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Original Research Article

Outcome of focused training on tuberculosis and air-borne infection control for third-year undergraduate medical students

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ABSTRACT

Background: Though health care personnel are at particularly high risk of contracting air-borne infections, including tuberculosis, the current undergraduate health science curriculum does not have a course devoted to training on airborne infection control and universal biosafety precautions in the pre-clinical stage.
Methods: This before-and-after type of educational interventional study (without controls) was conducted on third-year medical students (n=55) in state of Maharashtra, Western India. After completing curriculum-based traditional didactic lectures on tuberculosis and air-borne infection control, a pre-test was conducted. After focused training on tuberculosis and air-borne infection control the post-test was administered. The outcome studied was the difference in cognitive domain scores after attending traditional didactic lectures (by a pre-test) and focused training (by a post-test).
Results: The differences between correct responses in pre-and post-tests were statistically significant in 12 out of 15 questions with an overall increase in median correct responses in the post-test with increase in minimum and first quartile.
Conclusions: The study results reflect the superiority of focused training using videos and practical demonstration over traditional didactic lectures. This study highlights the focus areas in teaching infection control measures and the importance of focused training in the curriculum for undergraduate medical students. It is necessary to review the curriculum so that knowledge on infection prevention and control is imparted during the pre-clinical first year before medical students enter clinical settings.

Keywords: Air-borne infection control, Tuberculosis, Training

INTRODUCTION

Exposure of human beings to different airborne pathogens has resulted in the emergence of epidemics of respiratory infections.[1] Most of the microorganisms released from infectious patients can disperse in a wide geographical area by air currents and finally can be inhaled by susceptible individuals who have had no direct contact with the primary source.[2] This airborne transmission becomes even more prevalent in healthcare settings because of overburdened hospitals and the presence of immuno-suppressed patients.[3] The median annual incidence of occupationally-acquired tuberculosis has been reported to be consistently higher than tuberculosis incidence in the general population and was linked to degree of tuberculosis exposure and the presence or absence of airborne infection control.[4,5]

This airborne transmission becomes even more prevalent in health-care settings because of overburdened and overcrowded hospitals and the presence of patients with immuno-suppression.[6] Transmission of tuberculosis in

health-care settings can be decreased by triaging, physically separating patients with (or suspected to have) tuberculosis, teaching cough etiquette and respiratory hygiene, and minimizing the time spent in health-care facilities.[7]

In many countries, the current undergraduate health science curriculum does not have a course devoted to training on infection control and universal biosafety precautions in the pre-clinical stage; this information is spread out during TDLs in the microbiology and community medicine courses during the clinical stage. The objective of this study was to determine the differences in cognitive domain scores pertaining to air-borne infection control after attending traditional didactic lectures (by a pre-test) and focused training (by a post-test) so that improved educational modules could be developed in the long term.

METHODS

This before-and-after type of educational interventional study (without controls) was conducted in 2016 in a municipal medical college in Kalwa, Thane, located about 30 kilometres from Mumbai city in the state of Maharashtra in Western India. After getting permissions from the Institutional Ethics Committee (IEC) and other institutional authorities, the objectives of the study were explained to third-year students enrolled for the Bachelor of Medicine, Bachelor of Surgery (MBBS) course. Written informed consent was obtained from willing participants. After completing curriculum-based traditional didactic lectures (TDLs) on tuberculosis and air-borne infection control, a pre-test was conducted. The pre-test comprised 15 multiple choice questions with one mark for each correct answer and zero mark for each incorrect answer. Focused training on tuberculosis and air-borne infection control was conducted using videos and practical demonstrations. The post-test, which was identical to the pre-test, was administered after focused training. The outcome studied was the difference in cognitive domain scores after attending TDLs (by a pre-test) and focused training (by a post-test).

The pre-test and post-test scores were tabulated in MS Excel spreadsheet (Microsoft Corporation, Redmond, Washington, USA). EpiInfo Version 7.2 (public domain software from Centers for Disease Control and Prevention, Atlanta, Georgia, USA) was used to calculate Karl Pearson's Chi square test (with Yates' correction, where applicable), odds ratio (OR) and relative deviate (Z). Statistical significance was taken as p-value<0.05.

RESULTS

All the 55 third-year MBBS students who participated in the study attended TDLs and focused training and took the pre- and post-tests. The scores of the respondents differed in various questions as per the topic and areas of airborne infection prevention and control. The differences between correct responses in pre-and post-tests were statistically significant in 12 out of 15 questions. The difference was not statistically significant for questions pertaining to preventing transmission, building design and role of health staff due to high level of correct responses in the pre-test (Table 1).

Table 1: Analysis of responses in pre-and post-tests.

Topics	Pre-test (n=55)		Post-test (n=55)		Chi^2 value#	p value	Odds Ratio
	No.	Percent	No.	Percent			
Bacteriology	24	43.64	43	78.18	13.78	0.0002 *	0.216
Cough etiquette	36	65.45	50	90.91	9.01	0.002 *	0.189
Sample collection risks	35	63.64	50	90.91	10.15	0.001 *	0.175
Intensified case finding	28	50.91	46	83.64	13.37	0.0002 *	0.20
Preventing transmission	49	89.09	52	94.55	0.484	0.487	0.471
Building design	47	85.45	48	87.27	0.077	0.781	0.857
ABI control measures	7	12.73	42	76.36	45.08	0 *	0.045
Role of health staff	39	70.91	45	81.82	1.81	0.178	0.541
Role of surgical mask	7	12.73	39	70.91	38.26	0 *	0.06
Indication for surgical mask	41	74.55	54	98.18	11.12	0.0008 *	0.054
Indication for N95 mask	37	67.27	48	87.27	6.26	0.01 *	0.299
Ventilation	31	56.36	47	85.45	11.28	0.0007 *	0.22
Air changes per hour	30	54.55	48	87.27	14.28	0.0002 *	0.175
Air conditioning	23	41.82	54	98.18	38.96	0 *	0.013
ABI risk assessment	8	14.55	40	72.73	37.85	0 *	0.064

* Statistically significant ; # Karl Pearson's Chi square test with Yates' correction where applicable; ABI = Air-borne infection.

The box plot (Figure 1) shows significant (Z= 16.96; p<0.00001) increase in median correct responses in the post-test with increase in minimum and first quartile.

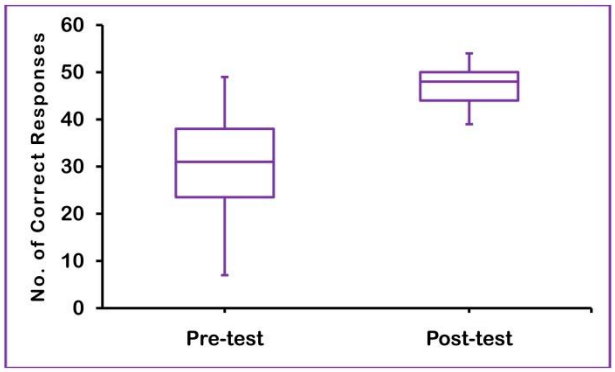

Figure 1: Box plot of correct responses in pre- and post-tests.

DISCUSSION

The statistically significant differences between correct responses in pre-and post-tests in 12 out of 15 questions (Table 1) and the drastic increase in median and minimum correct responses and the first quartile (Q1) in the post-test (Figure 1) indicates the advantage of focused training in improving cognitive domain scores because a basic level of competency is expected from every medical student.

Similar results have been obtained by Parashar et al, who assessed the impact of training on the awareness of medical students in Shimla, Himachal Pradesh for handling H1N1 influenza cases and reported increase in post-training mean score to 8.7 from the pre-training level of 6.3.[8] Improvement in post-intervention knowledge (78%) from pre-intervention level (58%) has been reported by a study from Cape Town, South Africa.[9]

A cross-sectional survey on standard precautions and infection control, conducted on 251 medical students in Saudi Arabia reported low knowledge scores in all domains.[10] A survey on 1486 undergraduates from two medical universities in Southwest China reported that only 27.9% respondents were aware that tuberculosis could be transmitted through exposure to droplet nuclei from the cough of an infected person.[11] A Bhopal-based study on 245 dental students has reported deficiency in comprehension of fundamentals of infection control and the prevention of transmission of communicable infectious diseases.[12] Exposure of health science students to clinical settings increases risk of acquiring infections. In developing countries, the risk of acquiring occupationally transmitted infections is high for medical students.[13] For this reason, a comprehensive infection control curriculum ought to be introduced in the pre-clinical year of the MBBS course. Subsequently, infection control training can be reinforced more effectively when the students attend their clinical postings.[14]

The limitations of the study were that the results cannot be generalised because cognitive domain scores may vary across batches of students even in the same institution.

CONCLUSION

The statistically significant differences in correct responses in pre-and post-tests reflect the superiority of focused training using videos and practical demonstration over TDLs. In addition, the odds of correct response increased substantially in students after the intervention, which will be actually applied in practice by the future physicians. Airborne infection control is vital in preventing a gamut of life-threatening diseases and this study highlights the focus areas in teaching infection control measures and the importance of focused training in the curriculum for undergraduate medical students. It is necessary to review the curriculum so that knowledge on infection prevention and control is imparted during the pre-clinical first year before medical students enter clinical settings.

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