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The use of information and communication technology in continuing education in tuberculosis

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ABSTRACT

Introduction: The use of information and communication technologies (ICT) tools has been impacting health care. Distance learning has been used for the continuing improvement of healthcare workers (HCWs). In this systematic review, we evaluated the use of ICT in tuberculosis (TB) continuing education.

Methods: We searched Medline and Embase for cross-sectional studies that included HCWs or students, and that reported participants' learning level.

Results: Four studies proved eligible. Three used online educational tools, and another one used CDroms and live video conferencing. All studies evaluated participants' learning level through online pre- and post-tests. The quality of the studies was high.

Conclusions: There is a paucity of studies evaluating distance learning in TB training. Continuing education of students and HCWs is essential for TB control. Accomplishing this is critical in increasing the skills and the numbers of qualified HCWs capable of meeting the health care needs of the population.

Keywords

tuberculosis; information technology; information and communication technology; distance education; health education; distance learning

INTRODUCTION

Tuberculosis (TB) is the top infectious killer worldwide. In 2018, there were an estimated 10 million new TB cases worldwide, and 1.5 million people died from TB. The essential components of TB control are early diagnosis and appropriate treatment [1]. Continuing education of healthcare workers (HCWs) is an essential strategy for the control of TB transmission, enabling early detection and appropriate treatment of TB cases [2]. In addition, the quality of the training of HCWs has an important influence on the quality of patient care [3].

The use of information and communication technology tools has substantially impacted health care. In particular, distance learning has been used for the continuing improvement of HCWs [2,3]. The globalization of distance learning provides many opportunities for developing countries to scale up TB training at a lower cost than for learning approaches in the classroom [4–6]. Considering the limited daily time available for learning,

different shift schedules, and the possibility of self-paced study, distance learning can offer effective instructional methods for continuing TB education for HCWs [2].

Therefore, in this systematic review, we evaluated the use of information and communication technology in TB continuing education.

MATERIALS AND METHODS

Search strategy

We used a multimodal search strategy focused on 2 bibliographical databases (MEDLINE and EMBASE). There were no language restrictions. The search included those databases from inception to December 2019. The search consisted of three concepts combined using the AND operator: (1) tuberculosis, (2) health information technology and (3) education. Studies that included HCWs or students, and that evaluated participants' learning level were included in the systematic review.

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Study selection

Eligibility criteria

Eligible trials met the following criteria: (1) cohort, case-control or cross-sectional design; (2) use of information technology in continuing education in TB education for HCW.

Assessment of study eligibility

Two reviewers (VKC and CPBA) trained in health research methodology screened independently and in duplicate, the titles and abstracts of all citations identified in our search. The same reviewers screened all full text articles for eligibility; disagreements were resolved by consensus, with consultation of a third investigator (DRS) when resolution could not be achieved. We measured agreement between reviewers with the kappa statistic to assess the reliability of full-text review using the guidelines proposed by Landis and Koch [7]: <0.20 as slight agreement, $0.21-0.40$ as fair agreement, $0.41-0.60$ as moderate agreement, $0.61-0.80$ as substantial agreement and >0.80 as almost perfect agreement.

Assessment of study quality

Two reviewers (VKC and CPBA) assessed risk of bias for each eligible study, independently and in duplicate, using the adapted form of the Newcastle-Ottawa

quality assessment scale (NOS) for cross-sectional studies [8,9]. The scale consists of seven items that cover three dimensions: (1) selection (4 items); (2) comparability (1 item); and (3) outcome (2 items). The total score therefore ranges from zero to ten, with higher scores indicating higher quality. A total score ≥ 7 represents high quality.

Data Extraction and Analysis

Two reviewers (VKC and DRS) extracted data from each eligible study, including demographic information (e.g. sex, age, race), methodology, and all information technology methods used in continuing education in TB. We could not perform a meta-analysis because of the heterogeneity of the data.

RESULTS

We identified 5,298 unique records, of which we retrieved 20 articles in full text; four studies, published between 2008 and 2017, proved eligible. Figure 1 shows the study selection flow diagram. Table 1 shows the description of studies. There was substantial agreement ($\kappa = 0.73$) at the titles and abstract screening stage and perfect agreement ($\kappa = 1.00$) between reviewers at the full-text review stage.

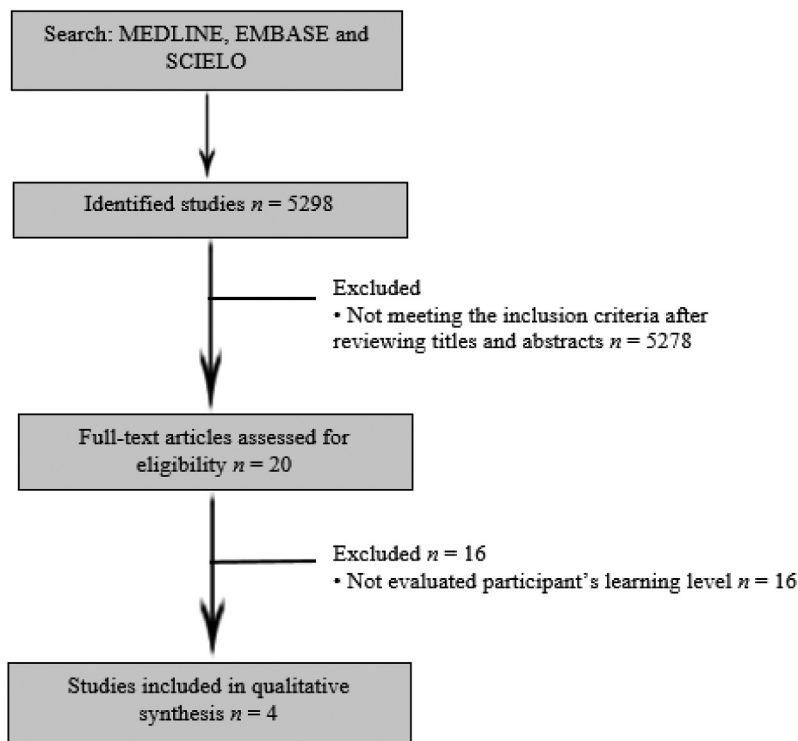


Figure 1 Flow diagram of study selection.

Table 1. Studies describing the use of information technology in continuing education in tuberculosis.

First author, reference	Year of publication	Country	Sample size	Information Technology Educational Tools	Participant's learning level evaluation	Results
Bollinger	2011	US, South Africa, India, Pakistan	235 students	6-week modular course, with 25 prerecorded lectures on CDroms and live video conference-supported activities	Online pre- and post-course knowledge assessments (pre- and post-tests)	The median correct score for the pre-test was 66%, compared to 86% for the post-test; 95% of students completing the post-test received a score >70% (cut-off for certification of competence)
Cabral	2017	Brazil	66 nurses	Distance learning course, developed within a virtual learning environment (Moodle). The content was addressed in 4 modules: TB concepts and epidemiology; development of TB; detection of TB cases; TB transmission and biosafety basics.	Quasi-experimental before and after study, with online pre- and post-tests (Moodle platform)	The overall mean pre-test and post-test scores were 10.3 ± 2.2 and 11.4 ± 2.7, respectively. Participants increased their knowledge to a statistically significant degree (p<0.0001)
Walsh	2008	England	106 primary care professionals (GPs and practice nurses)	Online, interactive case presentations on several infectious diseases topics, including TB.	Online pre- and post-tests.	The mean pre-test and post-test scores were 47 and 91, respectively. The learners increased their knowledge to a statistically significant degree (p< 0.001).
Weaver	2012	US, Uganda	72 mid-level practitioners	3-week core course, two 1-week boost sessions, distance learning, Twelve written case scenarios tested clinical competences in several infectious diseases (one in TB)	Online pre- and post-tests.	Mean score increase was 12.1 [9.6, 14.6], p< 0.001)

US: United States; TB: tuberculosis; HCW: healthcare workers; GP: general practitioner.

Table 2 - Newcastle-Ottawa scoring system for cross-sectional studies.

Study	Selection score	Comparability score	Outcome score	Total score
Bollinger	5	1	2	8
Cabral	5	1	3	9
Walsh	3	1	3	7
Weaver	5	2	3	10

All four eligible studies were in English and there were two multicentric studies and two single-center studies. One study included only students and the others, HCWs. Three studies used online educational tools, and the fourth used CDroms and live video conferencing. All studies evaluated participants' learning level through online pre- and post-tests. Overall, the quality of the studies, evaluated by the NOS checklist was high (Table 2).

DISCUSSION

In this systematic review, we found only four studies that used information and communication technology tools in continuing education in TB, and that evaluated the participants' learning level. Overall, the studies' quality was high.

Ongoing training and education are important for HCWs so they can develop and enhance skills for case management and improve clinical outcomes. Increasing TB awareness is effective for TB control and may arise as a result of continuing education. This continuing education, when done through distance learning, has the benefit of convenience and accessibility of training for those HCWs who do not work in or live near traditional training centers and universities. In addition, distance learning courses can be developed with fewer funds, teachers, and infrastructure – important issues in places with limited resources [4–6].

Among the studies included in this systematic review, diverse information and communication technology tools were used. Cabral et al. [2] developed a distance learning course within a virtual learning environment (Moodle); the content was addressed in 4 modules: TB concepts and epidemiology; development of TB; detection of TB cases; TB transmission, and biosafety basics. Online, interactive case presentations on several infectious diseases topics, including TB, was the method used in another study [11]. Weaver et al [12] conducted a 3-week core course, followed over a 24-week period by two 1-week booster courses and distance learning; twelve written case scenarios tested clinical competences in several infectious diseases (one in TB). In another study [13], the authors used a 6-week modular course, with 25 prerecorded lectures and live video conference-supported activities. The authors elaborated eight tutorials including

subjects like epidemiology and transmission of TB, prophylaxis, diagnostic methods, and pulmonary vs extra-pulmonary TB.

All studies evaluated the participants' learning level, and used online pre- and post-tests [10–13]. Three studies [10–12] showed that participants increased their knowledge to a statistically significant degree, comparing pre- and post-tests results. Bollinger et al. [13] demonstrated that the median correct score for the pre-tests was 66%, compared to 86% for the post-tests, and 95% of students completing the post-test received a score > 70% (cut-off for certification of competence).

This review has some limitations. First, due to the heterogeneity of the studies (different topics covered, different questions in the tests), we could not perform a meta-analysis. Second, the studies included in the review had no control group, so we cannot presume that the changes in the participants' knowledge were attributable only to the courses. Third, the studies only evaluated the quality of TB training at the participant level, and did not assess the impact of training on job behavior. Nevertheless, our review has a number of strengths. Our search had no language restrictions, and literature screening and data extraction were performed independently and in duplicate by two reviewers using pretested, standardized extraction forms.

In conclusion, while several studies [4–6] have found distance learning to be an effective way to train HCWs, there is a paucity of studies evaluating this in the TB training. Continuing education of HCWs is an essential strategy for the TB control. Accomplishing this is critical in increasing the skills and the numbers of qualified HCWs capable of meeting the health care needs of the population, especially in areas with high TB burden.

Declaration of interest

the authors declare they have no conflicts of interest to disclose.

REFERENCES

1. World Health Organization. Global Tuberculosis Report. [Internet]. 2019; Available from: www.who.int.

2. Cook DA, Dupras DM. Flexible teaching for inflexible schedules: An online resident curriculum in acute ambulatory care. *Med Teach*. 2003;25(3):330–331.
3. Zucker S, White JA, Fabri PJ, et al. Instructional intranets in graduate medical education [Internet]. *Acad Med*. [cited 2020 Apr 8];73(10):1072–1075. Available from. 1998; <http://www.ncbi.nlm.nih.gov/pubmed/9795625>
4. Awofeso N, Schelokova I, Dalhatu A. Training of front-line health workers for tuberculosis control: Lessons from Nigeria and Kyrgyzstan. *Human Resources for Health Training of front-line health workers for tuberculosis control: Lessons from Nigeria and Kyrgyzstan*. Human Resources for Health. [cited 2020 Apr 8]; Available from. 2008. <http://www.human-resources-health.com/content/6/1/20>
5. Curran VR, Fleet L. A review of evaluation outcomes of web-based continuing medical education. *Med Educ*. 2005;39(6):561–567.
6. Pandza H, Masic I. Distance Learning Perspectives. *Acta Inform Medica*. 2010;18(4):229. DOI:10.5455/aim.2010.18.229-232
7. Landis JR, Koch GG The Measurement of Observer Agreement for Categorical Data. 1977.
8. Amedeo Modesti P, Reboldi G, Cappuccio FP, et al. Panethnic Differences in Blood Pressure in Europe: A Systematic Review and Meta-Analysis Working Group on CV Risk in Low Resource Settings. 2016
9. Herzog R, Álvarez Pasquin MJ, Díaz C, et al. Are healthcare workers' intentions to vaccinate related to their knowledge, beliefs and attitudes? a systematic review. *BMC Public Health*. 2013;13(1). DOI:10.1186/1471-2458-13-154
10. Cabral VK, Valentini DF, Vinícius M, et al. Distance Learning Course for Healthcare Professionals: Continuing Education in Tuberculosis.
11. Walsh K. Online educational tools to improve the knowledge of primary care professionals in infectious diseases. 2008;21(1):1–4. *Educ Heal Chang Learn Pract*.
12. Weaver MR, Crozier I, Eleku S, et al. Capacity-building and clinical competence in infectious disease in Uganda: a mixed-design study with pre/post and cluster-randomized trial components. *PLoS One*. 2012;7(12):e51319. DOI:10.1371/journal.pone.0051319.
13. Bollinger RC, McKenzie-White J, Gupta A. Building a Global Health Education Network for Clinical Care and Research. The Benefits and Challenges of Distance Learning Tools. Lessons Learned from the Hopkins Center for Clinical Global Health Education. *Infect Dis Clin North Am*. 2011;25(2):385–398.