

Original Research Article

Practices and challenges in implementing tuberculosis program at medical colleges in Karnataka, India

Lalita D. Hiremath¹, Nidhi Sharma², Sudeepa D.¹, H. R. Shivaramakrishna¹,
Nandkishor Warbhe¹, Ashwini Lonimath^{3*}, Sharath Burugina Nagaraja³

¹Oxford Medical College, Bengaluru, Karnataka, India

²Shri Lal Bahadur Shastri Government Medical College and Hospital, District Mandi, Himachal Pradesh, India

³ESIC Medical College and PGIMS, Rajajinagar, Bengaluru, Karnataka, India

Received: 17 August 2023

Revised: 16 October 2023

Accepted: 17 October 2023

*Correspondence:

Dr. Ashwini Lonimath,

E-mail: ashwini.lonimath@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The study aimed to evaluate the implementation status of the National Tuberculosis Elimination Program (NTEP) at medical colleges in Karnataka, India, and identify the challenges encountered by the medical college core committee members.

Methods: A cross-sectional study was conducted among 14 medical colleges in 2019-20, using a pre-tested, semi-structured questionnaire to collect data on various NTEP components.

Results: The implementation status of NTEP activities was categorized as adequate, partially adequate, or inadequate. Results showed that certain activities such as TB notification, DMC infrastructure, TB-HIV coordination, and the formation of the NTEP core committee were adequately implemented. However, challenges such as work overload, lack of dedicated manpower, and salary constraints were encountered.

Conclusions: Overall, the medical colleges involved in the study were actively implementing NTEP, but there is still room for improvement to fully optimize the implementation.

Keywords: Academic medical centres, Challenges, Implementation, Karnataka, National health programs, NTEP, RNTCP, Tuberculosis

INTRODUCTION

Tuberculosis (TB) is a major public health concern in India, accounting for 25-27% of global TB cases.¹ The Revised National TB Control Programme (RNTCP)/National TB Elimination Programme (NTEP) has made consistent efforts to control the spread of the disease, involving all stakeholders, including the private health sector and academic institutions like medical colleges. One unique approach adopted by the program when compared to the national health programmes in the country is the involvement of medical colleges, which not only serve as centres of epi-tome of learning for

undergraduate and postgraduate students but also as hospitals that cater to large sections of the community.²

The program has established RNTCP/NTEP units in medical colleges, which provide adequate human resources and logistics required for TB management. The main purpose of establishing such units is to streamline the process of screening of presumptive tuberculosis cases in the outpatient department, initiate the diagnosed TB patients on appropriate standard TB regimen, to ensure proper screening of all the presumptive TB cases for screening of diabetes and HIV, refer the patients to their domiciliary care and to ensure follow-up of all those initiated on TB treatment for development of drug

resistance. The medical officer and the TB health visitor in the medical college are supposed to visit all the outpatient department to ensure that all the clinical outpatient departments (OPD) are identifying at least 2-3% of their patients as presumptive TB case.³ A continued monitoring on key indicators of the programme implementation in the medical college should be done by the core committee of the medical college which is usually headed by the head of the institution with district tuberculosis officer as member secretary and this mechanism is well established through the RNTCP/NTEP structure of medical college task force (Figure 1). The review should be done once in three months and the minutes of the meeting should be shared with state tuberculosis officer and the state task force chairman for the medical colleges.⁴ The medical college core committee should also ensure that all the under-graduate students, post-graduate students, senior residents, teaching faculty and the paramedical staff are sensitized on the recent updates of the programme policies and guidelines from time to time and ensure that at least core committee members have undergone the NTEP modular training at district or state or national level.⁵

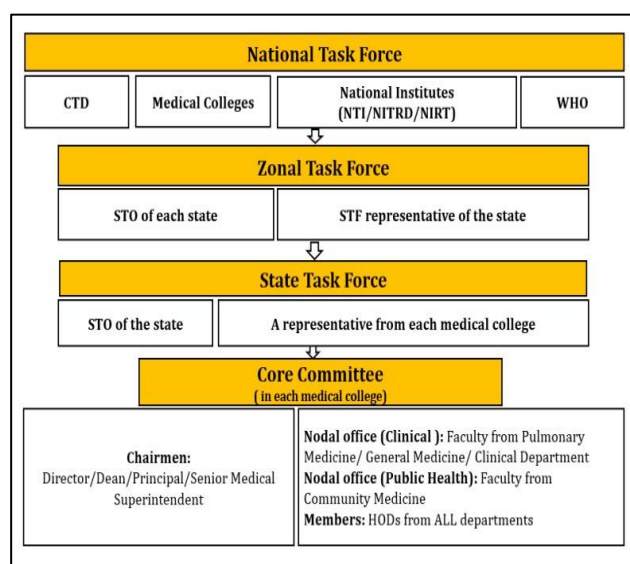


Figure 1: Medical college involvement in RNTCP/NTEP

The medical college core committee members are also responsible to encourage TB research at their institution. The programme provides an incentive of Rs. 30,000 for all those post-graduate students who undertake their thesis in the area of tuberculosis irrespective of their department. To encourage and sustain TB research interest among the faculty, the programme also provides funds to conduct operational research in the priority areas identified under the programme. The programme has established state operational research (OR) committee to select the post-graduate (PG) thesis and research projects for funding. The committee consists of a representative from the medical colleges of various departments and one among them is selected as chairman, for state OR

committee and the member secretary of the committee would be the state tuberculosis officer. The state OR committee has the sanctioning authority of up to two lakhs, however if any project crosses the stipulated budget is referred to zonal OR committee which has an approval authority of up to five lakhs while the project above this bench mark are referred to the national operational research committee. Many of the operational research studies have been published through this mechanism from Karnataka, India.⁶⁻⁸

The state TB office is responsible to review the implementation of the programme with all the nodal officers from medical colleges and the programme managers. All the issues regarding the implementation needs to be addressed to facilitate the smooth implementation of the programme.

The medical colleges are tertiary level health facilities that caters to difficult to treat cases in the districts; currently, with over more than 600 medical colleges in the country, they contribute immensely to the program's case-finding activities and management of drug-sensitive and drug-resistant TB cases.^{3,4} There is paucity of data and information in the country with regards to understanding the barriers and challenges that nodal officers face during the implementation of the programme. Hence, the study was conducted in the state of Karnataka which has nearly 57 medical colleges to assess the implementation status of RNTCP/NTEP at these institutions and identify barriers and challenges to implementation as perceived by the nodal officers and the core committee members of the medical colleges.

METHODS

During the period of 2019-2020, a cross-sectional study to a cross sectional study was conducted assess the implementation of the RNTCP/NTEP among medical colleges in the state of Karnataka, India. We identified 57 medical colleges, including those established within the last three years, that had an intake of 100-200 undergraduate students and at least 500 beds. Stratified random sampling was used to select 14 medical colleges across the four administrative divisions of the state for inclusion in the study. The key implementers of the programme at each medical college, including the RNTCP/NTEP nodal officer, medical officer, core committee members, health visitors, laboratory technicians, and HIV counsellors were invited to participate in the study. A pre-tested, semi-structured questionnaire was used to collect data on service delivery, training, research, and challenges. The questionnaire was administered by trained medical college faculty at a time and location convenient for participants. Service delivery was assessed using indicators such as the functioning of the core committee, TB notification, functioning of the designated microscopy centre (DMC), DOTS centre, DOTS-plus services, referral for treatment and feedback status, TB-HIV collaboration, and airborne infection

control. Training was evaluated by assessing the proportion of trained faculty, paramedics, interns, post-graduates, and under-graduates. Research was assessed by determining the number of operational research projects and post-graduate theses awarded funding from the programme. The data were compiled and entered into EpiData data entry software version 3.1 and analysed for numbers and proportions using EpiData analysis software. (EpiData Association, Odense, Denmark).⁹ We used an operational indicator for each component to assess the total implementation status in the state as adequate (>66%), partially adequate (33-65%), or inadequate implementation (<33%). The study was

approved by the institutional ethics committee, and participants provided informed consent prior to the interview.

RESULTS

The study included a total of 14 medical colleges, and a detailed assessment of the programme components was performed, as shown in Table 1. The findings of each component included are described below.

Table 1: TB program implementation status at medical colleges in Karnataka (N=14).

Thematic area	Particulars	Implementation status	N (%)	
Core committee	Functionality	Inadequate	4 (29)	
TB notification	Notification on monthly basis	Adequate	14 (100)	
Designated microscopy centre (DMC)	Infrastructure	Adequate	14 (100)	
	Human resource	Partially adequate	7 (50)	
	Logistics	Partially adequate	7 (50)	
	Supervision and monitoring	Partially adequate	7 (50)	
	Facilities	Partially adequate	7 (50)	
DOTS centre	Human resource	Partially adequate	8 (57)	
	Administration of DOT	Adequate	10 (72)	
	Recording and reporting	Adequate	10 (72)	
	Supervision and monitoring	Partially adequate	5 (36)	
	Facilities	Inadequate	0 (0)	
DOTS-plus services	Facilities	Inadequate	0 (0)	
Referral and feedback mechanism	Channelling	Partially adequate	7 (50)	
	Feedback	Inadequate	4 (29)	
Indoor DOTS service delivery	Logistics	Adequate	10 (72)	
	Transfer out mechanism	Inadequate	2 (25)	
TB-HIV coordination	Presence of ICTC centre	Adequate	14 (100)	
	Standard cross-referral	Partially adequate	5 (36)	
Airborne infection control	Air borne infection control practices	Presence of infection control committee	Adequate	14 (100)
		Good	0 (100)	
		Moderate	5 (36)	
		Poor	9 (65)	
Training-cum-teaching status	No. of activities in the last 3 years	Inadequate	2 (14)	
Operational research	PG Thesis on RNTCP/NTEP priority areas	Partially adequate	5 (36)	
	Operational research projects	Inadequate	4 (29)	

*(Score >10: good airborne infection control practices; score 5-10: moderate airborne infection control practices; score <5: poor airborne infection control practices)

The core committee was formed in all the medical colleges that were included in the study, which generally included teaching faculty from the departments of chest medicine, community medicine, microbiology, and general medicine, with at least four members. However, only 28% of colleges had regular quarterly core committee meetings. TB cases detected were all notified and the hospital adhered and was compliant in accordance with those of core committee guidelines. Functional designated microscopy centre (DMC) was present in all medical colleges. But, only 50% were partially adequate for human resources and other logistics.

While, all colleges had a DOT centre, only 50% had partially adequate infrastructure and human resources. Trained staff were present in 57% of colleges, and 72% of colleges provided DOT according to guidelines and maintained appropriate records and reports. Supervision and monitoring by senior treatment supervisors were partially adequate. No separate ward for drug-resistant TB patients was identified, and none of the medical colleges performed drug susceptibility testing.

All the 14 medical colleges maintained a referral for treatment register, but routing of TB patients was partially

adequate in only 50% of the colleges. Only 30% of the medical colleges provided feedback on the status of the referred patients in the institution. Drug and logistics delivery were found to be adequate in 72% of colleges, but transfer-out mechanisms for registered patients were inadequate.

The DMC and integrated counselling and testing centres (ICTC) were collocated in all the medical colleges, but the TB-HIV cross-referral mechanism was partially adequate in only 35% of medical colleges. Airborne infection control committees were formed in 100% of

medical colleges, but none of them had implemented good air-borne infection control (AIC) measures.

Among all 14 medical colleges only 2 (16.7%) of them had performed training activities in the last three years, which was found to be inadequate. PG thesis funding was utilized by 5 (36%) medical colleges, and 29% of the colleges had OR projects that were awarded by the program.

Table 2: Challenges in implementation of TB program at medical colleges of Karnataka.

Challenges	N	%
Challenges pertaining to core committee		
Reasons for no quarterly core committee meetings (n=10) (multiple responses permitted)		
Time constraints due to work overload	10	100.0
Shortage of manpower	6	60.0
New medical college and in the process of being involved	2	20.0
Challenges pertaining to designated microscopy centre (DMC)		
Reasons for non-availability of complete/trained staff (N=7) (multiple responses permitted)		
Salary constraints	7	100.0
More workload	7	100.0
Lack of dedicated staff	4	57.1
Challenges pertaining to DOTS Centre		
Reasons for non-availability of complete/trained staff (N=6) (multiple responses permitted)		
Salary constraints	6	100.0
More workload	6	100.0
Lack of dedicated staff	5	83.3
Challenges pertaining to DOTS-plus services		
Reasons for non-availability of DOTS-Plus site/mycobacterial culture and drug susceptibility testing lab (N=14) (multiple responses permitted)		
Lack of sufficient funding	14	100.0
Lack of infrastructure	14	100.0
Lack of sufficient adequately trained manpower	14	100.0
New Medical College and in the process of being involved	2	14.3
Challenges pertaining to referral and feedback mechanism		
Reasons for all TB patients diagnosed by all departments of the hospital not being channelled through the DOTS centre of the hospital (N=6)		
Work overload	6	100.0
Shortage of manpower	6	100.0
Lack of dedicated manpower	6	100.0
Reasons for feedback not being provided to the referring department by the DOT Centre/TB cell of the medical college (N=9)		
Work overload	9	100.0
Shortage of manpower	9	100.0
Lack of dedicated manpower	8	88.9
Challenges pertaining to Indoor DOTS		
Reasons for “transfer out” mechanism not working satisfactorily in the medical college for patients registered while on indoor treatment (N=12)		
All TB treatment outcomes not communicated back to the referral institution	12	100.0
Lack of appropriate patient education during transfer out	11	91.7
Negligence	10	83.3
Lack of sufficient adequately trained manpower	10	83.3
Patients referred to inappropriate institution	9	75.0

Continued.

Challenges	N	%
Lack of communication modalities	6	50.0
Patients giving wrong address	5	41.7
Challenges pertaining to TB-HIV coordination		
Reasons for no standard cross-referral mechanism between the DMC and ICTC (N=9) (multiple responses permitted)		
Lack of trained manpower	9	100.0
Lack of regular interaction between RNTCP/NTEP and ICTC personnel	9	100.0
Work overload	8	88.9
Lack of regular monitoring of HIV-TB collaborative services	7	77.8
Reasons for no ART centre (N=14) (multiple responses permitted)		
Lack of sufficient funds	14	100.0
Lack of infrastructure	9	64.3
Lack of sufficient adequately trained manpower	6	42.9
Challenges pertaining to training-cum-teaching/sensitization programs about RNTCP/NTEP		
Reasons for no training cum-teaching /sensitization programs about RNTCP/NTEP being conducted in the medical college (N=2) (multiple responses permitted)		
New medical college and in the process of being involved	2	100.0
Lack of funds	2	100.0
Lack of trained manpower	2	100.0
Challenges pertaining to operational research		
Reasons for no thesis work on RNTCP/NTEP priority areas conducted to date (N=9) (multiple responses permitted)		
Lack of awareness among faculty regarding the provisions of the RNTCP/NTEP on TB research	4	44.4
Misconceptions that the provisions of RNTCP/NTEP are limited to chest and TB and general medicine departments	3	33.3
Lack of interest to conduct thesis on RNTCP/NTEP priority areas	3	33.3
Delay in the release of funds for timely conduct of Research	3	33.3
No Postgraduation courses in college	2	22.2
Reasons for no operational research projects conducted till date (N=14) (multiple responses permitted)		
Capacity of faculty to create a research protocol, conduct research, write a manuscript and publish the work is suboptimal due to other work loads	14	100.0
Lack of training of doctors in research methodology and research grant writing	14	100.0
Delay in the approval of research protocols	14	100.0
Delay in the release of funds for research	14	100.0
Difficulty in obtaining ethics approval from the ethics committee of medical college	11	78.6
Extremely difficult for researchers to publish their work in a high impact journal without publication charges	9	64.3
Non-availability of biostatistical help in medical college	7	50.0

Table 2 provides a detailed overview of the challenges encountered during the implementation of each program component. The following challenges were identified as the most significant: Core committee meetings were hindered by time constraints resulting from work overload. Functional DMCs and DOT centres faced excessive workloads and lower salaries. DOTS-plus services were hindered by a lack of infrastructure, funds, and human resources.

Referral and feedback mechanisms were hampered by a shortage of manpower. Treatment outcomes were not communicated to the referral institution due to deficiencies in transfer-out mechanisms. TB-HIV coordination was hindered by irregular interaction between HIV and TB programmes and a lack of sufficient

funds for anti-retroviral treatment (ART) centres. Training programmes suffered from a lack of funds and manpower. Operational research was hindered by a lack of awareness regarding grants for post-graduate (PG) thesis and sub-optimal capacity among medical college faculty to write protocols, conduct research, and publish.

DISCUSSION

The importance of medical colleges in the fight against tuberculosis, especially in India, cannot be overstated. With these institutions serving as primary touchpoints for a significant section of the community, their effective integration into the revised National TB Control Programme (RNTCP)/National TB Elimination Programme (NTEP) is paramount. Our study among 14

medical colleges in Karnataka offers essential insights into the program's current implementation and the challenges faced.

A promising observation was that all the surveyed colleges had established core committees to address TB issues, and functional designated microscopy centre (DMC) was present in every institution. These findings emphasize that medical colleges are aware of their role in the RNTCP/NTEP and have made tangible strides to align with the program's objectives. A study conducted by Sharma et al states that overall, at a national level, medical colleges have contributed to 25 per cent of TB suspects referred for diagnosis; 23 per cent of 'new smear-positives' diagnosed; 7 per cent of DOT provision within medical college; and 86 per cent treatment success rate among new smear-positive patients. As the Programme widens its scope, future challenges include sustenance of this contribution and facilitating universal access to quality TB care; greater involvement in operational research relevant to the programme needs; and better co-ordination mechanisms between district, state, zonal and national level to encourage their involvement.² A study conducted by Nagaraja et al has emphasised that tertiary health facilities, medical colleges are equipped with all types of equipment for investigating a case. The decreasing trend of nationwide smear-negative TB case detection augments the importance of capturing the data at subunit levels of a medical college.³

However, several challenges overshadow these positive strides. The limited frequency of core committee meetings is concerning. Regular meetings are essential for consistent policy review, identifying gaps in service delivery, and enabling real-time corrective actions. The fact that only 28% of colleges had quarterly core committee meetings might hinder effective TB management.

A striking observation was the apparent disconnect between TB and HIV programmes, which only 35% of medical colleges managing a cross-referral mechanism effectively. This shortfall could be significant considering the well-established interaction between TB and HIV; where the presence of one increases the susceptibility to the other. The sub-optimal integration may lead to missed opportunities for early diagnosis, preventive therapy, and effective management of co-infected patients.

One recurring theme across the colleges was the issue of human resources. The study revealed challenges related to work overload, lower salaries, and manpower shortages. This shortage is particularly concerning in an ailment like TB, which demands rigorous and consistent patient care. The high prevalence of TB in India already puts a strain on the health system, and inadequate staffing levels can lead to reduced quality of care and patient follow-up, potentially resulting in higher default rates and increased transmission. Furthermore, the limited training activities and inadequate funding allocation for

operational research reveal another bottleneck in TB management. Training ensures the updated knowledge transfer, while research can provide insights into the effectiveness of current policies and suggest actionable improvements. The lack of awareness and capacity to undertake operational research might result in missed opportunities to inform the national TB program about potential areas of improvement.

A study conducted by Purty et al state certain challenges related to vacancy of RNTCP staff posts in medical colleges, salary constraints, delay or non-release of funds for OR are still common and need to be addressed effectively for the sustainability of the model and to deliver the added responsibilities effectively.⁴ In overcrowded government medical colleges ensuring AIC measures is a great challenge. Weaknesses seen in supervision capacity, quality maintenance, planning, monitoring and evaluation needs to be rectified immediately.

To summarize, while the initiative to integrate RNTCP/NTEP into medical colleges in Karnataka has seen some success, there are still significant gaps to address. The challenges faced by these institutions are multi-faceted, including human resource constraints, infrastructural deficits, and limited training and research activities.¹⁰⁻¹² Addressing these challenges requires a multi-pronged approach, involving not only medical colleges but also policy-makers, funding agencies, and other stakeholders. The lessons drawn from this study can provide a roadmap to strengthen the RNTCP/NTEP integration across medical colleges, ultimately accelerating India's journey towards TB elimination.

The study's strengths include data collected from trained medical faculty at each medical college by making a personal visit, which reflected the ground reality of field-level implementation. The study was funded by the NTEP Karnataka state OR committee, ensuring complete cooperation from the medical colleges identified for the study. However, the study's limitations include a geographically representative sample and only one random visit to each college after a prior appointment, which may have affected the completeness and correctness of records and reports.

CONCLUSION

This study emphasizes the pivotal role of medical colleges in augmenting India's fight against tuberculosis through the RNTCP/NTEP framework. While commendably, all surveyed colleges in Karnataka have institutionalized core committees and DMCs several challenges persist, jeopardizing the program's efficacy. Notably, there are gaps in routine committee meetings, human resource allocations, infrastructure, and coordinated TB-HIV interventions. Disconcertingly, a significant proportion of colleges haven't engaged in TB-related training in the recent past or tapped into available

research grants, hinting at possible awareness and capacity deficits. The identified challenges, ranging from operational constraints, like work overload, to systemic issues, like inadequate funding, underscore the need for multifaceted interventions. Addressing these barriers is crucial to harnessing the full potential of medical colleges in advancing TB control and elimination in India. Overall, the study concludes that the implementation status of the TB program at medical colleges in Karnataka was partially satisfactory in most aspects covering service delivery, training, and research activities.

ACKNOWLEDGEMENTS

This study was conducted as part of the ‘operational research course for medical college faculty under the National TB Elimination Programme (NTEP)’, which was organized by the NTEP State Task Force Operational Research Committee, Karnataka, with funding support from The State Tuberculosis Office (Government of Karnataka), Bengaluru, India. The protocol development and scientific writing workshops were held at the National Tuberculosis Institute, Bengaluru, India, and were developed and implemented jointly by Employee’s State Insurance Corporation (ESIC) Medical College and Post Graduate Institute of Medical Sciences and Research, Bengaluru, India; the National Tuberculosis Institute, Bengaluru, India; the Centre for Operational Research, International Union Against Tuberculosis and Lung Disease (The Union), Paris, France; and Vydehi Institute of Medical Sciences and Research Centre, Bengaluru, India.

The authors express their gratitude to Mr. Nandkishore Warbhe, statistician at The Oxford Medical College, Hospital and Research Centre, Bengaluru, for his valuable assistance in data analysis.

Funding: The study was funded by the National TB Elimination Programme (NTEP), State Tuberculosis Office (Government of Karnataka), Bengaluru, India. The funders had no role in the study design, conduct or interpretation of the results

Conflict of interest: None declared

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

REFERENCES

1. Global tuberculosis report 2021. Who.int. 2022 Available from: <https://www.who.int/publications-detail-redirect/9789240037021>. Accessed on 2 October 2022.
2. Sharma SK, Mohan A, Chauhan LS, Narain JP, Kumar P, Behera D, Sachdeva KS, Kumar A, Task Force for Involvement of Medical Colleges in the Revised National Tuberculosis Control Programme. Contribution of medical colleges to tuberculosis control in India under the Revised National Tuberculosis Control Programme (RNTCP): lessons learnt and challenges ahead. Indian J Med Res. 2013;137(2):283.
3. Nagaraja SB, Shastri S, Singarajipur A, Menezes RG. Mainstreaming tuberculosis case detection and reporting in medical colleges in India: early lesson learnt. Public Health Act. 2015;5(4):269.
4. Purty AJ, Anandan V. Expanding the role of Medical Colleges in RNTCP towards End TB strategy: Scope and Challenges. Indian J Community Health. 2018;30(1):4-6.
5. Revised National TB Control Programme Checklist for Core Committees Meetings in Medical Colleges. Tbcindia.gov.in. 2022. Available from: <https://tbcindia.gov.in/WriteReadData/1892s/6806084372Checklist%20for%20Core%20Committee.pdf>. Accessed on 2 October 2022.
6. Functions of core committee. Ntep.in. Available from: <https://ntep.in/node/4754/CP-functions-core-committee>. Accessed on 13 October 2022.
7. Ministry of Health, Family Welfare-Government of India. NTF consensus statement: Ministry of Health and Family Welfare. Gov.in. Available from: <https://tbcindia.gov.in/showfile.php?lid=3283>. Accessed on 13 October 2022.
8. Bhargava M, Bhargava A, Akshaya KM, Shastri SG, Bairy R, Parmar M, et al. Nutritional assessment and counselling of tuberculosis patients at primary care in India: do we measure up? Int J Tuberc Lung Dis. 2019;23(2):147-50.
9. Christiansen TB, Lauritsen JM, eds. EpiData-Comprehensive Data Management and Basic Statistical Analysis System. Odense Denmark, EpiData Association; 2010.
10. Ranganath R, Shewade HD, Bahadur AK, Naik V, Nagaraja SB, Kumar AMV, et al. Uptake of universal drug susceptibility testing among people with TB in a south Indian district: How are we faring? Trans R Soc Trop Med Hyg. 2022;116(1):43-9.
11. Chawla K, Burugina Nagaraja S, Siddalingaiah N, Sanju C, Kumar U, Shenoy VP, et al. Tuberculosis screening for pediatric household contacts in India: Time to adapt newer strategies under the National TB Elimination Programme! PLoS One. 2023;18(10):e0292387.
12. Krishnappa L, Gadicherla S, Chidambaram P, Anuradha HV, Somanna SN, Naik PR, et al. ‘Have we missed reporting adverse drug reactions under Revised National TB Control Programme?’- A mixed method study in Bengaluru, India. Indian J Tuberc. 2020;67(1):20-8.

Cite this article as: Hiremath LD, Sharma N, Sudeepa D, Shivaramakrishna HR, Warbhe N, Lonimath A, et al. Practices and challenges in implementing a tuberculosis program at medical colleges in Karnataka, India. Int J Community Med Public Health 2023;10:4284-90.