54	46	0
Infections and antimicrobials	100	0	84	16	0
Neurocritical care	86	14	38.8	53.1	8.2
Radiology, lab diagnosis, and POCUS	97.9	2.1	78	22	0
Procedural training including ICD, tracheostomy	94	6	88	12	0
Research methodology	86	14	42	52	6
ECMO and extracorporeal therapies (CRRT)	56	44	4	64	32
Financial management of critical care practice	80	20	18	46	36
Administrative and managerial skills	86	14	28	48	24

*Definition of abbreviations:* CRRT = continuous renal replacement therapy; ECMO = extracorporeal membrane oxygenation; ICD = intercostal drainage tube, POCUS = point of care ultrasound.

baseline postgraduate training course domain and another from the critical care domain.

A large number of trainees have graduated (in anesthesiology) from two prestigious institutions; namely, All India Institute of Medical Sciences in New Delhi and the Postgraduate Institute of Medical Education and Research in Chandigarh. This trend could be attributed to their significant exposure to ICUs being at apex centers during their postgraduate medical program, which enabled them to recognize the potential for pursuing a career in CCM; furthermore, there was a very limited number of seats in courses for DM in CCM. To ensure that every eligible trainee has a chance to specialize in CCM, we recommend that, during the

postgraduate medical program, they rotate through facilities with ICUs to gain a comprehensive understanding of the work culture and the potential for further subspecialization in this field.

Of all the allotted research projects (thesis) submitted, 62.7% were presented at conferences, and 30% were published in journals. Moreover, 51.1% of trainees continued to publish research papers beyond their obligatory thesis, including those who did not publish their thesis. However, it is important to note that although a research project was a mandatory part of all training programs, the majority of trainees spent less than 25% of their time on it and did not fully comprehend its significance. Because of the lack of dedicated time allocated for research during residency, trainees have to

manage their clinical work and collect, analyze, and write research data at the same time. Studies have revealed that dedicating specific time slots to research is a critical factor in increasing h-index and publication output, independent of other variables (15). In fact, the National Medical Commission has recognized its importance and clarifies this in recently released rules (January 2024) that allow added academic paid leave of 5 days per year so that trainees get an opportunity to enhance their research output and consolidate learning experience through participating in focused knowledge- and skill-enhancing courses like simulation and conferences (16).

The results indicate that 74% of trainees required additional guidance to meet their job responsibilities, revealing areas where the training program lacks proper training and where improvement is possible. Trainees specifically mentioned the need for more training in extracorporeal therapies, financial and administrative management, neurocritical care, and research methodology. This is because of either the nonavailability of facilities or insufficient exposure to extracorporeal therapies, including ECMO, in these institutes, mostly in the government. They also expressed that expertise in these areas is essential to fulfilling their job responsibilities, mainly when they join private institutes and hospitals after completing their training. To address these gaps, the training program should offer adequate training and resources in these domains. When the program lacks sufficient cases in a specific subarea, an exchange program can be arranged for the trainee to receive adequate training in that area at another institution or hospital. All except 3 respondents confirmed that they had continued to serve as intensivists after

completing their 3-year training program, as there is a huge demand–supply gap for adequately trained intensivists in India, with new CCM departments being created in both the public and private sectors. The possible reasons for the 3 participants, who are working as anesthesiologists instead of intensivists, might be because of stressful work, financial reasons, or the unavailability of a critical care facility at their choice of workplace or city.

In our study, trainees have proposed several suggestions to enhance the training program, including the following:

1. Improving duty hours and reducing frequent night duties to promote a healthier lifestyle and better circadian rhythm.
2. Offering exchange programs to learn about various practices at other institutes.
3. Providing anonymous feedback for each rotation to assess the fulfilment of goals and objectives.
4. Providing dedicated teaching, academic, and research time to enhance learning and research opportunities.

Incorporating these suggestions could potentially improve the quality of training and help trainees achieve their goals more effectively.

Our study provides valuable insights into training trends and perceived adequacy, but it is important to exercise caution in drawing firm conclusions because of several limitations. First, the data collected are subjective and prone to recall bias. Second, according to the Kirkpatrick hierarchy of educational outcome evaluation, assessments of students' knowledge and skills, behavioral changes, and patient outcomes are more valuable for training evaluation than self-assessments (17, 18). Third, although our study included a large sample size of trainees who completed CCM residency, generalizing our results to all residency programs may not be suitable because of the differences in settings and

curricula. Fourth, some institutes had low representation while others overrepresented, because of different numbers of pass-out trainees for DM in CCM per year from different institutes. Last, the questionnaire was not tested in a pilot group of students.

Therefore, it is important to keep these limitations in mind while interpreting our study's findings, and further research is needed to validate our results and assess the effectiveness of training programs in CCM.

## CONCLUSION

In the present study, a 3-year training program in CCM in India is critically appraised by the trainees themselves. Study results highlighted the areas of self-perceived deficiency reported by participants in the training program, such as inadequate training in extracorporeal

therapies and financial and administrative managerial skills in critical care. Some also expressed their concern about inadequate training in cardiac and neurocritical care and research methodology courses during their 3-year training period. The study findings might be helpful for policymakers in taking corrective measures to address the deficiencies in the CCM training program, so that there could be an available pool of more trained and competent intensivists in India.

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