

Original article

**Really patient education influences the sputum protocol among gender for the diagnosis of pulmonary tuberculosis?**

T.Jaya Chandra

Department of Microbiology, GSL Medical College, Rajahmundry, Andhra Pradesh, South India;

Corresponding author: Dr. T.Jaya Chandra, Associate Professor, Department of Microbiology, GSL Medical College, Rajahmundry, Andhra Pradesh, South India. Mobile: 9490646100. E-mail address: chanduthegreat2014@gmail.com

---

**Abstract**

**Aim:** Patients have to submit good sputum for ideal microscopy results for the diagnosis of pulmonary tuberculosis (TB). This study was to find the importance of patient education for collection of good quality sputum.

**Methods:** Study was conducted in the department of Microbiology, GSL Medical College. Participants were given a choice to enroll either in test or control group. For the control group, sputum protocol was explained and demonstrated practically and for test group, information was given on a paper in local language. Immediately after collection, smears were prepared and stained by fluorescent staining technique. Smear results were pooled and compared in two categories: spot morning, and same-day smears. Chi-square test was used to find the statistical significance and *P* value of less than 0.05 was considered statistically significant.

**Results:** More number (28%) of women satisfied the sputum protocol and more (11.4%) smear positive cases were identified among men.

**Conclusions:** Patient education influence sputum protocol among gender and thorough patient education with practical demonstration is required for collection of good quality sputum. Additional efforts are needed especially on men.

**Keywords:** Sputum, Tuberculosis.

---

**Introduction**

Majority of *Mycobacterium tuberculosis* infections are pulmonary tuberculosis (TB) and India has the highest TB burden among other countries in the world.<sup>1</sup> As per the revised national tuberculosis control programme (RNTCP) guidelines, sputum microscopy results are the basis for diagnosis and treatment of pulmonary TB.<sup>2</sup> Sputum microscopy is a simple, rapid, and economical technique. Various microscopy techniques such as Ziehl Neelsen (ZN) staining,<sup>1</sup> modified ZN staining,<sup>3</sup> fluorescent staining (FS)<sup>4</sup> and so on are available for the diagnosis of pulmonary TB. The World Health Organization (WHO) technical advisory group for TB recommended fluorescent microscopy using light emitting diode as an alternative for conventional ZN microscopy.<sup>5</sup>

A minimum of 10,000 bacilli/mL of sputum are required to identify smear positive TB.<sup>6</sup> Hence the quality of sputum is an important factor that can influence the smear microscopy results. So patients have to submit good sputum to get ideal microscopy results. Gender influence on sputum microscopy results was reported<sup>7</sup>. With these, a study was undertaken to find the influence of patient education on gender for collection of good quality sputum.

**Materials and Methods**

The study was conducted in the department of Microbiology, GSL Medical College from January 2013 to December 2013. Study protocol was approved by the Institutional Ethics and Research Committee. An informed written consent in the

presence of witness was taken from all the volunteers.

The participants were given a choice to enroll either in test or control group. For the control group participants, sputum protocol that is the importance of submission of good quality sputum was explained; the difference between sputum and saliva, how to produce good quality and required quantity sputum were explained and demonstrated practically. For the participants in the test group, sputum protocol was provided on paper in local language and they were asked to read the information thoroughly. Both the groups were provided with marked sample containers to submit 5 mL sputum. All the individuals were requested to provide three sputum samples: a spot sample at the first visit to the hospital, a second spot sample collected 1 h after the spot sample, and a morning sample collected after waking early in the morning. After providing two spot samples, the patients were given prelabelled sample containers to collect the morning sample at home. Immediately after collection of sputum, one smear was prepared and stained by FS technique as per RNTCP guidelines.<sup>8</sup> Smear results were pooled and compared in two

categories: spot morning, and same-day approaches.

#### Data analysis:

The data were analyzed by SPSS version 18.0 (SPSS Inc., Chicago, IL) by taking patient as the unit of analysis. Chi-square test was used to find the statistical significance. A *P* value of less than 0.05 was considered statistically significant.

#### Results

Among the 716 study participants, 53.6% (384) were enrolled in the control group and 46.4% (332) were in the test group; the male female ratio was 1.54. More number of women satisfied sputum protocol and more number of men didn't satisfy the sputum protocol; statistically the difference was not significant between the gender and groups in satisfactory category and statistical significance was observed in not satisfactory category (Table 1). In test and control groups, more number of men were diagnosed as smear positive TB in spot morning and same day approaches; statistically the difference was not significant in both the approaches respectively between the groups and gender (Table 2).

	Satisfactory		Not satisfactory		Total
	Male	Female	Male	Female	
Control	128 (17.9)	129 (18)	105 (14.7)	22 (3)	384 (53.6)
Test	59 (8.2)	71 (9.9)	142 (19.8)	60 (8.4)	332 (46.4)
Total	187 (26.1)	200 (28)	247 (34.5)	82 (11.5)	716 (100)
	387 (54)		329 (46)		
Statistical analysis	P = 0.411088; Not significant at <i>P</i> < 0.05		P = 0.011496; Significant at <i>P</i> < 0.05		

	Spot morning approach; n (%)		Same day approach; n (%)	
	Male	Female	Male	Female
Control; n = 384	44 (11.4)	34 (8.9)	38 (9.9)	34 (8.9)
Test; n = 332	32 (9.6)	26 (7.8)	26 (7.8)	24 (7.2)
Statistical analysis	P = 0.88567; Not significant at $P < 0.05$		P = 0.932577; Not significant at $P < 0.05$	

### Discussion

Due to the advantages such as rapidity and low cost, WHO and various national tuberculosis control programmes insist on sputum microscopy for the diagnosis of pulmonary TB<sup>1,4</sup>. In addition to the sputum quality, factors such as type of sputum that is spot or morning,<sup>9</sup> quantity,<sup>10</sup> staining technique used,<sup>3</sup> gender difference,<sup>11</sup> number of samples,<sup>12</sup> and so on influence the sputum microscopy results. Among these factors except the sputum quality the remaining are technical issues. Because if the patients did not submit good quality sputum, due to low bacillary load, they may be diagnosed as smear negative for acid fast bacilli, this may be a false negative report. Hence thorough patient education is mandatory for collecting good quality sputum.

In the field conditions, laboratory technicians play an important role in patient education for collection of sputum. This study was purely for research purpose, conducted in tertiary health care setup where the resources in the form of man power are not issues. So the researcher spent more time on patient education for collection of good quality sputum. With these efforts, in control group, very few women (3%) didn't satisfy sputum

protocol and the ratio between the satisfactory and not satisfactory category was 5.86; among men, 105 (14.7%) participants didn't satisfy sputum protocol and the ratio was 1.22 (Table 1); statistically the difference was significant ( $P < 0.05$ ). In test group, the ratio between the satisfactory and not satisfactory category was 1.18, 0.41 respectively for women and men (Table 1); statistically the difference was significant ( $P < 0.05$ ). It was reported that most women were not aware that sputum is to be submitted for the diagnosis of pulmonary TB rather than saliva<sup>13</sup>. Uplekar et al. mentioned that cultural knowledge about TB diagnosis in low and middle income countries might affect the quality of sputum submitted by women<sup>14</sup>. As per this study results, with proper instructions women also submitted good quality sputum for the diagnosis of pulmonary TB. In this study, significant number (46%) of participants didn't satisfy the sputum protocol (Table 1). When the researcher questioned on sputum protocol issue, most of the men answered that importance was given for sputum submission only but not for sputum quality. This is the interesting feature in this study.

Warren et al. reported that >5 mL of sputum increases the smear microscopy sensitivity.<sup>10</sup> Alijahbana et al. reported that smear positivity was improved two times after introducing large sample containers and instructions resulted in 15% higher case detection rate.<sup>15</sup> In this study, when sputum quantity was only considered, more number of male participants failed to submit the required quantity sputum in both groups; the male female ratio was 3.6, 5.64, respectively for control and test groups (data not showed).

The smear positivity was reported to be more among the men in the groups as well as in spot morning and same day approach (Table 2). But more number of women satisfied sputum protocol hence the smear positivity was supposed to be more. Due to the immune pathology as seen among HIV patients<sup>16</sup> there will be low bacillary

load in sputum among the female. Moreover, TB is prevalent among men. Due to these reasons more number of women were less likely to be diagnosed as smear positive TB. With this, we conclude that patient education influence sputum protocol among the gender and thorough patient education with practical demonstration is required for collection of good quality sputum. Additional efforts are needed especially on men.

**Conclusions:** Patient education influence sputum protocol among gender and thorough patient education with practical demonstration is required for collection of good quality sputum. Additional efforts are needed especially on men.

**Acknowledgements:** This paper was presented in the 73<sup>rd</sup> National Tuberculosis and Chest Diseases (NATCON) conference, held in Nagpur on 05, 06 Jan 2019.

#### References:

1. Chandra TJ. Same day sputum smear microscopy approach for the diagnosis of pulmonary tuberculosis in a microscopy center at Rajahmundry. *Ind J Tuberc* 2012; 59: 141 – 144.
2. RNTCP Case finding and diagnosis strategy. <https://tbcindia.gov.in/showfile.php?lid=3216>. Accessed May 2018.
3. Chandra TJ, Raj RS, Sharma YV. Same day sputum smear microscopy approach with modified ZN staining for the diagnosis of pulmonary tuberculosis in a microscopy centre at Rajahmundry. *Ind J Med Microbiol* 2014; 32: 153 – 156.
4. Chandra TJ, Raj RS, Sharma YV. Same day sputum smear microscopy for the diagnosis of pulmonary tuberculosis: Direct versus concentrated sputum smear. *Int J Tuberc Lung Dis* 2016; 20: 247 – 251.
5. International Union against Tuberculosis and Lung Disease Technical guide 2000. Sputum examination for tuberculosis by direct microscopy in low income countries. Paris; International Union against Tuberculosis and Lung Disease.
6. David HL. Bacteriology of mycobacterioses. Centre for Disease Control, Atlanta & US Public Health Service, PHS, HEW, Superintendent of Documents, US Govt Printing Office, Washington DC 1976.
7. Yap Boum 2<sup>nd</sup>, Atwine D, Oririkiza P, Assimwe J, Page AL, Mwanga-Amumpaire J, Bonnet M. Male Gender is independently associated with pulmonary tuberculosis among sputum and non-sputum producers people with presumptive tuberculosis in Southwestern Uganda. *BMC Infect Dis* 2014; 14: 638 – 645.
8. Central TB Division, Directorate General of Health Services Ministry of Health and Family Welfare. Manual for sputum smear fluorescence microscopy. New Delhi, India: Ministry of Health and Family Welfare. <http://www.tbcindia.nic.in/showfile.php?lid=2988>. Accessed December 2017.

9. Cuevas LE, Al-Sonboli N, Lawson L, et al. A multi-country non-inferiority cluster randomized trial of frontloaded smear microscopy for the diagnosis of pulmonary tuberculosis. *PLOS MED* 2011; 8: e1000443.
10. Warren JR, Mondira B, Kleper NF, et al. A Minimum 5.0 ml of sputum improves the sensitivity of acid-fast smear for *Mycobacterium tuberculosis*. *Am J Respir Crit Care Med* 2000; 161: 1559 – 1562.
11. Khan MS, Dar O, Sismanidis C, Shah K, Faussett PG. Improvement of tuberculosis case detection and reduction of discrepancies between men and women by simple sputum submission instructions: a pragmatic randomized controlled trail. *Lancet* 2007; 369: 1955 – 1960.
12. Chandra TJ. One-sample two-smear versus two-sample two-smear approach for the diagnosis of pulmonary tuberculosis. *J Lab Physicians* 2018; 10: 135 – 139.
13. Thorson A, Hoa NP, Long NH, Allebeck P, Diwan VK. Do women with tuberculosis have a lower likelihood of getting diagnosed? Prevalence and case detection of sputum smear positive pulmonary TB, a population based study from Vietnam. *J Clin Epidemiol* 2004; 57: 398 – 402.
14. Uplekar M, Rangan S, Ogden J. Gender and tuberculosis control: towards a strategy for research and action. Geneva: World Health Organisation, 2000.
15. Alisjahbana B, van Crevel R, Danusantoso H, et al. Better patient instruction for sputum sampling can improve microscopic tuberculosis diagnosis. *Int J Tuberc Lung Dis* 2005; 9: 814 – 817.
16. Kivihya-Ndugga LE, van Cleeff MR, Githui WA, et al. A comprehensive comparison of Ziehl-Neelsen and fluorescence microscopy for the diagnosis of tuberculosis in a resource-poor urban setting. *Int J Tuberc Lung Dis* 2003; 7: 1163 – 1171.