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Need-based training of community health officers for tuberculosis care in Ahmednagar district of Maharashtra, India: A before and after study

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Abstract:

BACKGROUND: Community health officers (CHOs) are a newly introduced cadre of mid-level health-care providers who will man the health and wellness centers under *Ayushman Bharat Mission* in India. Need-based training will help them fulfil their role in early diagnosis, treatment, and referral of tuberculosis (TB) patients. The present study identified the gaps in the awareness about TB in a heterogeneous group of trainees and addressed them through need-based training.

MATERIALS AND METHODS: A before and after the study was carried out in 110 trainee CHOs at Rural Medical College, Loni. In-depth interviews were conducted with public health experts and focus group discussion was conducted with trainees to gain the quality inputs. Structured questionnaires based on training objectives specifically pertaining to TB were designed. Training was provided with an emphasis on addressing the gaps identified in the pretest. Posttest evaluation was done at the end of the training to assess its effectiveness. Data were analyzed using the SPSS software version 17.0 (Inc., Chicago, IL, USA).

RESULTS: The mean pretest score was 15.15 (standard deviation [SD] = 3.55) which improved after 6 months training to 24.01 (SD = 1.223), i.e., from 60% to 96%. There was highly significant improvement in overall knowledge score of trainees ($t = 28.124$, $df = 109$, $P < 0.001$). There was a statistically significant improvement in scores of all topics at the end of 6 months training in both Nursing and Ayurved graduates. Except for knowledge regarding the treatment of multidrug-resistant TB ($P = 0.004$), knowledge about all other topics was comparable in nursing and Ayurved graduates at the end.

CONCLUSIONS: Needs assessment proved effective in identifying the gaps in knowledge and skills of interdisciplinary trainee CHOs. Medical colleges with expertise in teaching, training, and health service provision can work with the public health system to provide a model for rapid upgrading and capacity building to meet health-care challenges such as TB.

Keywords:

Allied health personnel, community health worker, needs assessment, training program, tuberculosis

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Introduction

India has the highest burden of tuberculosis (TB) in the world, having an estimated incidence of 2,690,000 cases in 2019.^[1] In spite of newer modalities for the diagnosis and treatment of TB, millions of people are still suffering and

dying from this disease.^[2] Comprehensive Primary Health-care (CPHC) services at the grassroots are must to address these problems. To provide universal health coverage, the *Ayushman Bharat Mission* of Government of India envisions upgradation of subcenters to health and wellness centers.^[3] These centers will cater

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to a population of 3000–5000 and are to be manned by community health officers (CHOs).^[4] This newly created cadre of mid-level health-care providers is being built by training graduates from the Indian systems of medicine such as Bachelor of Ayurvedic Medicine and Surgery (BAMS) and nursing graduates. The BAMS and Nursing graduates have different skill sets and mind sets. The CHO training program must build upon these skills and identify the needs of all trainees appropriately to bring them on an equal footing to effectively deliver CPHC services.

The CHOs along with a team of health workers are expected to provide 13 basic health-care services including the management of communicable diseases in National Health Programs.^[5] Training them for the early diagnosis treatment and referral of patients with TB would play an important role in the implementation of TB control program and achieve the goal of END TB by 2025.^[1]

A certification course of 6 months is conducted by the Maharashtra University of Health Sciences in Maharashtra state in co-ordination with National Health Mission to train CHOs to become efficient mid-level health-care providers.^[6] The authors believe that this is the first study to present the data findings based on the training program. The present study aimed to assess the knowledge about referral and care of TB patients among trainee CHOs. The gaps that were identified were then addressed by imparting need-based training, followed by the evaluation of training in bridging the gaps.

Materials and Methods

Study setting

Rural Medical College, Loni, is a Program Study Center for training of CHOs and a 6-month *Modern Mid-level Service Provider Certificate* course is conducted by the institute in affiliation with Maharashtra University of Health Sciences.

Study design and population

A before and after the study was done in 110 CHO trainees enrolled at Rural Medical College, Loni, from August 2019 to January 2020.

Baseline assessment before training

In-depth interviews were conducted with public health experts regarding expectations from CHOs once they begin working in wellness centers to identify requisite knowledge and skills. Focus group discussion was conducted with CHO trainees to gain quality inputs regarding felt needs. Themes and subthemes were identified after the analysis of transcripts, and verbatim responses were also noted [Table 1]. Baseline

assessment was conducted in the trainees. A structured questionnaire was prepared based on training objectives specifically pertaining to TB. It was designed taking Operational Guidelines for Health and Wellness Centers as reference. Questionnaire consisted of multiple choice single response and multiple choice multiple response questions.

Training

The training included classroom lectures in the English and local language Marathi. Modules developed by the State Health Services were used. Maharashtra University of Health Sciences has given a detailed curriculum that included clinical postings and case presentations. The training introduced concepts such as behavior change communication (BCC) and information, education, and communication. Familiarization of trainees with recent protocols and policies was also given priority. Importance of health beliefs about TB, planned behavior, and transtheoretical approach to de-addiction was also emphasized. These approaches have found to be effective in other studies.^[7,8] In addition, trainees were posted TB treatment and diagnostic microscopy center (DMCs). They also visited Cartridge-Based Nucleic Acid Amplification Test (CBNAAT) lab, Anti-Retroviral Treatment Center, and Integrated Counseling and Testing Center (ICTC) situated within the institution. They took part in immunization services, sample collection, and counseling of TB patients. Community-based training was provided at the urban and rural health training centers. The training encompassed cognitive, affective, and psychomotor domains. Gaps identified at baseline were addressed during the training.

Assessment after the training

Structured questionnaire consisting single and multiple response questions was administered as a posttest. Clinical skills and understanding were evaluated during the practical examination. The evaluation was objective, structured, and measurable.

Data analysis

Descriptive statistical analysis included mean, percentage, and standard deviation (SD). Possible associations between the variable of interest were explored using the Fisher's exact test, and comparison of pretest and posttest responses was done using McNemar test. Unpaired *t*-test was used to compare the mean scores between Ayurveda and nursing graduates. Paired *t*-test was used to compare the mean before and after scores. Data were analyzed using the SPSS software v. 17.0 (Inc., Chicago, IL, USA).

Ethical issues

This study was approved by the Rural Medical College Ethical Review Committee with reference no. RMC/UG-PG/2020/77. Study procedure was explained *a*

Table 1: Themes identified in focus group discussion

Theme	Sub themes	Responses
Knowledge gaps	Programmatic guidelines	I don't know what my responsibility will be
	Functioning of public health system	Whom to tell? Where to send the patient
	Recent advances	We know broadly what drugs to give but not sure about current regimens
Skill gaps	Sample collection	I don't know how to collect sputum or who is supposed to collect it
	Survey techniques	We have no knowledge of how to find cases in community or what to do during surveys
	Counseling	Not clear about what all I should tell him once he gets TB
Felt needs	Hands on approach	We know what TB is; we want to understand what to do?
	Practical training	In private practice, we usually avoid treating TB we will now have to focus on its screening, diagnosis, counseling, referral, and follow-up
	Use of local language	We understand it better if you explain in Marathi (local language)

TB: Tuberculosis

priori and written informed consent obtained from participants.

Results

Age and sex profile of trainees

Of the 110 CHOs, 75 (68.2%) were Ayurveda graduates and 35 (31.8%) were nursing graduates. There were 65 (59.1%) male and 45 (40.9%) female trainees. The average age was 30.33 years (SD = 5.3). The average age of nursing graduates was 24.6 (SD = 1.6) and that of Ayurveda graduates was 33.01 (SD = 4.17). There was a statistically significant difference in the mean age distribution of nursing and Ayurved graduates with nursing graduates being younger than Ayurved practitioners ($t = 11.475$, $df = 108$ $P < 0.001$).

Interviews with experts

Interviews with experts revealed that CHOs were expected to.

Implement National Health Programs and initiatives at grassroots in a better way provide services above and beyond Reproductive and Child Health care at sub center level (for a population of 3000–5000). Ensure Universal Health Coverage. *Do the things that auxiliary health workers are unable to do.* Provide preventive, promotive, curative, and rehabilitative care. Treat common communicable diseases and screen for communicable and noncommunicable diseases. Ensure value added services by being available, approachable, and better qualified. To conduct health education and BCC in a more effective way. Provide community leadership and ensure community participation. The operational guidelines for health and wellness centers also show services expected to be provided [Figure 1].

Assessment of community health officers before and after 6 months of training

The mean pretest score was 15.15 (SD = 3.55) which improved to posttest score of 24.01 (SD = 1.223) i.e., from 60% to 96%. There was highly significant improvement in

Care at Community Level
• Community awareness for prevention and control measures
• Screening, Identification & referral
• Ensure compliance with follow up/ medication compliance
• Provision of DOTS/ensuring treatment adherence as per protocols in cases of TB
Care at the Health and Wellness Centres/ Sub Health Centres
• Sample collection for diagnosis and treatment as appropriate for that level of care
• Provision of DOTS for TB
• HIV Screening (in Type B SHC), appropriate referral and support for HIV treatment.
• Referral of complicated cases
Care at the Referral Site (PHC)
• Confirmatory diagnosis and initiation of treatment
• Management of Complications
<small>Source: Operational Guidelines for Health and Wellness Centres, Ayushman Bharat, Ministry of Health & Family Welfare, Govt. of India</small>

Figure 1: Services for tuberculosis care

overall knowledge score of trainees ($t = 28.124$, $df = 109$, $P < 0.001$).

There was no statistically significant difference between mean pretest scores of male (15.54 ± 3.133) and female (14.58 ± 4.05) trainees at baseline ($t = 1.4$, $df = 108$, $P = 0.165$). There was no significant difference between posttest scores of male (24.03 ± 1.224) and female (23.98 ± 1.234) trainees after the completion of training ($t = 0.22$, $df = 108$, $P = 0.825$) with comparable improvement in scores of both the sexes.

There was no statistically significant difference between mean pretest scores of Ayurved (15.52 ± 3.75) and nursing (14.34 ± 2.97) trainees at baseline ($t = 1.63$, $df = 108$, $P = 0.106$). There was no significant difference between posttest scores of Ayurved (24.11 ± 1.158) and nursing (23.80 ± 1.346) trainees after completion of training ($t = 1.228$, $df = 108$, $P = 0.222$) with comparable improvement in both scores.

At baseline, most of the trainees knew about the common symptoms of TB (85.45%), mode of transmission of TB (100%), extrapulmonary TB (92%), and control measures in community (93%). On pretest, awareness regarding sample collection for TB ($P = 0.008$), screening for TB ($P = 0.04$), staffing pattern under RNTCP ($P = 0.01$), nutrition in TB ($P < 0.001$), and end TB campaign was higher in nursing graduates as compared to Ayurved

graduates. Whereas, on pretest awareness regarding control measures ($P = 0.02$), therapy ($P < 0.001$), and *Nikshay* web portal ($P < 0.001$) was more among Ayurved graduates [Table 2].

There was statistically significant improvement in the scores of all topics at the end of 6 month training in both nursing and Ayurved graduates. Except for knowledge regarding the treatment of multidrug resistant TB ($P = 0.004$), knowledge about all other topics was comparable in nursing and Ayurved graduates at end of the training [Table 2]. The clinical evaluation conducted at end of the training program all 110 trainees could demonstrate requisite clinical skills to complete the training.

Discussion

Studies have emphasized that health-care workers must have sufficient knowledge of TB and its management, especially in resource-limited countries.^[9] Mor *et al.* after reviewing various global initiatives concluded that there is a need for a credible nationally recognized certification

and training program, which combines textbook learning as well as practical skills.^[10] Subject experts and trainees themselves agreed, that a hands on approach would give confidence to CHOs for taking initiative and delivering services at grassroots [Table 1]. The training was successful in improving the knowledge of trainees significantly, as per the operational guidelines for health and wellness centers and curriculum developed for the modern midlevel service providers.^[11,12]

The training gave more clinic time with special postings in TB care center. This ensured adequate inpatient and outpatient care experience. Family survey, health talks in community, immunization activities, creating awareness among patients and community, conducting outreach activities on days of public health importance such as World AIDS day, collecting sputum samples for staining and CBNAAT, interacting with microbiologists on common problems with sample collection, visiting anti-retroviral therapy center and ICTC gave the trainees a thorough understanding of TB care. Examining patients, filling forms and case record sheets at treatment center and DMC gave trainees knowledge of protocols

Table 2: Assessment of community health officers before and after 6 months of training

Awareness regarding	Pretest				Posttest				McNemar test, P
	Correct responses (%)			Fisher exact, P	Correct responses (%)			Fisher exact, P	
	Ayurved (n=75), n (%)	Nursing (n=35), n (%)	Total (n=110), n (%)		Ayurved (n=75), n (%)	Nursing (n=35), n (%)	Total (n=110), n (%)		
Common symptoms of TB	64 (85.3)	30 (85.7)	94 (85.45)	0.95	75 (100)	35 (100)	110 (100)	-	<0.001
Mode of transmission	75 (100)	35 (100)	110 (100)	-	75 (100)	35 (100)	110 (100)	-	-
Extrapulmonary TB	75 (100)	27 (77.1)	102 (92.7)	-	75 (100)	33 (94.3)	108 (98.1)	0.09	<0.031
Control measures in community	68 (90.7)	25 (71.4)	93 (84.5)	0.02	74 (98.6)	35 (100)	109 (99)	-	<0.001
Sample collection for TB	59 (78.6)	34 (97.1)	93 (84.5)	0.008	70 (93.3)	35 (100)	105 (95.4)	0.176	<0.001
Screening of TB patients	54 (72)	32 (91.4)	86 (78.2)	0.04	69 (92)	34 (97.1)	103 (93.6)	0.427	<0.001
Screening for TB in HIV	44 (58.7)	14 (40)	58 (52.7)	0.06	72 (96)	31 (88.6)	103 (93.6)	0.206	<0.001
Screening for TB in diabetes	17 (22.7)	4 (11.4)	21 (19.1)	0.19	74 (98.6)	34 (97.1)	108 (98.1)	0.09	<0.001
CBNAAT indications	53 (70.7)	26 (74.3)	79 (71.8)	0.69	70 (93.3)	29 (82.8)	99 (90)	0.322	<0.001
Confirmation of diagnosis	49 (65.3)	20 (57.1)	69 (62.7)	0.5	70 (93.3)	34 (97.1)	104 (94.5)	0.662	<0.001
Appropriate use of PPE	49 (65.3)	20 (57.1)	69 (62.7)	0.5	70 (93.3)	34 (97.1)	104 (94.5)	0.662	<0.001
Staffing pattern	8 (10.6)	11 (31.4)	19 (17.2)	0.01	60 (80)	32 (91.4)	92 (83.6)	0.171	<0.001
Nodal officer for referral	42 (56)	26 (74.2)	68 (61.8)	0.06	74 (98.6)	35 (100)	109 (99)	-	<0.001
Procedure for referral	33 (44)	11 (31.4)	44 (40)	0.2	75 (100)	35 (100)	110 (100)	-	<0.001
Daily dose regimen	62 (82.7)	25 (71.4)	87 (79.1)	0.2	75 (100)	35 (100)	110 (100)	-	<0.001
Tracing loss to follow-up	49 (65.3)	18 (51.4)	67 (60.9)	0.16	68 (90.6)	31 (88.6)	99 (90)	0.741	<0.001
Multidrug-resistant TB	53 (70.7)	19 (54.3)	72 (65.5)	0.09	72 (96)	27 (77.1)	99 (90)	0.004	<0.001
Nutrition in TB	26 (34.7)	30 (85.7)	56 (50.9)	<0.001	75 (100)	35 (100)	110 (100)	-	<0.001
Direct benefit transfer	36 (36.7)	17 (48.6)	53 (48.2)	0.559	74 (98.6)	33 (94.3)	107 (97.2)	0.237	<0.001
Isoniazid prophylaxis in children	49 (65.3)	21 (60)	70 (63.6)	0.58	75 (100)	35 (100)	110 (100)	-	<0.001
Complications of TB	58 (77.3)	22 (62.9)	80 (72.7)	0.11	75 (100)	35 (100)	110 (100)	-	<0.001
Helpline number for TB	50 (66.7)	23 (65.7)	73 (66.4)	0.92	75 (100)	35 (100)	110 (100)	-	<0.001
Reporting TB cases	14 (18.6)	0	14 (12.7)	-	75 (100)	35 (100)	110 (100)	-	<0.001
Nikshay (web portal)	55 (73.3)	5 (14.3)	60 (54.5)	<0.001	68 (90.6)	31 (88.6)	99 (90)	0.322	<0.001
Mobile based monitoring	54 (72)	8 (22.8)	62 (56.3)	<0.001	67 (89.3)	30 (85.7)	97 (88.1)	0.752	<0.001
End TB campaign	17 (22.7)	19 (54.2)	36 (32.7)	<0.001	75 (100)	35 (100)	110 (100)	-	<0.001

Fisher's exact test was used to compare the correct responses in Ayurveda and nursing trainees. McNemar test was used to compare the pretest and posttest scores. TB: Tuberculosis, CBNAAT: Cartridge-based nucleic acid amplification test, PPE: Personal protective equipment

of the National TB Elimination Program. Utilization of the local language along with English by experienced faculty members of medical college proved helpful in the engagement of the students. The quality of health-care workforce depends more on the quality of training that the provider receives than on any other prior background or qualifying examination scores.^[8] The program could take students with different backgrounds and reskill them.

At baseline, knowledge about screening of patients with Diabetes for TB (19%), organization and function of national programs (17.2%), procedure for notification of TB cases (40%), management of multidrug resistant TB patients (65%), and END TB campaign (40%) was low. These areas showed significant improvement after the training. Nutritional requirements in TB patients are the most neglected part of TB care.^[13] Involving health workers has shown to significantly improve these outcomes in TB.^[14] Our study showed significant improvement in knowledge about nutrition in TB. Involving paramedical trainees to address the importance of drug adherence, resistance to anti-TB drugs and follow-up, and giving performance based incentives to these workers can be an effective strategy.^[15]

A review showed that the factors associated with treatment nonadherence and lost to follow-up included lack of social support and patient-health worker miscommunication. Therefore, understanding and minimizing of the effect of these associated factors are very important to enhance treatment adherence and follow-up completion in developing countries.^[16] Provision of counseling and health education to TB patients who are on regular treatment can be incorporated into the routine TB treatment strategy by need based training.^[17] Preexisting vertical training has to be complemented by horizontal skills. The use of technology in early enrolment and empanelment of population, patient management, and follow-up has to be taught to health workers. The trainees were savvy enough to learn about tele-consultation, web-based portal NIKSHAY, and mobile-based methods of ensuring treatment compliance. Jitendra have termed harnessing information technology for the delivery of enhanced TB care as imperative in achieving our goal of END TB.^[18] Studies have also found that technology-driven dissemination of information proved effective in improving awareness about TB.^[19]

The study was novel in terms of assessing the effect of a program in a heterogeneous group of trainees. The program succeeded in orienting both AYUSH and nursing graduates for TB care in the community by overcoming separate barriers. It, however, remains to be seen how effective the CHOs would prove in the field. The study will serve as a baseline upon

which further assessments may be based. A review of training needs and regular retraining is must for health workers. Continuous refresher training, data handling, developing, and implementing a sound retention strategy to attract and motivate health professionals to work in the rural areas are necessary interventions to improve the TB control program.^[20] At present, the CHOs are doing a commendable work in the control of COVID-19 pandemic and keeping the primary health-care services functional at grassroots. They have also played a role in a district wide survey of TB and leprosy. Recent studies by public health trainers have emphasized the need for interdisciplinary training of health practitioners and interprofessional competency-based health education.^[21,22] The CHO training program may very well prove to be a successful example of this model.

Limitations

The study did not analyze the impact of CHOs on TB care in community. Further studies need to be conducted to evaluate the outcomes and benefits of the program to the community in due course of time.

Conclusions

Needs assessment proved effective in identifying the gaps in knowledge and skills of trainee CHOs. These gaps were addressed during their training. The first step for success of health and wellness centers in delivering CPHC is capacity building. Medical colleges with expertise in teaching, training, and health service provision can work with public health system to provide a model for rapid upgrading and capacity building to meet health-care challenges such as TB.

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Conflicts of interest

There are no conflicts of interest.

References

1. Central TB Division, Ministry of Health and Family Welfare India TB Report 2020. 2020. p. 11. Available from: <https://tbcindia.gov.in/index1.php?lang=1&level=1&sublinkid=5216&lid=3351>. [Last accessed on 2020 Mar 20].
2. Sandhu GK. Tuberculosis: Current situation, challenges and

- overview of its control programs in India. *J Glob Infect Dis* 2011;3:143-50.
- Lahariya C. "Ayushman Bharat" program and universal health coverage in India. *Indian Pediatr* 2018;55:495-506.
 - Ved RR, Gupta G, Singh S. India's health and wellness centres: Realizing universal health coverage through comprehensive primary health care. *WHO South East Asia J Public Health* 2019;8:18-20.
 - Desai S, Bishnoi RK, Punjot P. Community health officer: The concept of mid-level health care providers. *Int J Community Med Public Health* 2020;7:1610.
 - Keshri VR, Gupta SS. Ayushman Bharat and road to universal health coverage in India. *J Mahatma Gandhi Inst Med Sci* 2019;24:65.
 - Mohebbi B, Tol A, Sadeghi R, Mohtarami SF, Shamshiri A. Self-management intervention program based on the health belief model (HBM) among women with gestational diabetes mellitus: A quazi-experimental study. *Arch Iran Med* 2019;22:168-73.
 - Sabouri M, Shakibazadeh E, Mohebbi B, Tol A, Yaseri M, Babae S. Effectiveness of an educational intervention using theory of planned behavior on health care empowerment among married reproductive-age women: A randomized controlled trial. *J Educ Health Promot* 2020;9:293.
 - Naidoo S, Taylor M, Esterhuizen TM, Nordstrom DL, Mohamed O, Knight SE, *et al.* Changes in healthcare workers' knowledge about tuberculosis following a tuberculosis training programme. *Educ Health (Abingdon)* 2011;24:514.
 - Mor N, Bang A, Chaudhuri A, Mohan S, Ravikanth L, Nadu T. Human resources for primary healthcare in India training and certification. Bangalore, India. 2020:10. [Doi: 10.13140/RG.2.2.10335.00167/2]
 - Ayushman Bharat. Comprehensive Primary Health Care through Health and Wellness Centers: Operational Guidelines. New Delhi: Ministry of Health and Family Welfare, Government of India; 2018. Available from: <http://nhsrcindia.org/sites/default/files/Operational%20Guidelines%20For%20Comprehensive%20Primary%20Health%20Care%20through%20Health%20and%20Wellness%20Centers.pdf>. [Last accessed on 2021 Jan 02].
 - Priya R. The status and role of AYUSH and local health traditions in public health. The Newsletter of the International Institute of Asian Studies. 2013 19;65:24-5.
 - Bhargava A. Undernutrition, nutritionally acquired immunodeficiency, and tuberculosis control. *BMJ* 2016;355:i5407.
 - Balakrishnan S, Manikantan J, Sreenivas A, Jayasankar S, Sunilkumar M, Rakesh PS, *et al.* Social inclusion: An effort to end loss-to-treatment follow-up in tuberculosis. *Indian J Tuberc* 2015;62:230-4.
 - Saha I, Paul B. Private sector involvement envisaged in the National Strategic Plan for Tuberculosis Elimination 2017-2025: Can tuberculosis health action learning initiative model act as a road map? *Med J Armed Forces India* 2019;75:25-7.
 - Tola HH, Tol A, Shojaeizadeh D, Garmaroudi G. Tuberculosis treatment non-adherence and lost to follow Up among TB patients with or without HIV in developing countries: A systematic review. *Iran J Public Health* 2015;44:1-1.
 - Tola HH, Shojaeizadeh D, Tol A, Garmaroudi G, Yekaninejad MS, Kebede A, *et al.* Psychological and educational intervention to improve tuberculosis treatment adherence in Ethiopia based on health belief model: A cluster randomized control trial. *PLoS One* 2016;11:e0155147.
 - Jitendra, R. (2012) 'NIKSHAY' – harnessing Information technology for delivery of enhanced TB care NTI Bulletin, 48 (1&4). pp. 1-4. Available as URL <http://tbresearch.ntiindia.org.in/1629/> Accessed on 2nd January 2021
 - Ancy AV, Thangaraj P, Hemalatha K, Bethubarani M. Effect of an e-learning tool on knowledge of recent revised national tuberculosis control programme guidelines among medical interns. *J Educ Health Promot* 2020;9:257.
 - Gebreegziabher SB, Yimer SA, Bjune GA. Qualitative assessment of challenges in tuberculosis control in west gojjam zone, Northwest Ethiopia: Health workers' and tuberculosis control program coordinators' perspectives. *Tuberc Res Treat* 2016;2016:20-24.
 - Moradi P, Omid A, Yamani N. Needs assessment of the public health curriculum based on the first-level health services package in Isfahan University of Medical Sciences. *J Educ Health Promot* 2020;9:314.
 - Negandhi P, Negandhi H, Tiwari R, Sharma K, Zodpey SP, Quazi Z, *et al.* Building interdisciplinary leadership skills among health practitioners in the twenty-first century: An innovative training model. *Front Public Health* 2015;3:221.