Original Article

Active case finding of tuberculosis among household contacts of newly diagnosed tuberculosis patients: A community-based study from southern Haryana

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Abstract

Background: Active case-finding is provider-initiated and implies systematic searching for TB in individuals who would not spontaneously present to a health service, and bringing them into care for diagnosis and treatment. **Aim:** The present study was carried out with the objective to assess the yield and feasibility of active case finding strategy among household contacts of newly diagnosed pulmonary TB cases and to determine risk factors in household contact. **Methods:** This community-based study with cross-sectional design was conducted among the household contacts of all newly diagnosed microbiologically confirmed pulmonary TB patients registered at Tuberculosis Unit (TU), Nuh. Investigator conducted house to house visit and met respective index case and his/her household contacts to build the rapport. **Results:** In the present study, there were 55 sputum smear-positive index cases and 356 household contacts of index cases. The most common symptom among screening positive household contacts was cough followed by weight loss. A substantial proportion (83.8%) of symptom positive household contacts were investigated for tuberculosis and among them, 18.9% were found to be positive for tuberculosis. The overall prevalence of TB cases among household contacts was found to be 1.97%. **Conclusion:** The present study concludes that household contact screening for active case finding for TB is a feasible and efficient tool that can potentially result in earlier diagnosis and treatment of active TB, thus minimizing the severity and decreasing transmission. It can also contribute toward improving treatment outcomes, health sequelae, and the social and economic consequences of TB.

Keywords: House to house visit, Index cases, RNTCP, Tuberculosis unit

Introduction

Active tuberculosis (TB) refers to a disease which occurs in someone infected with *Mycobacterium tuberculosis*.[1] Tuberculosis contacts are people who have close contact with patients with infectious TB. These contacts should be screened actively for TB infection and disease. The risk of acquiring TB infection and disease in contacts depends on the infectiousness of the patient, duration of exposure, and proximity and susceptibility (children less than 6 years and people living with HIV) of the contact. Household contacts are at higher risk because of their close proximity to the active TB case.[2]

Active case-finding is provider-initiated and implies systematic searching for TB in individuals who would not spontaneously present to a health service, and bringing them into care for

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diagnosis and treatment. It is offered outside of health facilities, for example, through house to house visits by health workers.[1] Various studies have recommended active case finding of TB among high-risk groups including household contacts.[3-6] The yield of cases depends on the screening tool, the characteristics of the contacts being screened, and most importantly, the linkage between effective diagnostic and treatment facilities.[7]

Systematic reviews show that an average of 3.5%–5.5% of household members or other close contacts with an infectious TB case are themselves found to have previously undiagnosed, active TB, although there is considerable heterogeneity in these results.[8,9]

Active case finding among household contacts of tuberculosis patients may result in early identification of active TB cases and their effective treatment, thus decreasing its severity and transmission.[1,2] Systematic screening of household TB contacts can be an efficient, targeted approach to strengthen TB case finding that is within the purview of TB control programs.[10,11]

Studies from India, looking into yield and feasibility of household contact screening for active case detection of TB, are meagre. Results of studies from other countries cannot be generalized to the Indian setup due to differences in epidemiology and health care delivery system. Therefore, the present study was carried out with the objective to assess the yield and feasibility of active case finding strategy among household contacts of newly diagnosed microbiologically confirmed pulmonary TB cases and to determine risk factors in a household contact who acquired TB from index case.

Materials and Methods

Study area and period

The study was conducted among the household contacts of all newly diagnosed microbiologically confirmed pulmonary TB patients who were registered at Tuberculosis Unit (TU), Nuh during the period of January 2019 to June 2019. Population catered by TU, Nuh is 150,938 and about 10–12 cases of pulmonary TB are newly diagnosed at TU every month. Every TB case is having around 6–7 household contacts. Ethical approval was obtained from institutional ethical committee before commencing the study (IEC approval letter no. SHKM/IEC/2018/06, dated 29/10/2018).

Study design

This was community-based study with cross-sectional design.

Study population and sample size

Following case definitions were used in the study:

Microbiologically confirmed pulmonary TB case refers to a pulmonary TB patient with biological specimen positive for acid-fast bacilli, or positive for mycobacterium TB on culture, or positive for TB through Quality Assured Rapid Diagnostic molecular test.[12]

Index case is defined as the first microbiologically confirmed pulmonary TB case identified in the household.[6]

Household contact refers to a person who shared the same household for one or more nights or for frequent or extended periods during the day with the index case during the 3 months before initiation of the current treatment episode.[2]

Symptom screening positive contacts are defined as household contacts with one or more symptoms suggestive of TB including cough, fever, weight loss, or hemoptysis irrespective of duration.[2]

A total of 55 index cases and their 356 household contacts were included in the study and those who were not confirming to the case definitions and not willing to give written consent were excluded from the study. All persons were treated with respect, and confidentiality was maintained.

Study tool

Information, such as name, age, contact number, and address, of newly diagnosed microbiologically confirmed pulmonary TB cases (Index cases) was obtained regularly during the study period from Tuberculosis Unit (TU), Nuh. A close coordination with TU staff was ensured so that household contacts of every index case can be screened and investigated.

Investigator conducted house to house visit and met respective index case and his/her household contacts to build the rapport. After explaining the purpose and objectives of the study and answering their queries if any, a written consent was obtained from the index case as well as from household contacts (consent of parents/guardian when contacts were minor) prior to their inclusion in the study.

Data collection

Data were collected using semistructured questionnaire; first part of the questionnaire was meant for index case interview which included information regarding demography, current TB episode, prior TB episode, co-morbidities, and TB patient chart review. Second part of the questionnaire was meant for household contact interview which included information regarding demography, TB symptom screening, level of exposure to index case, and medical history such as HIV, diabetes, and malnutrition.[2]

Symptom screening positive household contacts were counselled to attend TU, Nuh so that they can be diagnosed and treated as per Revised National Tuberculosis Control Programme (RNTCP) guidelines. When required, investigator paid up to three additional house visits to counsel symptom screening positive household contacts, those who were not turning up at TU for diagnosis. Household contacts diagnosed with TB were marked positive

on their respective interview form which in turn will be used to assess the yield of active case finding.

Other household contacts were educated about the symptoms of TB and counselled to visit nearby TB diagnosis and treatment facility in case such symptoms appear.

Data analysis

The data were entered into Microsoft excel sheet 2016 and will be analyzed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp. Armonk, NY, USA). Tests were performed assuming significance level of 5%; thus, an association will be significant if the "*P* value" is less than 0.05. Categorical variables were depicted as percentage (%). The variables with quantitative data were analyzed using Student's *t*-test and odds ratio statistic.

Results

In present study, there were 55 sputum smear-positive index cases and 356 household contacts of index cases. Table 1 shows that very few (1.8%) index cases belonged to age less than 15 years, more than half of index cases were males, four-fifth of index cases were found in urban area, more than half of index cases had cough duration of more than 4 weeks, surprisingly the X-ray was not done in nearly half of index cases, and similarly, more than half of index cases were unaware of their HIV status. Out of every 10 index cases, 7 were current or past smoker; among index cases, more than one-tenth had history of default when asked for drug history of previous TB.

In Table 2, nearly half of household contacts for index cases belonged to the age group of 15–44 years; on symptom screening, positivity was observed in 12.1% household contacts of index cases.

Table 3 shows that the most common symptom among screening positive household contacts was cough followed by weight loss. A substantial proportion (83.8%) of symptom positive household contacts were investigated for tuberculosis and among them, around one-fifth (18.9%) were found to be positive for tuberculosis. Among 7 TB positive contacts, only one contact (14.3%) was having smear-negative TB and rest were having sputum smear-positive TB. The overall prevalence of TB cases among household contacts was found to be 1.97%. The TB positive contacts ($n = 7$) amount to addition of 12.7% cases over already known 55 index cases.

Table 4 shows that variables such less mean BMI, more average daily contact hours with index case, smoking, and diabetes had a statistically significant association with occurrence of TB among household contacts.

Table 1: Sociodemographic and clinical profile of sputum smear-positive index cases (*n*=55)

Variable	Categories	Number of Patients (%)
Age	0-14	01 (1.8)
	15-44	32 (58.1)
	>=45	22 (40.1)
Gender	Male	30 (54.5)
	Female	25 (45.5)
Residence	Rural	10 (18.2)
	Urban	45 (81.8)
Cough Duration	< 2 weeks	14 (25.5)
	2-4 weeks	10 (18.2)
	> 4 weeks	31 (56.3)
Sputum Grading	< 2	29 (52.7)
	>= 2	26 (47.3)
X-Ray Cavity	Present	22 (40.1)
	Absent	06 (10.9)
	Not done	27 (49.0)
HIV Status	Positive	04 (7.3)
	Negative	21 (38.2)
	Not known	30 (54.5)
Smoking	Never	16 (29.0)
	Current or Past smoker	39 (71.0)
Drug History of Previous TB	No Previous TB	38 (69.1)
	Completed	11 (20.0)
	Default	06 (10.9)

Table 2: Sociodemographic and screening positivity of household contacts of sputum smear- positive index cases (*n*=356)

Variable	Categories	Number of contacts (%)
Age	0-6	44 (12.4)
	6-14	85 (23.9)
	15-44	176 (49.4)
	>=45	51 (14.3)
Gender	Male	183 (51.4)
	Female	173 (48.6)
Residence	Rural	74 (20.2)
	Urban	282 (79.8)
Relationship with the index cases	Spouse	31 (8.7)
	Parent	31 (8.7)
	Child	108 (30.3)
	Sibling	57 (16.0)
	Grand Child	45 (12.7)
	Other Adult (> 14 years)	63 (17.7)
	Other Child (<= 14 years)	21 (5.9)
Symptom Screening	Positive	43 (12.1)
	Negative (>6 Years)	272 (74.4)
	Negative (<6 Years)	41 (11.5)

Discussion

The present study was conducted among 356 household contacts of 55 index cases and depicted that 12.1% ($n = 43$) of household contacts were having one or more symptoms suggestive of TB [Tables 1 and 2]. A substantial proportion (83.8%) of symptom positive household contacts were investigated for tuberculosis and among them, around one-fifth (18.9%, $n = 7$) were found to be TB positive denoting a prevalence of 1.97% among the household contacts of index cases. The TB positive

contacts ($n = 7$) amount to addition of 12.7% cases over already known 55 index cases. Among 7 TB positive contacts, only one contact (14.3%) was having smear-negative TB and rest were having sputum smear-positive TB [Table 3]. This study highlights that active case finding among household contacts could be used as an effective TB case detection tool. This observation is in agreement with published literature.

Table 3: Clinical profile of symptom screening positive household contacts of sputum smear-positive index cases (*n*=43)

Variable	Categories	Number of contacts (%)
Symptom (s) profile among screening positive contacts*	Cough	31 (72.0)
	Hemoptysis	09 (20.9)
	Fever	16 (37.2)
	Weight loss	23 (53.5)
	Swelling in neck, arm pit, or groin	4 (9.3)
Symptom screening positive contacts' investigation	Investigated	37 (83.8)
	Could not be investigated	6 (16.2)
Results of symptom screening positive contacts' investigation (*n*=37)	Tuberculosis positive	7 (18.9)
	Tuberculosis negative	30 (81.1)
Profile of TB positive contacts (*n*=7)	Sputum smear positive	6 (85.7)
	Sputum smear negative	1 (14.3)
	Extra pulmonary	0
Overall prevalence of TB among household contacts (7 out of 356 contacts)		1.97%
Additional yield of TB cases (*n*=7) over already known 55 index cases		12.7%

*Multiple answers

A study conducted by Gupta *et al.* in Maharashtra, India showed that 3.45% of household contacts had symptoms suggestive of TB. One-third of the symptomatic household contacts were later found to have active TB depicting a prevalence of 1.15% among the household contacts of index cases. That way, they could add 4.51% more cases to already detected index cases.[6]

Nair *et al.*[13] in a study conducted in Chennai, India showed that overall prevalence of active tuberculosis among household contacts was 5.3% and similar studies conducted in Chhattisgarh, India and eastern Ethiopia reported 9.0% and 7.8% prevalence, respectively.[14,15] The yield for active TB case finding through contact investigations ranged from 0% to 6.9% among household contacts in high burden countries.[16,17]

A meta-analysis published by Blok *et al.* from 19 projects across Asia, Africa, and Middle-East reported a pooled prevalence of 1.5% (range: 0.1–6.2%) among the contacts screened. They also concluded that background prevalence of TB and setting of project (rural/urban/mixed) result in variation of yield.[3] A source case investigation for children with TB disease in Pune, India also showed that opportunities for TB prevention and control were missed because of poor contact screening.[18]

Wide variations in prevalence of active TB among household contacts observed in aforementioned studies can be attributed to differences in study setting, infectiousness of index cases, vulnerability of contacts, living condition, and health-seeking behavior of household contacts.

Comparison of symptom screening positive and TB diagnosed contacts with symptom negative contacts [Table 4] shows that

Table 4: Comparative profile of symptom screening positive and screening negative household contacts

Variable		Symptom screening positive household contacts (*n*=43)		Symptom screening negative household contacts (*n*=313)	Odds Ratio and t-test statistic between screening positive TB diagnosed cases and screening negative contacts
		Diagnosed with TB (*n*=7)	Not having TB / Could not be investigated (*n*=36)		
Mean Age		38.3	33.4	31.9	*P*=0.54
Mean BMI		17.9	20.3	20.8	*P*=0.01*
Mean duration of symptoms (days)		27.2	11.4	0	-
Average daily contact with index case (hours)		11.4	7.1	6.7	*P* < 0.01*
Sputum grading of index cases	< 2	2 (28.6%)	21 (58.3%)	179 (57.2%)	OR=3.33 (95% CI 0.63-17.47)
	>= 2	5 (71.4%)	15 (41.7%)	134 (42.8%)	*P*=0.15
Smoking	Smokers	6 (75.7%)	17 (47.2%)	124 (39.6%)	OR=9.14 (95% CI 1.08-76.88)
	Nonsmokers	1 (14.3%)	19 (52.8%)	189 (61.4%)	*P*=0.04*
Diabetes	Diabetics	2 (28.6%)	3 (9.1%)	18 (5.7%)	OR=6.55 (95% CI 1.19-36.15)
	Nondiabetics/not known	5 (71.4%)	33 (90.9%)	295 (94.3%)	*P*=0.03*
Radiological findings	Cavitary	2 (28.6%)	0	0	-
	Noncavitary / not known	5 (71.4%)	36 (100%)	313 (100%)	
HIV Status	Reactive	1 (14.3%)	0	0	-
	Nonreactive / not known	6 (75.7%)	36 (100%)	313 (100%)	

*Statistically significant, OR-Odds Ratio, CI- Confidence Interval

contacts diagnosed with TB had lower BMI when compared to those who were symptom negative and did not have TB.

Our study also showed that TB diagnosed symptomatic contacts had relatively longer symptom duration and greater mean duration of contact with index cases. Smoking and diabetes prevalence were also found to be significantly higher among TB diagnosed contacts. Similar findings were observed by Gupta *et al.* in Maharashtra, India[6] and in a prospective follow-up study conducted in Iraq.[19]

These findings suggest that BMI, duration of symptoms, duration of contact with index cases, smoking, and diabetes could be important predictors for risk of TB among symptomatic contacts.

Limitations of the present study are the not investigating symptom negative contacts radiologically and for HIV status due to resource constraints and feasibility issue. Nevertheless, it provides substantial evidence that active case finding among household contacts can lead to an additional yield of TB cases.

Conclusion

The present study concludes that household contact screening for active case finding for TB is a feasible and efficient tool that can potentially result in early diagnosis and treatment of active TB, thus minimizing the severity and decreasing transmission. It can also contribute toward improving treatment outcomes, health sequelae, and the social and economic consequences of TB.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient/participant consent forms. In the form, the patients/participants have given consent for their images and other clinical information to be reported in the journal. The patients/participants understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organization. Systematic screening for active tuberculosis: Principles and Recommendations [Internet]. Geneva: WHO; 2013. [Last cited on 2019 Jun 06]. Available from: http://www.who.int/tb/publications/tbscreening/en/.pdf.
2. World Health Organization. Recommendations for investigating contacts of persons with infectious tuberculosis in low- and middle-income countries [Internet]. Geneva: WHO; 2012. [Last cited on 2019 Jun 06]. Available from: http://www.who.int/tb/areas-of-work/laboratory/contact-i nvestigation/en/.pdf.
3. Blok L, Sahu S, Creswell J, Alba S, Stevens R, Bakker MI. Comparative meta-analysis of tuberculosis contact investigation interventions in eleven high burden countries. PLoS One 2015;10:e0119822.
4. Sekandi JN, Neuhauser D, Smyth K, Whalen CC. Active case finding of undetected tuberculosis among chronic coughers in a slum setting in Kampala, Uganda. Int J Tuberc Lung Dis 2009;13:508-13.
5. Saunders MJ, Koh GC, Small AD, Dedicoat M. Predictors of contact tracing completion and outcomes in tuberculosis: A 21-year retrospective cohort study. Int J Tuberc Lung Dis 2014;18:640-6.
6. Gupta M, Saibannavar AA, Kumar V. Household symptomatic contact screening of newly diagnosed sputum smears positive tuberculosis patients - An effective case detection tool. Lung India 2016;33:159-62.
7. Prathiksha G, Daniel BD, Natrajan M. Active case-finding for tuberculosis in India. Natl Med J India 2019;32:90-5.
8. Morrison J, Pai M, Hopewell PC. Tuberculosis and latent tuberculosis infection in close contacts of people with pulmonary tuberculosis in low-income and middle-income countries: A systematic review and meta-analysis. Lancet Infect Dis 2008;8:359-68.
9. Fox GJ, Barry SE, Britton WJ, Marks GB. Contact investigation of tuberculosis, a systematic review and meta-analysis. Eur Respir J 2013;41:141-56.
10. International Union against Tuberculosis and Lung Disease. Desk guide for the diagnosis and management of tuberculosis in children [Internet]. Paris: The UNION; 2010. [Last cited on 2019 Jun 03]. Available from: https://www.theunion.org/what-we-do/publications/english/2010_Deskguide_Africa_Web.pdf.
11. World Health Organization. Guidelines for intensified case-finding and isoniazid preventive therapy for people living with HIV in resource constrained settings [Internet]. Geneva: Department of HIV/AIDS, Stop TB Department, WHO; 2011. [Last cited on 2019 Jun 02]. Available from: http://whqlibdoc.who.int/publications/2011/9789241500708_eng.pdf.
12. Central TB Division. Revised national tuberculosis control programme: Technical and operational guidelines for tuberculosis control in India 2016 [Internet]. New Delhi: Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India; 2016. [Last cited on 2019 Jun 02]. Available from: https://tbcindia.gov.in/WriteReadData/TOG.pdf.
13. Nair D, Rajshekhar N, Klinton JS, Watson B, Velayutham B, Tripathy JP, *et al.* Household contact screening and yield of tuberculosis cases- A clinic based study in Chennai, South India. PLoS One 2016;11:e0162090.
14. Khaparde K, Jethani P, Dewan PK, Nair SA, Deshpande MR, Satyanarayana S, *et al.* Evaluation of TB case finding through systematic contact investigation, Chhattisgarh, India. Tuberc Res Treat 2015;2015:670167.14.
15. Adane A, Damena M, Weldegebreal F, Mohammed H. Prevalence and associated factors of tuberculosis among adult household contacts of smear positive pulmonary tuberculosis patients treated in public health facilities of Haramaya district, Oromia region, eastern Ethiopia. Tuberc Res Treat 2020;2020:6738532.
16. Liu E, Cheng S, Wang X, Hu D, Zhang T, Chu C. A systematic review of the investigation and management of close

contacts of tuberculosis in China. J Public Health 2010;32:461-6.

17. Jia Z, Cheng S, Ma Y, Zhang T, Bai L, Xu W, *et al.* Tuberculosis burden in China: A high prevalence of pulmonary tuberculosis in household contacts with and without symptoms. BMC Infect Dis 2014;14:64.
18. De D, Kinikar A, Adhav PS, Kamble S, Sahoo P, Koli H, *et al.* Source case investigation for children with TB disease in Pune, India. Tuberc Res Treat 2014;2014:182836.
19. Al Kubaisy W, Al Dulayme A, Hashim DS. Active tuberculosis among Iraqi schoolchildren with positive skin tests and their household contacts. East Mediterr Health J 2003;9:675-88.