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Knowledge of Tuberculosis, Services of TB Control Programme and Associated Socio-Demographic Inequity among Rural Participants of Jaipur, Rajasthan, India: A Cross Sectional Study

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Abstract

Background: Tuberculosis (TB) is one of the top 10 causes of death worldwide. India is still the highest TB burden country. There is a scarcity of data on TB knowledge from Rajasthan state of India. **Objective:** The objective of this study was to estimate the prevalence of knowledge about TB and services of TB control programme and to determine its correlates among rural population of Jaipur, Rajasthan. **Methods:** Cross-sectional community based study was carried out at Model Rural Health Research Unit, Jaipur, a unit of Department of Health Research, Ministry of Health & Family Welfare, Government of India. **Results:** Study reports the result from 1993 adult participants from 10 villages of 2 sub-districts of district Jaipur. About 88.9% of studied participants knew that TB is an infectious disease and it spreads from TB patient to healthy person in close contact. Only 22.3% of participants knew "DOTS is the treatment for TB". While, only 58.9% knew "*sputum is used for diagnosis of TB*" at health centers. *Scheduled castes, scheduled tribes* and *backward classes* social groups knew less than the mainstream "*General*" social group. The observed difference was statistically significant ($p < 0.05$). Logistic regression analysis estimated the relative contribution to knowledge status. **Conclusion:** The knowledge of study participants on transmission of

tuberculosis was similar to knowledge of population in country wide study. They poorly knew sputum is used for diagnosing tuberculosis disease; socio-demographic inequity exists in this knowledge too. People from older age groups, underprivileged social groups and minority need extra educational activities.

Keywords

India, Inequity, Knowledge, Tuberculosis

1. Introduction

Tuberculosis (TB) is one of the top 10 causes of death worldwide. Eight countries of the world, including India, account for two-thirds of global total of TB cases [1]. The Global Plan and Stop TB Partnership 2006-2015 visualized a TB free world. To ensure the TB free world, access to effective diagnosis, treatment and cure by every TB patient is one of five missions of Global Plan. India is still the highest TB burden country globally in regards to absolute numbers of incident cases each year. Mortality due to this disease is the third leading cause of years of life lost (YLLs), in India [2].

Lack of knowledge on tuberculosis has been found to be associated not only with occurrence of tuberculosis but also with delayed diagnosis [3] [4] [5] [6] [7]. Cross sectional studies on tuberculosis knowledge have been published for different parts of India [8]-[20]. Nationwide studies for India were conducted on secondary data and are more than a decade old [13] [16].

Rajasthan state of India is located in the north-western part of country. The capital city is Jaipur [21].

Recent study of ICMR reports prevalence for the country and its states separately. The prevalence of microbiologically confirmed tuberculosis among population aged ≥ 15 years were 316 and 484 per 100,000 population of India and Rajasthan state respectively. Rajasthan is having more prevalent cases of TB then the country [22].

There is a scarcity of published articles on TB knowledge from Rajasthan state in general and Jaipur district in particular. The published studies available from Rajasthan were conducted on small sample sizes and in other places of state [23] [24]. Therefore, this study was carried out to estimate the prevalence of knowledge about TB and services of TB control programme and to determine its correlates among rural population of selected villages of Jaipur, hitherto unreported area.

2. Methodology

Study Design: Cross-sectional study.

Study setting: Study was carried out at Model Rural Health Research Unit,

Jaipur.

Data collection: Data was collected from August 2014 to July 2017.

Study participants: Individuals of age ≥ 15 years residing in selected study villages from both the genders were our study participants.

Sample size: Sample size was calculated by expected prevalence (p) of knowledge of tuberculosis among 50.0%; 95% confidence limits; and 2% absolute precision error. We calculated sample size of 2395 in Epi-info version 7.2.4.0. [25].

Sampling Design: Two stage simple random sampling was adopted. In the first stage, 2 sub-districts Jamwa Ramgarh and Sanganer were selected from district Jaipur. In the second stage, 5 villages were randomly selected from each selected sub-district, summing up to 10 villages. From each selected village, 100 households were selected. Household in the central location in village was first of all selected. From this selected household all consecutive households in East direction were chosen. In case of non availability of consecutive households in east direction, further selection were made from west, north and south direction till desired number of households chosen. From each of the selected household, each of the available individuals aged ≥ 15 years were registered in the study after seeking consent.

Data collection team: A "Data collection team" comprising of scientists, and technical staffs was imparted training about the study, its objectives, & methodologies. They were also trained in seeking consent from participants, administration of study questionnaire, collection and entry of data.

Study questionnaire: Study questionnaire was developed in English language by reviewing previous published articles and having discussion among study investigators. Study questionnaire was translated to vernacular language "Hindi" and back translated to English. Both versions were checked for content consistency. Hindi questionnaire meeting content consistency applied to members of "Data collection team" to ensure its comprehensibility. After this comprehensibility testing, questionnaire was applied to sample participants. Corrections were made as per the responses of sample participants. Final questionnaire comprised of 15 variables in total in its 3 parts including 1) Participant'S information and his/her socio-demographic details; 2) History of tuberculosis and anti-tubercular treatment in family; 3) Questions with regard to knowledge on tuberculosis and services of TB control programme. Sample participants were not part of study sample. Study questionnaire was administered to the selected study participants through face-to-face interview by the trained interviewer. Responses of the study participants were recorded in study questionnaire.

Study variables: Study variables were categorized in to following:

1) Outcome variables: Six categorical variables on knowledge of tuberculosis and services of TB control programmewere used as outcome variables. Questions related to these outcome variables were:

a) *Do you know TB spreads from its patient to healthy person in contact*?

b) Do you know the way tuberculosis spreads?

c) *Is TB treatable*?

d) *DOTS is the treatment for which disease*?

e) *Do you know diagnosis and treatment of TB are provided completely free of cost at government health centers*?

f) *How TB is diagnosed at government health centre*?

2) Predictor variables: Fourcategorical variables on socio-demographic status were used as predictor variables. These predictor variables were a) age group, b) gender, c) religion and d) Social group.

Social group: Social group, known locally as *caste,* was defined as per the Government of Rajasthan guidelines. There are 5 social groups viz. *scheduled caste* (*SC*), *scheduled tribe* (*ST*), *other backward class* (*OBC*), m*ost backward class* (*MBC*), and *general* social group [26] [27]. Data on social group of individual study participant was recorded as reported.

3) Confounding variables: Following variables were considered as confounding variables, because these could bias the result. The considered confounding variables were a) History of tuberculosis disease or anti-tubercular therapy among any family member of study participant, b) History of tuberculosis disease or anti-tubercular therapy among study participant, c) Any family member including study participant receiving anti-tubercular treatment in present days.

Statistical analysis: Data entered in computer was subjected to analysis after data cleaning. Participant's records with affirmative response with any "confounding variables" were filtered out. Studied outcome variables and predictor variables were summarized as (%) proportions in table. Outcome variables with knowledge among less than 60% participants were chosen arbitrarily for computing bivariate and multivariable logistic regression analysis. We used χ^2 as the test of significance. Adjusted Odds Ratio was estimated to identify the independently associated predictor variable. The p value < 0.05 considered statistically significant. Analysis was carried out in Epi-info 7 version 7.2.4.0. [25].

Ethicalconduct: Informed & written consent or assent as applicable was sought from participants [28].

Study reporting: Study was carried out as per the STROBE guidelines [29].

3. Results

We recruited 2293 participants. Participants with confounding variables were removed from data, as they could bias and skewed the results. Participant's data with "missing" information was also removed (n = 300). Finally 1993 participant's data with information on all variables were subjected for statistical analysis.

Table 1 describes the knowledge of tuberculosis and services of National TB elimination programme among participants. About 88.9% of participants knew that TB is an infectious disease. Knowledge on mode of transmission of tuberculosis was adequate. About 88.9% of studied participants knew that the disease spreads through coughing or sneezing by TB patient to healthy person in close

contact. About 80.3% of participants knew that TB is treatable. About 72.5% of participants knew that the diagnosis and treatment of TB are provided free of cost at government run health centers. Only 22.3% of participants knew that "DOTS is the treatment for TB". Only 58.9% knew that the diagnosis of TB is made through examining the sputum at health centers.

Table 2 details on the knowledge of "DOTS is the treatment for TB" among studied participants as per socio-demographic factors. Overall the knowledge on this parameter was low. About 34.5% "*General*" social group participants knew about this. The proportions of participants who knew about this among "*SC*", "*MBC*", & "*OBC*" social groups were 10.1%, 18.3% & 25.3% respectively. All these three social group participants were statistically significantly known less ($p < 0.05$). The proportion of *ST* participants who knew about this was 28.1%. The difference was statistically insignificant.

Table 1. Knowledge on tuberculosis and services of TB control programme among study participants (n = 1993).

Question asked	Types of responses (Correct response in bold letter)	n(%) with correct response
Do you know TB spreads from its patient to healthy person in contact?	**Yes**/NO/Don't know	1773 (88.9%)
Do you know the way tuberculosis spreads?	**1) By coughing/sneezing of patient to person in close contact** 2) By touching hand 3) Through mosquitoes 4) Through animal's bite 5) By drinking dirty water 6) By eating old kept food 7) Other reasons 8) Don't know	1773 (88.9%)
Is TB treatable?	**Yes**/NO/Don't know	1600 (80.3%)
DOTS is the treatment for which disease?	**TB**/Other disease…/Don't know	446 (22.3%)
Do you know diagnosis and treatment of TB are provided completely free of cost at government health centers?	**Yes**/NO/Don't know	1446 (72.5%)
How TB is diagnosed at government health centre?	Blood test/Stool-urine tests/**Sputum test**/Other tests…/Don't know	1171 (58.9%)

Table 2. Knowledge of "DOTS is the treatment for TB" among studied socio-demographic factors of participants (n = 1993).

Socio-demographic factors	Sub-group	Knowledge of "DOTS is the treatment for TB"			
		Know	Don't know	X^2 value	p value
Social Groups*	*ST* (n = 444)	125 (28.1%)	319 (71.9%)	2.65	0.10
	SC (n = 445)	45(10.1%)	400 (89.9%)	56.7	**0.0001**
	MBC (n = 316)	58 (18.3%)	258 (81.7%)	17.3	**0.0001**
	OBC (n = 585)	148 (25.3%)	437 (74.7%)	6.3	**0.01**
	General (n = 203)	70 (34.5%)	133(65.5%)	reference	reference
Age groups	≥60 Years (n = 91)	8 (8.8%)	83 (91.2%)	23.0	**0.0000**
	40 - 59 years (n = 453)	69 (15.2%)	384 (84.8%)	43.8	**0.0000**
	25 - 39 years (n = 956)	202 (21.2%)	754 (78.8%)	27.8	**0.0000**
	15 - 24 years (n = 493)	167 (33.8%)	326 (66.2%)	reference	reference
Gender	Female (n = 932)	236 (25.3%)	696 (74.7%)	8.73	**0.003**
	Male (n = 1061)	210 (19.8%)	851 (80.2%)	reference	reference
Religion	Hindu (n = 1974)	442 (22.4%)	1532 (77.6%)		1.0000**
	Muslim (n = 19)	4 (21.0%)	15 (79.0%)		reference

*SC = Scheduled caste; ST = Scheduled tribe; MBC = Most Backward caste; OBC = other backward caste; **Fisher exact test 2 tailed p value.

Similarly, 15 - 24 years age group was used as benchmark. About 33.8% of participants of age group 15 - 24 years knew "DOTS is the treatment for TB". The proportions of participants belonging to age groups 25 - 39 yrs, 40 - 59 yrs and ≥60 yrs were 21.2%, 15.2% and 8.8% respectively. These age groups participants had statistically significantly low knowledge ($p < 0.05$). About 25.3% female knew compared to 19.8% of male about this parameter. The difference in proportions was statistically significant ($p < 0.05$). There was no significant difference with respect to religion.

Table 3 details knowledge of "*sputum is used for diagnosis of TB*" among participants as per socio-demographic factors. About 72.4% "*General*" participants knew about this. The proportions of participants belonging to *ST*, *SC*, & "OBC" were 61.3%, 49.6% & 54.0% respectively. The differences were statistically significant ($p < 0.05$).

About 63.0% of participants of age group 15 - 24 years knew about this. The proportion of participants belonging to age groups 25 - 39 yrs, 40 - 59 yrs and ≥60 yrs who knew about this were 60.4%, 52.3% and 52.7% respectively. The difference was statistically significant in case of 40 - 59 yrs age group only ($p < 0.05$). About 56.9% females knew compared to 60.6% males about this parameter; however difference was insignificant. About 59.2% of Hindus knew compared to 26.3% Muslims about this parameter ($p < 0.05$).

Table 3. Knowledge of "*sputum is used for diagnosis of TB*" among studied socio-demographic factors of participants (n = 1993).

Socio-demographic factors	Sub-group	Knowledge on "*sputum is used for diagnosis of TB*"			
		Know	Don't know	X^2 value	p value
Social groups*	*ST* (n = 444)	272 (61.3%)	172 (38.7%)	7.59	**0.005**
	SC (n = 445)	221 (49.6%)	224 (50.4%)	29.4	**0.0001**
	MBC (n = 316)	218 (69.0%)	98 (31.0%)	0.69	0.4
	OBC (n = 585)	316 (54.0%)	269 (46.0%)	21.0	**0.0001**
	General (n = 203)	147 (72.4%)	56 (27.6%)	reference	reference
Age groups	≥60 Years (n = 91)	48 (52.7%)	43 (47.3%)	3.46	0.06
	40 - 59 years (n = 453)	237 (52.3%)	216 (47.7%)	11.2	**0.0008**
	25 - 39 years (n = 956)	578 (60.4%)	378 (39.6%)	0.94	0.33
	15 - 24 years (n = 493)	311 (63.0%)	182 (37.0%)	reference	reference
Gender	Female (n = 932)	531 (56.9%)	401 (43.1%)	2.69	0.10
	Male (n = 1061)	643 (60.6%)	418 (39.4%)	reference	reference
Religion	Hindu (n = 1974)	1169 (59.2%)	805 (40.8%)	8.4	**0.003**
	Muslim (n = 19)	5 (26.3%)	14 (73.7%)	reference	reference

*SC = Scheduled caste; ST = Scheduled tribe; MBC = Most Backward caste; OBC = other backward caste.

Table 4 details on logistic regression analysis for determining the relative contribution of predictor variables in knowledge of "DOTS is the treatment for TB". Odds of occurrence of knowledge of this parameter among age groups 25 - 39 yrs, 40 - 59 yrs, and ≥60 yrs were 0.49, 0.32 and 0.18 against the reference age group 15 - 24 yrs. The observed lesser odds of occurrence were statistically significant independently in these age groups ($p < 0.05$). Males had 0.71 Odds of occurrence of knowledge on this and it was statistically significant ($p < 0.05$). Considered social groups viz. *MBC*, *OBC*, *SC* & *ST* had 0.31, 0.56, 0.17 & 0.65 Odds ratio against *General* social group. The values of odds ratio were statistically significantly lower among these social groups ($p < 0.05$).

Table 5 details on the results of logistic regression analysis for determining the relative contribution of studied socio-demographic factors in knowledge of "*sputum is used for diagnosis of TB*". Odds of occurrence of knowledge among 40 - 59 yrs and ≥60 yrs were 0.6 in both age groups compared to 15 - 24 yrs age group. The observed value of odds ratio was statistically significant ($p < 0.05$). Muslim had 0.25 odds ratio compared with Hindu and the difference was statistically significant ($p < 0.05$). Males had odds ratio of 1.29, which was statistically significant ($p < 0.05$). Social groups viz. *OBC*, *SC* & *ST* had Odds ratios of 0.46, 0.37 & 0.6 respectively, and these were statistically significant ($p < 0.05$).

Table 4. Multivariable logistic regression analysis of socio-demographic factors with knowledge on "*DOTS is the treatment for TB*" (n = 1993).

socio-demographic factors	Adjusted Odds ratio	95% Confidence interval	p value
Age group (25 - 39 yrs/15 - 24 yrs)	0.49	0.38 - 0.63	**0.0000**
Age group (40 - 59 yrs/15 - 24 yrs)	0.32	0.23 - 0.45	**0.0000**
Age group (≥60 yrs/15 - 24 yrs)	0.18	0.08 - 0.39	**0.0000**
Religion (Muslim/Hindu)	0.83	0.26 - 2.6	0.76
Sex (Male/Female)	0.71	0.56 - 0.89	**0.003**
Social Group (MBC/General)	0.31	0.20 - 0.47	**0.0000**
Social Group (OBC/General)	0.56	0.39 - 0.80	**0.0015**
Social Group (SC/General)	0.17	0.11 - 0.26	**0.0000**
Social Group (ST/General)	0.65	0.45 - 0.93	**0.0218**

Table 5. Multivariable logistic regression analysis of socio-demographic factors with knowledge on "*sputum is used for diagnosis of TB*" among studied participants (n = 1993).

Socio-demographic factors	Adjusted Odds ratio	95% Confidence interval	p value
Age group (25 - 39 yrs/15 - 24 yrs)	0.89	0.71 - 1.13	0.36
Age group (40 - 59 yrs/15 - 24 yrs)	0.60	0.46 - 0.78	**0.0002**
Age group (≥60 yrs/15 - 24 yrs)	0.60	0.38 - 0.96	0.0333
Religion (Muslim/Hindu)	0.25	0.08 - 0.71	0.0097
Sex (Male/Female)	1.29	1.07 - 1.56	**0.0073**
Social Group (MBC/General)	0.88	0.59 - 1.31	0.53
Social Group (OBC/General)	0.46	0.33 - 0.66	**0.0000**
Social Group (SC/General)	0.37	0.25 - 0.53	**0.0000**
Social Group (ST/General)	0.60	0.41 - 0.86	**0.0062**

4. Discussions

Tuberculosis is an infectious disease which transmits from infective patient to healthy person in close contact through micro droplets formed during coughing and sneezing. In our study, 88.9% of participants knew this fact.

Previous studies reported prevalence of this knowledge in more than 80.0% participants [9] [16]. Some studies also reported lower prevalence of this knowledge. Study by Kulkarni P *et al.* reported 61.0% tribal participants of Jharkhand knew TB as a transmissible disease [10]. Study among 360 college students of

Karnataka showed 56.7% prevalence of such knowledge [17]. Study from Bikaner, Rajasthan in 510 TB patients reported only 19.6% patients knew this fact [23]. Possible reasons for such wide variations can be differences in population, time of conduct of study and information, education & communication activities under programmein these areas. However, our finding is similar to the findings reported from country wide data and from general population of Delhi [9] [16].

Total 88.9% participants of our study knew that TB transmits from patient to person in close contact by coughing or sneezing by patient. Available data from various states and population of India report wide variation [9] [10] [11] [13] [17] [19]. The reported range of knowledge on "TB transmits from patient to person in close contact by coughing or sneezing" is 20.0% - 71.8% [9] [11]. Study on general population of Delhi reported 71.8% subjects knew coughing/sneezing as the mode of transmission [9]. Study from tribal population of Jharkhand reports 38.0% participants knew TB transmits through cough droplets [10]. 20.0% rural population of Tamil Nadu knew the mode of spread of TB [11]. A nationwide study on 198,718 participants found 55.5% knew about the correct mode of tuberculosis transmission *i.e.* "Through the air when coughing or sneezing [13]". Cross sectional study of Karnataka showed 38.9% students knew correct mode of transmission [17]. The study on TB patients in a tertiary care centre in northern India reported only 51.5% patients knew about its causation [19].

As it is understood from previous studies, knowledge on mode of transmission of TB varies by not only by geography but also by type of participants. The knowledge on mode of transmission among rural population ranged from 20.0% - 38.0% in previous studies [10] [11]. Ourrural participants showed even higher coverage of the knowledge on mode of transmission. The possible reasons for this difference can be local population level characteristics like education, age, & information of services of TB control programme and period of study undertaken.

About 80.3% of our participants knew that TB is treatable. This value is higher than the reported values 62.3% for rural people from Telangana [18].

In this study, 72.5% of participants knew that the diagnosis and treatment of TB are provided free of cost at government health centers. The reported knowledge on this variable in previous studies varies from 34.0% to 91.0%. Only 34.0% rural people from Tamil Naduknew that treatment for TB was available free of cost [11]. Study by Muniyandi M *et al.* among Sahariatribes reported 91.0% knew that TB diagnosis, and treatment facilities were available in both government and private hospitals [15]. Study by Shedole DT *et al.* among college students of Karnataka found 71.7% participants knew about the availability of diagnostic and treatment facilities [17]. Study among young rural people of Telangana state found 89.0% knew about free diagnostic services and 85.3% free treatment services in the government setup [18]. 73.5% knew that treatment is available at government health centre free of cost [23]. Our finding is similar to findings of most of the previous studies undertaken in country.

There were two study variables which showed poor knowledge in our studied participants. About 22.3% participants of our study knew that "DOTS is the treatment for TB". Previous studies also reported similar findings from other parts of country. A study in tribal population in Madhya Pradesh reported 32.8% knew that DOTS is treatment for TB [12]. Only 18.6% rural people in Telangana knew about DOTS [18]. Only 9.8% TB patients from Bikaner, Rajasthan knew about DOTS [23]. So, knowledge on DOTS was reported poor in most of the reported studies, including our study.

Second variable which reported poor knowledge was "*sputum is used for diagnosing TB*". Only 58.9% participants of this study knew that the diagnosis of TB is made through examining the sputum at health centers. Kulkarni P *et al.* reported 37.0% tribals knew sputum examination as method of diagnosis [10]. Rural people of Telangana showed better knowledge as 71.3% knew sputum is used for diagnosis [18]. The finding of our study is in the range of published reports.

The poor performing knowledge indicators of our study "*DOTS is the treatment of TB*" and "*sputum is used for diagnosing TB*" were subjected to bivariate analysis for comparing the socio-demographic factors and inequity if any (**Table 2** and **Table 3**).

Although in our study knowledge on "*DOTS is the treatment of TB*" was poor among most of the studied socio-demographic characteristics, however proportions of participants among *SC*, *MBC* and *OBC* who knew "*DOTS is the treatment of TB*" were statistically significantly lower than the *General* social group ($p < 0.05$). Similarly, proportion of participants who knew "*DOTS is the treatment of TB*" among male and age groups 25 yrs and above were statistically significantly lower than the proportion among female and 15 - 24 yrs age groups respectively ($p < 0.05$).

Proportions of participants knowing "*sputum is used for diagnosis of TB*" among *SC*, *ST*, and *OBC* were statistically significantly lower than the proportion among *General* social group ($p < 0.05$). Similarly, proportion of participants among Hindus who knew was statistically significantly higher than the proportion among Muslims ($p < 0.05$).

Previous published studies on socio-demographic inequity on knowledge on TB and services of TB control programme provide some data. Nationwide cross sectional survey carried out by Sreeramareddy CT *et al.* found being male, and Hindu were associated with correct knowledge on tuberculosis transmission [13]. Similarly study by Mukherjee S *et al.* found that the extent of knowledge about TB was more in the age group between 25 to 40 years than any other age group [14]. Study by Sharma SK *et al.* found that Hindu participants had significantly higher knowledge [19]. However, there is scarcity of data addressing socio-demographic inequity with respect to knowledge on "*DOTS is the treatment of TB*" and knowledge on "*sputum is used for diagnosis of TB*". The present study provides this pertinent data and report socio-demographic inequity of

knowledge on "*DOTS is the treatment of TB*" and knowledge on "*sputum is used for diagnosis of TB*".

Multivariable logistic regression analysis found out socio-demographic inequity with knowledge on "*DOTS is the treatment of TB*" and "*sputum is used for diagnosis of TB*". Being male, older age group, and belonging to *MBC*, *OBC*, *SC* & *ST* social groups are likely to be less knowledgeable on "*DOTS is the treatment of TB*". Similarly being older age, Muslim, and belonging to *OBC*, *SC*&*ST* social groups were likely to be less knowledgeable on "*sputum is used for diagnosis of TB*". Being male was more likely to know "*sputum is used for diagnosis of TB*".

5. Conclusion

Rural population of district Jaipur, Rajasthan is poor in knowing that sputum is used for diagnosing the tuberculosis disease and DOTS is the treatment of TB. People from older age groups, underprivileged social groups and minority need extra educational activities.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Author Contributions

PKA, GST, MR, & MLM contributed to the study conception and design. Questionnaire was prepared by PKA, MLM, MR. Data collection was performed by PKA, CRM, & BMS. Data entry and analysis was performed by PKA, MLM & BMS. The first draft of the manuscript was written by PKA & VD and all co-authors commented on first draft of manuscript. All authors read and approved the final manuscript.

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