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Effect of an e-learning tool on knowledge of recent Revised National Tuberculosis Control Programme guidelines among Medical Interns

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Abstract:

BACKGROUND: Medical students should have adequate knowledge on tuberculosis (TB) and national guidelines pertaining to its control, which is a major public health problem in developing countries. The present study aims to evaluate the knowledge on TB and Revised National TB Control Programme (RNTCP) among medical interns and the change in the level of knowledge following the dissemination of self-directed learning (SDL) modules using an e-learning tool (WhatsApp).

MATERIALS AND METHODS: A prospective, nonrandomized, pre- and posttest study was done among 124 medical interns in a private medical college during July–August 2019. A semi-structured, self-administered questionnaire was prepared and filled by the interns in the pretest. Following the educational intervention, the same questionnaire was administered and posttest data were collected. The pre- and posttest results were expressed in frequency and percentage. Wilcoxon signed rank test was used to compare the change in the total mean score of knowledge using the e-learning tool following the dissemination of SDL modules.

RESULTS: The mean age of the interns was 22.82 ± 0.82 years. Of the total 124 interns, 60 (48.3%) had heard about the recent changes in RNTCP. The Internet (25.8%) and textbooks (23.4%) were the most common source of recent information regarding TB and RNTCP. The mean pretest score was 12.9 ± 3.08, which increased to 15.3 ± 2.62 during the posttest ($z = -9.75$, $P < 0.05$) following the intervention.

CONCLUSIONS: The knowledge regarding TB and RNTCP among the interns was inadequate. The usage of an e-learning tool "WhatsApp" was found to be effective in improving the knowledge in posttest as compared to pretest.

Keywords:

E-learning, interns, Revised National Tuberculosis Control Programme, tuberculosis

Introduction

The Global tuberculosis (TB) report 2018 estimated the total incidence of TB in India to be 204/1 lakh population, contributing to 26% of worldwide burden.[1] India continues to account for about a quarter of the world TB cases in spite of TB control activities implemented in the country for more than 50 years. The first major changes in National TB programme took place in 1997 with the launch of Directly Observed Treatment-Short course (DOTS) under the Revised National TB Control Programme (RNTCP). In spite of the improved quality of services provided by the RNTCP, there continued to be a TB epidemic due to which significant initiatives were taken during the National Strategic Plan (NSP) 2012–2017 in terms of mandatory TB notification of all cases, integration of program under the National Health

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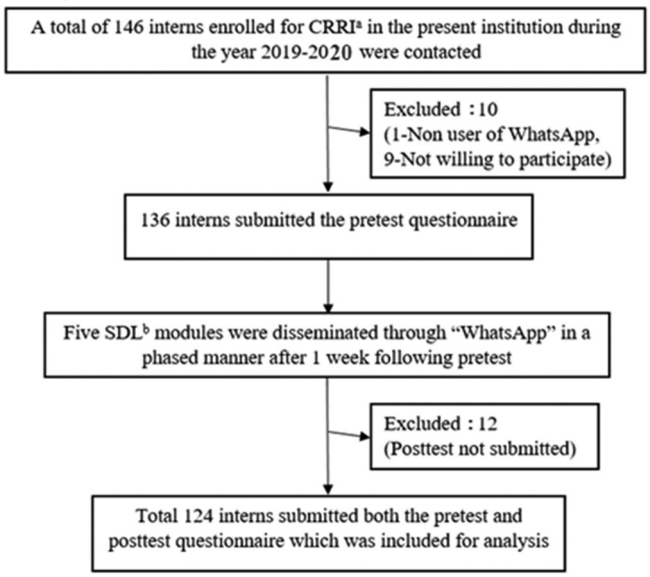
Mission, expansion of diagnostic services, programmatic management of drug-resistant TB, etc.[2] The recent NSP for TB 2017–2025 had been reframed based on the National Health Policy 2015, World Health Organization's end TB strategy, and the Sustainable Development Goals of the United Nations.[1] It has been integrated into four strategic pillars of "Detect-Treat-Prevent-Build," which aims to control and eliminate TB in India by 2025.[2]

Several changes in diagnosis and treatment protocol has taken place under the RNTCP following the latest NSP.[3] All stakeholders, including medical students, should be involved to combat TB which is a major public health problem of national importance. Therefore, awareness about the recent RNTCP guidelines among the interns needs to be evaluated and updated because they will be the first-contact physicians for most of the TB patients. Changes in the recent guidelines on any national program to be printed in the textbooks takes time and therefore there is a need for research on alternative methods to ensure that new information reaches every physician. Many studies[4-12] have evaluated the level of knowledge on RNTCP, however this study will additionally assess the change in the level of knowledge using an e-learning tool "Whatsapp," which has gained importance in the recent years as a teaching tool.[13-15] The present study was done with the objective for assessing the current level of knowledge on RNTCP among interns in a medical college and to provide information of the recent guidelines on RNTCP through an e-learning tool (WhatsApp) and compare the results with pretest level of knowledge.

Materials and Methods

A prospective, nonrandomized, pre- and post-test study design with an educational intervention was conducted among medical interns of a private medical college in Trichy, during the period of June to August 2019. All medical interns undergoing their compulsory rotatory resident internship in the present institution and those willing to give consent were included for baseline assessment of knowledge on TB and RNTCP. Interns without android mobile phone or nonuser of WhatsApp were excluded from the study. Those interns not available for the posttest survey within the time frame were also excluded from the analysis. A total of 124 interns were included in the final analysis. Figure 1 shows the details of selection methodology.

Previous studies[4-12] on the awareness of RNTCP and TB were reviewed to identify the key areas of knowledge assessed along with the recent RNTCP guidelines (2017) available at the Ministry of Health and Family Welfare (MoHFW) website and Indian Council of Medical Research (ICMR)-National Institute of Research in TB



a- Compulsory rotatory residency internship
b- Self-directed learning

Figure 1: Flowchart showing the methodology of study

online course on "Manage TB."[16] A questionnaire was prepared to assess the level of knowledge on TB and RNTCP. The questionnaire had five sections (general facts, diagnosis, treatment and follow-up, prevention, and notification) with a total of thirty questions, with the majority being multiple-choice questions. Every correct answer was scored 1 so that the maximum test score obtained would be 30. The same questionnaire was used during the post interventional survey. Content validation of the questionnaire was done by pilot testing of the questionnaire among ten tutors/senior residents, and necessary modifications were made. The questionnaire was distributed to the participants by the principal investigator and the filled questionnaires were collected immediately. Similar procedure was followed for posttest data collection.

For educational intervention, self-directed learning (SDL) modules were prepared using PowerPoint for each of the five sections of the questionnaire to cover the recent guidelines on RNTCP and general TB information. The content of SDL module was checked and verified by the faculties of community medicine, microbiology, and respiratory medicine departments of the college. The SDL module was sent to the medical interns through their "WhatApp" number a week following the baseline data collection. A total of five SDL modules were sent in a phased manner to all the participants. The postinterventional survey (posttest) was done after 2 months.

The study was conducted after obtaining ethical clearance from the institutional research board of the

college. Both verbal and written informed consent was obtained from the study participants.

Data entry was done in MS excel and analysis was done using SPSS Version 21 (IBM Corp., Armonk, NY, USA). The results were expressed in frequency and percentage. Because the pre- and posttest scores had a nonnormal distribution, Wilcoxon signed rank test was used to compare the change in total mean/median score of knowledge using the e-learning tool, and $P < 0.05$ was considered statistically significant.

Results

A total of 124 interns, i.e., 64 females and 60 males, completed the pre- and post interventional tests. The mean age of the participants was 22.82 ± 0.827 years with a minimum age of 21 years and a maximum of 26 years. Only 60 out of the 124 interns (48.3%) had heard about the recent changes in RNTCP. The Internet (25.8%), textbooks (23.4%), and classroom lecture (19.4%) were the most common source of recent information regarding TB and RNTCP during the pretest survey. Table 1 shows the recent source of information on TB and RNTCP by the interns.

Among the questions relating to general facts on TB and RNTCP, 92.7% of the interns knew the full form of RNTCP during the pretest, which improved to 100% following the intervention. Only 15.3% answered correctly during the baseline survey about the natural history of TB regarding the proportion of individuals developing active and latent TB following exposure to TB bacilli. This proportion increased to 23.4% during the posttest [Table 2].

Only 16.9% of the respondents correctly answered during the pretest that a patient is a clinical suspect for pulmonary TB if he/she presents with chronic cough for >2 weeks with or without sputum production. This proportion increased to 21% during the posttest. Two sputum samples i.e., spot and next day early morning sample, should be taken from TB suspect patients was known to 71.7% of interns which improved to 82.2% during the post test. Nearly 67.7% and 37.1% of the interns answered correctly the diagnostic definition of multidrug-resistant (MDR) and extensively drug-resistant (XDR) TB, respectively, in the pretest, and this proportion increased to 75.8% and 39.5% in the posttest, respectively [Table 3].

Table 1: Source of information on tuberculosis and Revised National Tuberculosis Control Programme among the study participants during the pretest survey (*n*=124)

Source of information	Frequency (%)
The Internet	32 (25.8)
Textbook	29 (23.4)
Classroom lecture	24 (19.4)
WhatsApp message	11 (8.9)
Guest lecture	10 (8.1)
Newspaper	9 (7.3)
Journal	9 (7.3)

About 50% of the interns correctly answered the treatment regimen and drugs used in the intensive phase for newly diagnosed pulmonary TB cases; during post intervention, 56.5% of the interns answered it correctly. Only 14.5% knew that all anti-TB drugs are safe after the first trimester, which increased to 17.7% during the posttest [Table 4].

Knowledge on the role of bacillus Calmette–Guérin vaccine was known to 36.6% of the interns, which increased to 41.1% during posttest. Almost 55.6% of the interns had ever heard about isoniazid prophylactic therapy (IPT) during pretest, which was 68.5% post intervention [Table 5].

Nearly 91.9% and 83.9% of the interns were aware that TB notification is mandatory and that it should be notified to the district nodal TB officer, respectively, and during posttest, the awareness increased to 94.4% and 87.1%, respectively [Table 6].

The minimum and maximum scores obtained in the pretest were 5 and 22, respectively, while that of posttest were 15 and 24, respectively. The mean score obtained by the interns during pre- and posttest is summarized in Table 7. The means were compared using Wilcoxon signed rank test ($Z = -9.75$, $P < 0.05$), which was found to be statistically different [Table 7].

Discussion

The TB control program in India has undergone several changes since it was started in 1962. These revised guidelines are usually available at the government websites by the Central TB division under the MoHFW. Physicians working at public health sector may have direct information regarding this, but private practitioners working in small clinics and dispensaries getting to know these new guidelines is questionable. Moreover, a study by Srivastava *et al*.[10] found that government practitioners were more knowledgeable on TB and its management as per the RNTCP when compared to private practitioners. Therefore, there is a need to identify alternate methods of dissemination of such information. Continuing medical education (CME) is one such method used to disseminate such guidelines among physicians. The biggest pitfalls in CME are the quality of such programs and the cost factor.[17] In recent years, e-learning has become a standard teaching

Table 2: Proportion of correct responses given by the interns to questions based on general facts of tuberculosis and Revised National Tuberculosis Control Programme (*n*=124)

Question number	Questions	Pretest (%)	Posttest (%)
1.	Bacteria included in mycobacterium TB complex	38 (30.6)	52 (41.9)
2.	Natural history of TB	19 (15.3)	29 (23.4)
3.	Most common site for extrapulmonary TB	77 (62.1)	105 (84.7)
4.	Appearance of TB bacilli under fluorescence microscopy	33 (26.6)	66 (53.2)
5.	Full form of RNTCP	115 (92.7)	124 (100)
6.	Full form of DOTS	96 (77.4)	123 (99.2)
7.	Aware that diagnosis and treatment is free of cost under RNTCP	107 (86.3)	108 (87.1)

RNTCP=Revised National Tuberculosis Control Programme, TB=Tuberculosis, DOTS=Directly observed treatment-short

Table 3: Proportion of correct responses given by the interns to questions based on the diagnosis of tuberculosis under the Revised National Tuberculosis Control Programme (*n*=124)

Question number	Questions	Pretest (%)	Posttest (%)
1	Diagnose clinical suspects of pulmonary TB based on duration and type of cough	21 (16.9)	26 (21)
2	Number of sputum samples to be collected	89 (71.7)	102 (82.2)
3	Confirmatory diagnostic tests to start TB treatment	56 (45.2)	57 (46.0)
4	Diagnostic definition of MDR-TB	84 (67.7)	94 (75.8)
5	Diagnostic definition of XDR-TB	46 (37.1)	49 (39.5)
6	RNTCP recommendation on chest X-ray findings	31 (25.0)	38 (30.6)

RNTCP=Revised National Tuberculosis Control Programme, TB=Tuberculosis, MDR=Multidrug resistant, XDR=Extensively drug resistant

Table 4: Proportion of correct responses given by the interns to questions based on treatment, monitoring, and follow-up of tuberculosis under Revised National Tuberculosis Control Programme (*n*=124)

Question number	Questions	Pretest (%)	Posttest (%)
1	Treatment regimen for pulmonary TB under RNTCP (daily)	62 (50)	70 (56.5)
2	Drugs given during intensive phase for newly diagnosed pulmonary TB cases	61 (49.2)	72 (58.0)
3	Anti-TB drug safe in liver disease patients	50 (40.3)	60 (48.4)
4	When to start antiretroviral treatment for HIV-positive TB cases	28 (22.6)	43 (34.7)
5	Anti-TB drug safe after the 1st trimester of pregnancy	18 (14.5)	22 (17.7)
6	Drugs recently approved for treating MDR-TB cases under RNTCP	18 (14.5)	24 (19.4)
7	Purpose of 99 DOTS	36 (29.0)	53 (42.7)
8	Duration and method of follow-up for TB treatment-completed cases	22 (17.7)	28 (22.6)

RNTCP=Revised National Tuberculosis Control Programme, TB=Tuberculosis, DOTS=Directly observed treatment-short, MDR=Multidrug resistant

Table 5: Proportion of correct responses given by the interns to questions based on the prevention of tuberculosis under the Revised National Tuberculosis Control Programme (*n*=124)

Question number	Questions	Pretest (%)	Posttest (%)
1	BCG vaccine protects from childhood meningitis and miliary TB	45 (36.3)	51 (41.1)
2	Ever heard about IPT	69 (55.6)	85 (68.5)
3	To whom IPT is administered	20 (16.1)	44 (35.4)
4	Duration of IPT	70 (56.5)	85 (68.5)
5	Better seating arrangement (from two pictorial representations) of doctors and patients in OPD to avoid air-borne infection	43 (34.7)	50 (40.3)

IPT=Isoniazid preventive therapy, TB=Tuberculosis, OPD=Outpatient department, BCG=Bacillus Calmette-Guérin

Table 6: Proportion of correct responses given by the interns to questions based on the notification of tuberculosis under the Revised National Tuberculosis Control Programme (*n*=124)

Question number	Questions	Pretest (%)	Posttest (%)
1	Aware that TB notification is mandatory	114 (91.9)	117 (94.4)
2	Know at least two methods of TB notification	12 (9.7)	63 (50.8)
3	Aware that incentive is provided to private practitioners by government for notifying TB cases	54 (43.5)	76 (61.3)
4	District nodal TB officer is the authority for notifying TB cases	104 (83.9)	108 (87.1)

TB=Tuberculosis

approach in medical education.[18] Keeping this in view, our study was conducted to evaluate the use of an e-learning tool "WhatsApp" as a self-learning technique to improve the knowledge.

Table 7: Comparison of pre- and posttest scores among the study participants (*n*=124)

Summarizing indices for thirty questions	Pretest	Posttest	*Z**	*P*
Mean±SD score	12.9±3.08	15.3±2.62	−9.75	0.000
Median score (IQR)	13(4)	15(3)		

*Wilcoxon signed rank test. SD=Standard deviation. IQR=Interquartile range

A study by Abdurehiman *et al*.[4] among interns stated that Internet (>50%) was the most common source of information on RNTCP followed by journals (25%). Even in our study, Internet was the most preferred source. The Internet is a very good source to acquire information on new guidelines of various national health programs, but the only issue is that individuals should know the correct website, i.e., Government of India-authorized sites, and must take conscious effort to keep updating themselves.

In a similar study done in West Bengal,[19] 95% of the interns knew the acronym for RNTCP and DOTS. In our study, about 93% of the respondents could answer the expansion of RNTCP, but only 77% got the acronym of DOTS correctly during the pretest, which improved drastically in the posttest. In a study done in Nagpur,[20] only 36% of the respondents knew the full form of RNTCP, which could be probably because the study was done among all types of private practitioners including ayurvedic and homeopathy doctors. A study by Chavan *et al*.[6] in South India revealed that the general level of awareness on TB and RNTCP was satisfactory, but there is a gross inadequacy of knowledge on the DOTS guidelines. The study also stated the need for suitable training program for health-care providers. Our study has made an attempt in this regard by providing SDL modules on the recent guidelines to the interns through an e-learning tool "WhatsApp."

Our study shows that only 16.9% of the respondents correctly identified a clinical suspect for pulmonary TB based on chronic cough for >2 weeks that could be either productive or nonproductive. While in a study by Basu and Das[19] among interns, 65% correctly answered that cough for >2 weeks is the most common symptom for pulmonary TB. This huge difference in knowledge could be due to the fact that, the question was open ended in that study, while in ours, it was a multiple-choice question with four very similar options.

In previous studies[8,19] published during 2012, only around 50% of the interns knew that two sputum samples had to be collected for the diagnosis of pulmonary TB under RNTCP. However, in another study[4] as well as our study, >70% answered it correctly. This difference could be due to the fact that over the years most of the community medicine textbooks got updated on the changes in RNTCP from three to two sputum samples.

The definition of MDR and XDR TB was answered correctly by 67.7% and 37.1% of the interns, respectively, in our study. Similar finding was obtained in a study done among undergraduates in Chennai,[21] but in a study by Abdurehiman *et al*.,[4] knowledge in this regard was unsatisfactory (16.2% and 2.7%, respectively).

Anti-TB drugs contraindicated in liver disease were known to 40.3% of the interns in our study. This proportion was around 60% in other studies.[4,19] Basu and Das[19] and Giri and Phalke[22] reported that 50% and 69.7% of the interns correctly knew that streptomycin is contraindicated during pregnancy. However, in our study, we found a very poor percentage of 14.5; this could be explained by the fact that our multiple-choice question framed was, "which drugs are safe after the first trimester of pregnancy," for which all the drugs are safe.

There has been a great emphasis on detecting and treating TB with HIV co-infection at the national level. In a study by Abdurehiman *et al*.,[4] 51% of the interns knew that HIV screening is mandatory for all TB patients. Raghavendra *et al*.[5] in their study among interns had asked an open-ended question as to "why TB diagnosis is difficult among HIV-positive individuals," for which only 2.4% of the interns correctly answered the following four reasons: (1) high chance of sputum negativity, (2) negative tuberculin test, (3) chest X-ray less useful, and (4) more cases of extrapulmonary TB with co-infection. In our study, only 22.6% of the interns knew that antiretroviral therapy should be started for HIV patients, irrespective of their CD4 count. 99 DOTS was launched in India to track the adherence of TB/HIV co-infected patients.[23] Around 29% of the interns knew the purpose of 99 DOTS, but other studies have not evaluated this aspect.

As per the previous RNTCP guidelines, after treatment completion, only laboratory follow-up was done at 6 or 8 months. Recent guidelines recommend both clinical and laboratory follow-up for up to 2 years.[24] In our study, only 17.7% of the interns knew this recent change. Most of the other studies done among medical interns have not assessed the knowledge on follow-up except the study by Abdurehiman *et al*.,[4] in which 27% of the interns answered that sputum smear examination is done during follow-up.

Knowledge regarding IPT has been consistently poor in several studies. In a study by Raghavendra *et al*.,[5] only 3.61% of the respondents knew the correct drug and its duration of therapy. Basu and Das[19] and Giri and Phalke[22] in their studies found that 53.8% and 32.5% of the undergraduates knew that IPT is given to children below 6 years of age in contact with smear-positive pulmonary TB cases.

TB has been declared as a notifiable disease by the Government of India since 2012.[25] In 2018, the Gazette of India published that failing to report TB cases to the nodal officer is a punishable offence with fine or imprisonment or both under Sections 269 and 270 of the Indian Penal Code.[26] In our study, almost 92% of the respondents answered correctly that TB notification is mandatory. Most of the studies have not assessed the interns' awareness on TB notification except the study by Abdurehiman *et al*.,[4] where 85% of the interns knew that TB cases have to be notified to the government authority.

Previous studies[4-8] done among medical interns have concluded that the knowledge on RNTCP is inadequate similar to our study. The mean pretest score was 12.9 for a total of thirty respondents, which increased to 15.3 during the posttest, which was statistically significant ($P < 0.05$). Even though we got a statistically significant difference between the pre- and posttest scores, the mean difference of the scores was only 2.4; therefore, knowledge on RNTCP post intervention was also satisfactory only. An interventional study was done by Dyavarishetty and Patil[15] using "WhatsApp" as a teaching tool on four topics in community medicine (study designs, sampling methodology, epidemiology of TB, and diabetes). The study participants were 3rd-year MBBS students and found significant improvement in the mean scores after the "WhatsApp" intervention, in only two modules, i.e., study design and epidemiology of diabetes, with a mean score difference of 2.06 and 5.38, respectively. The response rate for the other two modules on sampling methodology and TB was very low, so the pre- and posttest analysis was not done. Bansal and Joshi[27] conducted a research among Bachelors in Education students to find their perception and attitude toward "WhatsApp" learning. Their findings indicated that students found it very interesting and useful with a willingness to use the methodology for future learning.

A comparative study to assess the effectiveness of "WhatsApp" over didactic lecture was done by Gon and Rawekar,[13] which concluded that there was no significant difference in the gain of knowledge between the two teaching techniques, but the authors stated that e-learning had more technical advantages over the conventional methods. On the other side, Gaupp *et al*.[28] in their study stated that students with a distinct set of self-regulated learning skills only will benefit maximum from the e-learning techniques.

Our study gives an insight in the usage of "Whatsapp" as a self-regulated learning tool with a positive outcome. However, there is a need to do further research on this regard with a larger sample size among different cadres of medical students to draw conclusive evidence on the usage of e-learning tools in improving medical education and to update medical professional on recent updates.

Conclusions

The present study has identified gaps in the knowledge on TB and RNTCP among medical interns as done in several other studies and also evaluated the change in the level of knowledge by providing information on the same through an e-learning tool such as "WhatsApp." The results of this study can provide baseline data needed for future studies to generate concrete evidence on whether e-learning helps individuals gain knowledge on recent management guidelines or medical updates.

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Conflicts of interest

There are no conflicts of interest.

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