Factors associated with tuberculosis cases in Semarang District, Indonesia: case-control study performed in the area where case detection rate was extremely low

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Factors associated with tuberculosis cases in Semarang District Indonesia; case-control study performed in the area where Case Detection Rate was extremely low

Sri Ratna Rahayu[1], Hironobu Katsuyama[2], Masashi Demura[1], Midori Katsuyama[1], Yoko Ota[1], Hideji Tanii[1], Tomomi Higashi[1,] Ngakan Putu Djaja Semadi[3] and Kiyofumi Saijoh[1].

[1]Kanazawa University School of Medicine, Kanazawa 9208640 Japan,

[2]Department of Public Health, Kawasaki Medical University, Kurashiki 7011092, Japan

[3]Health Department Semarang District, MT Haryono 29 Ungaran, Semarang District, Indonesia.

Correspondence:

Kiyofumi Saijoh, MD, PhD

Professor and chairperson

Department of Hygiene

Kanazawa University School of Medicine

13-1 Takaramachi,

Kanazawa 9208640, Japan

18 Email: saijohk@med.kanazawa-u.ac.jp

19 **Keywords**

20 Tuberculosis, Case Detection Rate, Risk factors, Indonesia, DOTS.

Abstract

Objectives Indonesia is ranked to be the 4th as a contributor to the Tuberculosis (TB) in the world. Semarang District in Central Java displays extremely low Case Detection Rate (CDR), possibly contributing to the local prevalence of TB.

Methods Case-control study was performed to explore the factors cause of such low CDR. We recruited 129 TB cases and 83 controls that visited the same centers and were not diagnosed as TB.

Results The cases had 7.5 ± 2.3 symptoms/person in average, indicating the delay of diagnosis because the controls only displayed 1.0 ± 1.7. The multiple logistic regression analysis comparing the cases/controls extracted following factors as a risk to have TB; farmer, close contact with TB patients, ignorance of whether Bacillus Calmette-Guérin (BCG) was accepted or no, smoking, low income, a lot of people living in the same room, irregular hand wash before meals, not wash hands after blow, soil floor, and no sunlight and no ventilation in the house.

Conclusions Neither the cases nor the controls always knew the symptoms and how to avoid TB infection probably causes the delay of diagnosis. It is difficult to change the current living condition. Thus, the amendment of the community based education program of TB seems to

be required.

Abbreviations

BCG : Bacillus calmette-guérin

CDR : Case detection rate

CI : Confidence Interval

DOTS : Directly observed treatment short-course

HIV : Human immunodeficiency virus

MA : Monovariate analysis

MDR : Multidrug resistant

MLR : Multiple logistic regression analysis

TB : Tuberculosis

1. Introduction

Tuberculosis (TB) is one of the biggest problems throughout the world and a leading cause of death and major public health problem [1]. Many people with TB remain poor in diagnosis or are diagnosed only after long delays. The high burden of undiagnosed TB causes much suffering economic hardship and sustained transmission [2-4].

According to Global Tuberculosis Report 2012 [5], Indonesia is ranked to the 4th (0.4 million-0.5 million) as a contributor to the TB world after India (2.0 million-2.5 million), China (0.9 million-1.1 million), and South Africa (0.4 million-0.6 million). Since 2000, 22 high burden countries account for 82 % of all estimated incident cases [5].

The discovery of TB in Indonesia in 2011 is 807 per 100,000 populations and that in Central Java is 637 per 100,000 populations [6]. The TB Case Detection Rate (CDR) of Central Java Province is estimated to be 56.93 % [7], but among its local districts, Semarang District displays extremely low CDR being 19.21 % [8]. National targets for TB control strategy Indonesia, the strategic plan of the Ministry of Health from 2010-2014, is to reduce the TB prevalence to 224 per 100,000 populations. Output targets are (1) to increase the CDR of new cases of smear-positive pulmonary TB from 73 % to 90 %, (2) to reach the percentage of successful treatment of new cases of smear positive pulmonary TB to 88 %, (3) to increase

66 “the percentage of province with CDR above 70 %” to reach 50 %, and (4) to increase “the
67 percentage of the province with treatment success rate being above 85%”, from 80 % to 88 %
68 [9].

69 To achieve the national targets controlling TB, some strategies seem to be very
70 important; empowerment in the community; early detection and registration of TB patients;
71 improvement of the quality Directly Observed Treatment short-course (DOTS) services;
72 facing the challenges of TB/HIV, Multidrug Resistant (MDR-TB) and childhood TB; to meet
73 the demands of society poor and other vulnerable groups [9]. Domain knowledge is very
74 important in the formation of action. In several developing countries, TB patients are
75 perceived to seek late care or avoid care, due to misunderstanding to popular TB etiologies
76 like sharing utensils, heavy labor, smoking, bewitchment and hereditary transmission
77 [10-12]. Thus, it seems very important to know the basic knowledge, attitude, and behavior of
78 the people in such a low CDR region to complete the TB programs.

79 In the present study, differences in the basic knowledge, attitude, and behavior were
80 compared among the TB cases registered in 2012 at the health centers in Semarang District
81 and the controls that visited the same health centers and diagnosed differently.

82

2. Methods

This study was designed to be Case-Control study [13] during 2012, January until 2013, October. The TB cases (129) were recruited among the cases registered with TB diagnosis at the health centers in Semarang District, and 50 % were female. The controls (83) were recruited among those who visited the same health centers and were diagnosed differently, and 52 % were female. Average age of the cases and controls (Mean ± SD) was 41.2 ± 15.3 and 35.7 ± 11.7, respectively. This research was approved by the ethical comities of Kanazawa University School of Medicine, Japan and Diponegoro University School of Medicine, Dr Kariadi Hospital Semarang, Indonesia and Semarang State University, Indonesia. All participants approved this research by written informed consent.

TB information of the cases

TB cases were sent to the Health Center from clinics and diagnosed to have TB using physical examination, microscopic examination by Ziehl Neelsen staining, X-ray, etc. Way of diagnosis, symptoms they had, and way of treatment were examined. All of them were treated with DOTS properly regardless of having side effects or not.

Characteristics of the cases and controls

Demographic characteristics like gender, age, occupation, origin, BCG experience, close

100 contact with TB patients, smoking habit, having pets, and income was examined. Source of
101 TB information (multiple answers) was also examined. Thereafter, differences in living
102 condition and attitudes in daily life were examined.

103 *Knowledge and opinion about TB*

104 Symptoms of TB (multiple answers) and the way to avoid TB (multiple answers) that the
105 participants thought were questioned. Differences in the opinion and attitude against TB
106 between the cases and controls were examined.

107 *Statistical analysis*

108 The difference in the age and numbers of complaint of the cases and controls was estimated
109 using Student's t-test. The differences in the frequency of answers between the cases and the
110 controls were estimated by Chi-square (χ^2) test (monovariate analysis, MA). Multiple logistic
111 regression analysis (MLR) with the cases/the controls as the dependent valuable was utilized
112 with the independent variables using groups classified by characteristics of the cases and
113 controls. All analyses were performed with SPSS ver. 19 (SAS Institute Inc., Cary, NY). In
114 all analyses, $\rho < 0.05$ was taken to indicate statistical significance.

115

116 **3. Results**

117 The 129 cases included 65 male and 64 female, respectively, and the average age was 41.2 ±
118 15.3 (Table 1). Although all the cases were registered at the health centers, around 20 % were
119 diagnosed at the different medical facilities (Table 2). Sputum smear was the first choice for
120 diagnosis [1, 14], but 20 cases were diagnosed without any clinical examination. Chest X-ray
121 was utilized for the diagnosis of more than half of the cases. Long lasting cough with sputum
122 was the most common symptom that was followed by chest pain, malaise, anorexia, and
123 weight loss. Around two third displayed hemoptysis, dyspnea, sweat at night, and long lasting
124 sub fever at night. The cases had many symptoms being 7.5 ± 2.3 complaints/person in
125 average. These cases were registered, hence all of them underwent to treatment, whether they
126 knew it was under DOTS or not (Table 3). Nine had no supervisors and at least one fourth had
127 to pay treatment fee, suggesting that they were not under DOTS. More than 85 % of the cases
128 quit taking medicine at 6 months, regardless of frequency of medication in first 2 months.
129 Treatment with 4 drugs was the most common, but that with 2 drugs was also observed in
130 around 15 % of the cases. Sputum smear was the most common examinations during
131 treatment followed by chest X-ray.

132 The controls were selected from people visited the same health center and
133 diagnosed not having TB. We tried to obtain age-gender-matched control. We could achieve

gender-matched, but their age was slightly younger than the cases (Table 1). Around 80 % of the cases were farmers and around 30 % of them graduated from elementary school alone. More than half of the controls received BCG whereas more than half of the cases did not know whether they received BCG or not. Nine percent of the cases experienced close contact with TB patients but none of the controls did. Income of the cases was significantly lower than that of the controls, and three fourth of them got less than 100 $/month. The cases were diagnosed already, hence they got the TB information from medical staff more than the controls, but they usually did not use other sources (Table 1). When the living conditions were compared, all conditions were significantly different between the cases and the controls (Table 4). “Ceramic floor”, “outside kitchen”, “gas for cooking”, “open windows everyday”, “sunlight into the house”, and “ventilation in every room” were more common in the controls, whereas “window in each room” and high “humidity in the house” were in the cases.

The cases less frequently “washed their hands before eating” but more frequently “shared the dishes with others” and “drunk from the same glasses/bottles” than the controls (Table 5). They also less frequently “washed their hands after blowing” than the controls, whereas no difference was observed in the frequency of whether “they worked when they felt unwell” between these two groups.

151 In order to clarify what kinds of these physical factors were most affected
152 difference in the cases and the controls, the MLR was applied (Table 6). The cases/controls
153 were the dependent variables and the groups divided by above mentioned information were
154 used as determinants. The way of obtaining TB information was removed from the
155 determinant because that from the cases was modified as described above. The obtained risks
156 were “farmers”, ”close contact with TB patients”, “whether or not they did not know they
157 received BCG”, “smoking”, and “low income; < 100 $/month”. “High income; > 150 $/month”
158 was also extracted as a risk compared with “middle income; 100-150 $/month”. To “wash
159 hands before eating”, “wash hands after blow” and “not work when unwell” were protective.
160 Among living conditions, “live with ≥ 3 person in the same room”, “soil floor”, no “sunlight
161 in the house” and no “ventilation in the house” were extracted as risk.
162 Regardless of many symptoms, the cases did not always display significant
163 differences with the controls among the opinion regarding what they thought was TB
164 symptoms (Figure 1). “Long lasting sub fever” alone was significantly higher in the controls.
165 More than 70 % of both the cases and the controls thought that it was important to
166 “cover mouth/nose when someone sneezed” (Figure 2). More than half of the controls thought
167 that “avoid sharing dish”, “avoid drinking from the same glass/bottle”, “wash hands after

168 touching items in the public" and "maintain good nutrition" were the way to avoid getting TB
169 and the rates were significantly higher than the cases. In fact, 76 % of the controls washed
170 hands before eating and only 35 % of the cases did so (Table 5). Moreover, 76 % (9 + 67) of
171 the cases at least sometimes "shared the dish" and" drunk from the same glass", that was
172 significantly higher than the controls. On the other hand, 87 % (39 + 48) of the controls at
173 least sometimes "washed hands after blowing". "Vaccination" was also higher in the controls
174 than the cases (Figure 2).

175 Opinions related to the seriousness and shame, did not display any significant
176 difference between the cases and the controls (Table 7). Although many of the cases and
177 controls thought TB to be "serious", they did not always think that TB was "serious at
178 workplaces" and "affected work performance". Significant difference was not observed in
179 "be ashamed of having TB" but the cases were tended to want to "hide having TB".
180 Significantly more controls thought "TB affected relationship with others" and "wanted to
181 live isolated", whereas there was no significant difference in "TB affected family
182 responsibility" against the controls. Both of the cases and controls usually tried to be good at
183 TB patients. Around 50 % of the controls believed "TB treatment was very costly" but
184 around one fourth of the cases thought so. "HIV positive people should concern about TB"

185 was significantly higher in the controls than in the cases. Around one fourth to one third of
186 the cases and controls believed that TB was hereditary.

187 **4. Discussion**

188 In Indonesia, regular health examination was not mandatory [6]. Therefore, after symptoms
189 became apparent, the person visited the clinic where sputum smear was not always available.
190 The cases in the present study displayed 7.5 ± 2.3 complaints/person in average, indicating
191 the delay of diagnosis [15]. Although early diagnosis and initiation of treatment of infectious
192 cases is the best measure to reduce transmission [3, 16, 17], in some countries, 20 % of
193 patients were not diagnosed for over 6 months from the onset of symptoms [18]. Even after
194 the symptoms became obvious, for diagnosis, it took at least 2 more days because positive TB
195 was defined as more than 2 positive sputum smears in the smear performed three times within
196 2 days [14]. Household contacts continued meantime, when patients were with potentially
197 infectious forms proceeding to high prevalence of TB [19, 20]. On the other hand, culture was
198 not common, whereas patients with smear-negative, culture-positive TB were reportedly
199 responsible for TB transmission [21, 22]. Immediate introduction of culture examination is
200 required because, in addition to high sensitivity, it allows determining whether the patient is
201 sensitive to anti-TB drugs and useful for finding extra pulmonary TB [14]

202 The cases did not always know whether they were under DOTS treatment or not, but all the
203 cases could luckily quit taking medicine regardless of the obvious delay of diagnosis. Around
204 80 % of the cases were farmer, and around 30 % graduated elementary school alone, hence
205 their income was lower than the controls. Low income and low education are reportedly
206 associated with TB infection [4, 23-25]. They also had lost the chance of BCG injection. This
207 occupation was also extracted as a risk by the MLR. However, the MLR extracted high
208 income as a risk as well. Such a result is not always in accordance with several studies [4,
209 23-25], whereas it is conceivable that people with high income, regardless of their occupation,
210 had more chances to live and/or work at the places with a lot of people where a risk of TB
211 transmission was supposed to be high. The number was small but only cases had a chance to
212 close contact with TB patients. TB contact was absolutely the risk of TB transmission [18, 26].
213 No significant difference in the rate of “smoking” by the MA, but the MLR extracted
214 “smoking” as a risk to be the case. This is in good accordance with the previous report [23]. It
215 is natural that the cases “source of TB information” was medical staff, but the cases were not
216 always eager to collect information from other sources comparing with the controls. All the
217 items related living condition was significantly different between the cases and the controls
218 by the MA. Among them, the MRL extracted “small number of the person in the room”,

219 “ceramic floor”, “sunlight in the house”, and “ventilation in the house” as protective.
220 Importance of good ventilation was emphasized elsewhere [3, 23]. Excluding “work when
221 unwell”, their attitudes displayed significant differences between the cases and the controls by
222 the MA. “Share the dish” and “drink from the same glasses/bottles” were not extracted by the
223 MLR. Instead, “work when unwell” was extracted as well as “wash hands before eating” and
224 “wash hands after blow”. These findings may be a reflection that TB is airborne. In general,
225 the cases were not aware of danger in their attitudes, which was in good accordance with
226 previous reports [10-12].
227 Both of the cases and the controls did not recognized “dyspnea” and “chest pain” as TB
228 symptoms. Significant differences existed, but “long lasting sub fever” was also not
229 considered as TB symptoms. “dyspnea”, “chest pain” and “long lasting sub fever” were less
230 frequent than “cough with sputum”, “malaise” and so on but number of the cases complaint
231 them. Thus, it seems necessary to let the people know the TB symptoms [10-12].
232 TB itself was recognized to be dangerous both by the cases and the controls, but they did not
233 recognize its dangerousness at work places. Many of the cases were farmers; hence it seems
234 less possible to spread TB than workers. However, TB positive workers can work and be able
235 to transmit TB to their colleagues. Comparing with the rate of both the cases and the controls

236 who thought “having TB was a shame”, that of “wanted to hide having TB” was less. It seems
237 natural that more controls who did not receive TB treatment believed that TB was “affected
238 relationship with others” and wanted to “live isolated in case of TB” than the cases. DOTS
239 performed under the governmental hospitals and health centers were free [9], but some cases
240 visiting private hospitals/clinics had to pay the treatment fee. Higher rate of “HIV positive
241 people should be concerned about TB” in the control was reflection that they were more eager
242 to collect information than the cases. HIV infection reportedly affected TB infection [27].
243 However, the number who believed “TB was hereditary” was not different between two
244 groups.
245 Some aspects underlying the low coverage CDR are problems of socioeconomic,
246 education/knowledge and stigma [4]. Economic conditions will affect the public in getting not
247 only good environmental home conditions but also the excellent level of education. The level
248 of education in this study was relatively low because many people only finished elementary
249 school where sufficient TB education was impossible. Poor education will cause shortage of
250 knowledge about TB, leading the public into embarrassment and sometimes attitude to hide
251 their disease if they exposed to TB. Such conditions may cause the delay for some people to
252 go to the health service [18]. As a result, TB was spread among the farmers even when their

253 contact was not always intense like workers. It is very difficult to change occupation, income
254 and housing condition, immediately. Thus, community based TB education is very important.
255 It may be useful to educate and expose not only public but also private practitioners to the
256 community based TB program [9, 28].
257 Some cases were not dependent on the free DOTS program. To inform the existence of this
258 program is also a good education. Utilization of this program not only reduces multi-drug
259 resistant TB, but also helps reducing out-of-pocket expenses to patients [27]. Number of
260 syndromes of the cases absolutely indicated the delay of diagnosis.
261 The classic symptoms of TB are fever, cough and weight loss, but they are non-specific and
262 can be mimicked by other conditions, including malignancy and other pulmonary infections.
263 That is, in an early stage, such syndromes are not always specific to TB. However,
264 importance of these classic lung related syndromes should be aware that they are possible
265 signs of initiation of TB expansion [29].
266

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

1. WHO. Systematic Screening for active TB. WHO: World Health Organization, 20 Avenue Appia, 1211 Geneva 27 Switzerland, 2013.
2. Bauer, M., A. Leavens, and K. Schwartzman, A systematic review and meta-analysis of the impact of tuberculosis on health-related quality of life. Qual Life Res. 2013; 22: 2213-35.
3. Saxena, S., V. Karkhanis, and J.M. Joshi, Tuberculosis prevention: an enigma worth unravelling. Indian J Tuberc. 2012; 59: 65-7.
4. Wu, J. and K. Dalal, Tuberculosis in Asia and the pacific: the role of socioeconomic status and health system development. Int J Prev Med. 2012; 3: 8-16.
5. WHO. Global Tuberculosis Report 2012. WHO, 20 Avenue Appia, 1211–Geneva–27, Switzerland, 2012:11.
6. Ministry of Health , R.I. Current Report of Development of Tuberculosis in Indonesia January-December 2012. Ministry of Health Republic Indonesia: Jakarta, Indonesia, 2012.
7. Ministry of Health , R.o.I. Profile of Health Data of Indonesia in 2011. Ministry of Health of The Republic of Indonesia: Jakarta, Indonesia. 2012,
8. Health Department , S.D. Reported TB Cases in Semarang District, 2011. Semarang District, Central Java, Indonesia.2011.
9. Ministry of Health, R.O.I, Directorate General of Disease Control and Environmental Health National. Strategy for Controlling TB in Indonesia 2010-2014. Republic Of Indonesia Health Ministry Directorate General of Disease Control and Environmental Health , Jakarta, 2011.
10. Notoatmodjo, S. Health promotion and behavioral sciences. Jakarta: Rineka Cipta. 2007.
11. Tasnim, S., A. Rahman, and F.M. Hoque, Patient's Knowledge and Attitude towards Tuberculosis in an Urban Setting. Pulm Med. 2012; 2012: 352850.
12. Buregyeya, E., et al., Tuberculosis knowledge, attitudes and health-seeking behaviour in rural Uganda. Int J Tuberc Lung Dis. 2011; 15: 938-42.
13. Raj S. Bhopal, A.B.a.J.U.P.o.P.H., et al., Concepts of Epidemiology, an itegrated introduction to the ideas, theories, principles and methods of epidemiology. 2002, United States,New York: Oxford University.
14. Health Minister of The Republic of Indonesia, N.M.S.V. Tuberculosis Control

306 Guidelines. Health Minister of The Republic of Indonesia Jakarta, Indonesia, 2009.
307 15. Ahmad, R.A., et al., Diagnostic delay amongst tuberculosis patients in Jogjakarta
308 Province, Indonesia is related to the quality of services in DOTS facilities. Trop Med
309 Int Health. 2011; 16: 412-23.
310 16. Dye, C., Tuberculosis 2000-2010: control, but not elimination. Int J Tuberc Lung Dis.
311 2000; 4: S146-52.
312 17. Reid, M.J. and N.S. Shah, Approaches to tuberculosis screening and diagnosis in
313 people with HIV in resource-limited settings. Lancet Infect Dis. 2009; 9: 173-84.
314 18. Yang, Y.R., et al., Evaluation of the tuberculosis programme in Ningxia Hui
315 Autonomous region, the People's Republic of China: a retrospective case study. BMC
316 Public Health. 2012; 12: 1110.
317 19. Batra, S., et al., Childhood tuberculosis in household contacts of newly diagnosed TB
318 patients. PLoS One. 2012; 7: e40880.
319 20. Jensen, P.A., Centers for Disease Control and Prevention (U.S.), and National Center
320 for HIV STD and TB Prevention (U.S.), Guidelines for preventing the transmission of
321 Mycobacterium tuberculosis in health-care settings, 2005. MMWR recommendations
322 and reports. 2005, Atlanta, GA: U.S. Dept. of Health and Human Services, Public
323 Health Service, Centers for Disease Control and Prevention. 141 p.
324 21. Kanaya, A.M., D.V. Glidden, and H.F. Chambers, Identifying pulmonary tuberculosis
325 in patients with negative sputum smear results. Chest. 2001; 120: 349-55.
326 22. Sarmiento, O.L., et al., Assessment by meta-analysis of PCR for diagnosis of
327 smear-negative pulmonary tuberculosis. J Clin Microbiol. 2003; 41: 3233-40.
328 23. Oxlade, O. and M. Murray, Tuberculosis and poverty: why are the poor at greater risk
329 in India? PLoS One. 2012; 7: e47533.
330 24. Shen, X., et al., Tuberculosis in an urban area in China: differences between urban
331 migrants and local residents. PLoS One. 2012; 7: e51133.
332 25. Clark, M., P. Riben, and E. Nowgesic, The association of housing density, isolation
333 and tuberculosis in Canadian First Nations communities. Int J Epidemiol. 2002; 31:
334 940-5.
335 26. Sacchi, F.P.C., et al., Sugar cane manufacturing is associated with tuberculosis in an
336 indigenous population in Brazil. Transactions of the Royal Society of Tropical
337 Medicine and Hygiene. 2013; 107: 152-157.
338 27. Ismail, I. and A. Bulgiba, Determinants of unsuccessful tuberculosis treatment
339 outcomes in Malaysian HIV-infected patients. Prev Med. 2013; 57: S27-30.

28. Artawan Eka Putra, I.W., et al., Factors associated to referral of tuberculosis suspects by private practitioners to community health centres in Bali Province, Indonesia. BMC Health Serv Res. 2013; 13: 445.
29. Davies, P.D.O., P.F. Barnes, and S.B. Gordon, Clinical tuberculosis. 4th ed. 2008, London: Hodder Arnold

Figure 1. TB symptoms

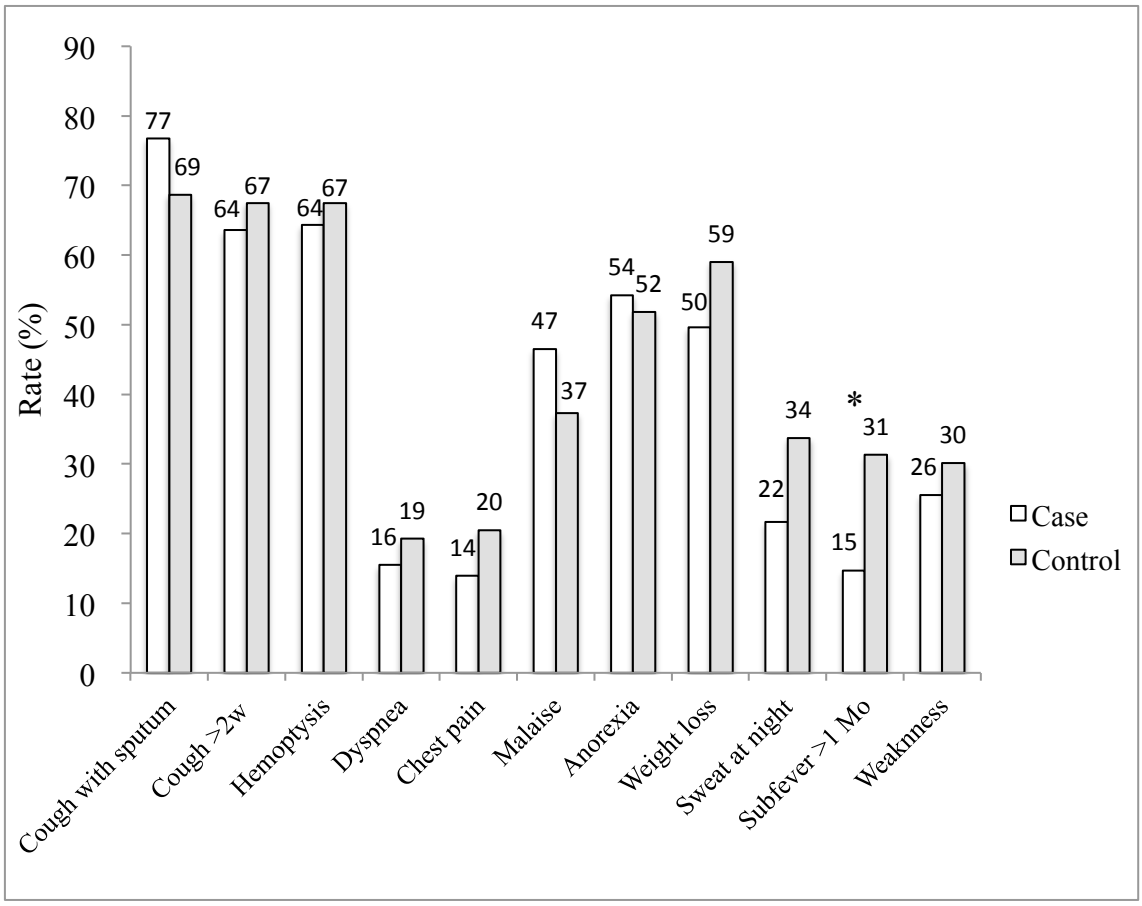

Figure 2. **The way to avoid getting TB**

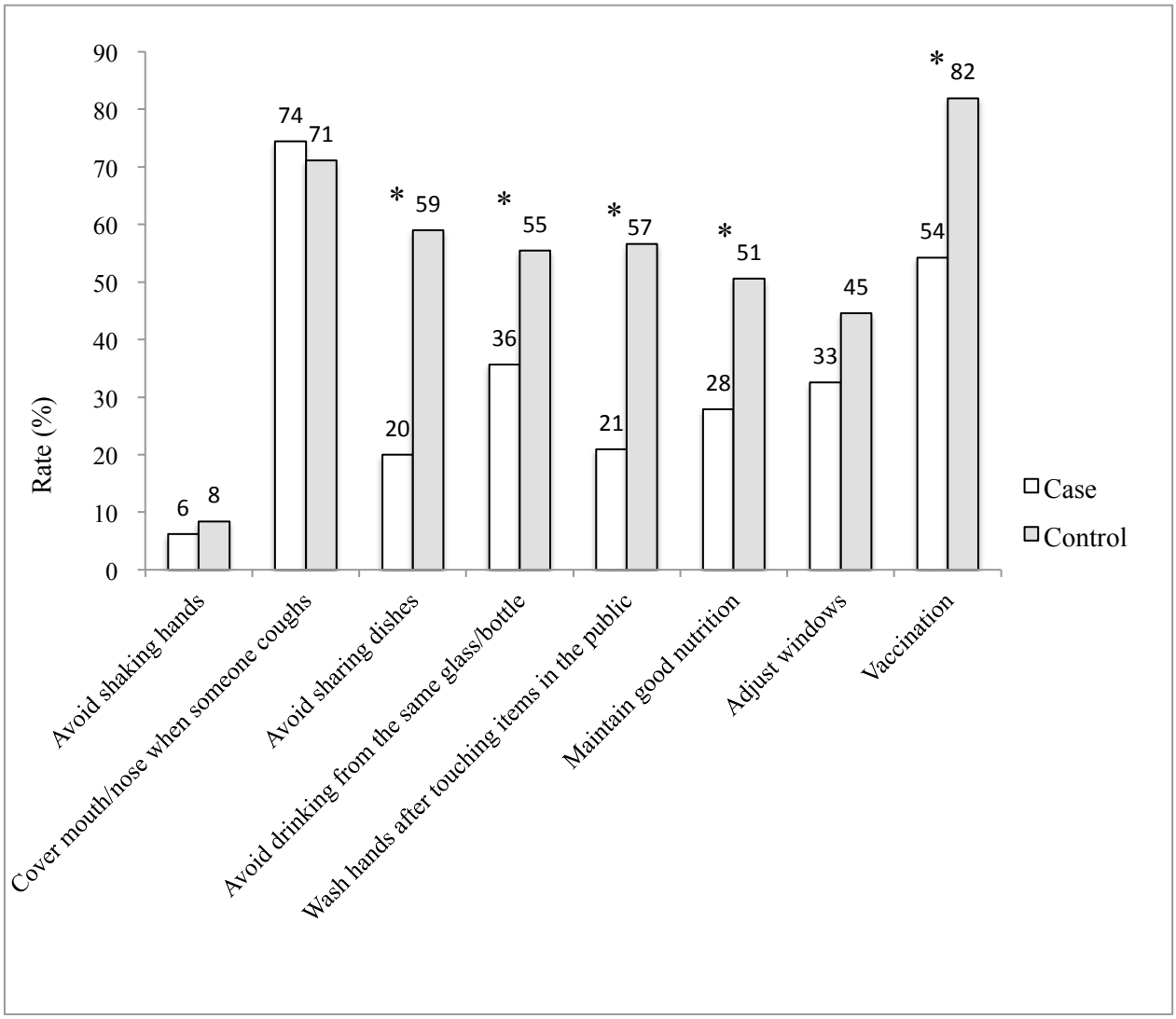

Figure legends

Fig.1

Differences in the knowledge about TB symptoms between the cases and controls (multiple answer). *Significant differences ($\rho < 0.05$, χ^2 test and Student's t-test).

Fig. 2

Differences in the way that the cases and controls thought it good to avoid getting TB *Significant differences ($\rho < 0.05$, χ^2 test).

Table 1. Demographic characteristics of the cases and control

	Cases		Controls	
	N	%	N	%
Total	129		83	
Gender				
Male	65	*50*	40	*48*
Female	64	*50*	43	*52*
Occupation*				
Farmer	101	*78*	31	*37*
Others	28	*22*	52	*63*
Education*				
Elementary school	38	*29*	8	*10*
Jr high school	59	*46*	32	*39*
High school or higher	32	*25*	43	*52*
Origin				
Rural	106	*82*	70	*84*
Urban	23	*18*	13	*16*
Have you ever had BCG?*				
Yes	33	*26*	46	*55*
No	30	*23*	21	*25*
Don't know	66	*51*	16	*19*
Close contact with TB patients*				
Yes	18	*9*	0	*0*
No	111	*86*	83	*100*
Smoking				
No	41	*32*	34	*41*
No, but family smokes	45	*35*	28	*34*
Yes	44	*34*	21	*25*
Pet				
Yes	67	*52*	34	*41*
No	62	*48*	49	*59*
Income*				
<100	96	*74*	38	*46*
100-150	19	*15*	31	*37*
>150	14	*11*	14	*17*
Source of TB information (multiple answer)				
Broadcast[#]	74	*57*	64	*77*
Billboards[#]	10	*8*	20	*24*
Newspaper[#]	18	*14*	23	*28*
Medical[#]	89	*69*	37	*45*
Acquaintance[#]	9	*7*	24	*29*
Teacher[#]	6	*5*	25	*30*

Average age of the case and control (Mean ± SD) was 41.2 ± 15.3 and 35.7 ± 11.7, respectively, and the difference was significant ($\rho < 0.05$, Students' t-test).

*Significant difference in the rate of answers between the case and the control ($\rho < 0.05$, χ^2 test).

[#]For multiple answer questions, the difference in the rate of each source was examined using χ^2 test. The case and control displayed significant differences in all sources ($\rho < 0.05$).

Table2. The way of diagnosis and symptoms

	N	%
Location of diagnosis		
Health center	147	78
Private clinic	31	16
Others	12	6
Way of diagnosis		
No clinical examination	20	11
Smear alone	38	20
Smear, X-ray	134	69
Symptoms (multiple answer)		
Cough with sputum	125	65
Cough >2w	123	64
Hemoptysis	76	40
Dyspnea	86	45
Chest pain	62	32
Malaise	108	56
Anorexia	108	56
Weight loss	107	56
Sweat at night	76	40
Subfever >1 Mo	73	38

Mantoux test was utilized only in 2 cases. The mean ± SD of complaints/ person was 7.5 ± 2.3, whereas that of the controls only have 1.0 ± 1.7 ($\rho < 0.05$, Students' t-test.)

Table3. Information related to treatments of the cases

	N	%
Was treatment made under DOTS?		
Yes	80	62
No	14	11
Don't know	35	27
Who was a supervisor ?[a]		
Family	86	67
Medical Service	67	52
None	9	7
Was treatment free of charge?		
Yes	80	62
No	33	26
Don't know	16	12
How long was the duration of treatment?		
<6 Mo	7	5
6Mo	112	87
>6Mo	10	8
How frequent do you take medication within first 2 Mo?		
Everyday	80	62
1x/week	35	27
Longer	14	11
How many kinds of drugs did you take?		
2	19	15
3	34	26
4	70	54
5	6	5
Were you suffered from side effects?		
+	70	54
Which examinations were utilized during treatment ?[b]		
Sputum smear	104	81
Chest X-ray	79	61
Sputum culture	11	8.5
Mantoux test	11	8.5
Distance to the health center		
≤5 min	85	66
≤30 min	21	16
Longer	26	18

[a]35 cases were supervised both by family and medical staff.

[b]76 cases were subjected more than 2 examinations.

Table 4.Comparison in living condition of the participants

	Cases		Controls	
	N	%	N	%
Number of person in the same room*				
1	15	*12*	10	*12*
2	84	*65*	72	*87*
>3	30	*23*	1	*1*
House floor*				
Soil	35	*27*	2	*2*
Plaster	49	*38*	18	*22*
Ceramics	45	*35*	63	*76*
Location of kitchen*				
Outside	51	*40*	60	*72*
Inside	78	*60*	23	*28*
Fuel for cooking*				
Cordwood	52	*40*	8	*10*
Gas	77	*60*	75	*90*
Window in each room*				
Yes	52	*40*	8	*10*
No	77	*60*	75	*90*
Open windows every day*				
Yes	43	*33*	60	*72*
No	86	*67*	23	*28*
Sunlight into the house*				
Yes	66	*51*	76	*92*
No	63	*49*	7	*8*
Ventilation in every room*				
Yes	50	*39*	75	*90*
No	79	*61*	8	*10*
Humidity in the house*				
Humid	84	*65*	17	*20*
Not humid	45	*35*	66	*80*

*Significant difference between the cases and the controls ($\rho < 0.05$, χ^2 test).

Table 5. The differences in attitudes that the participants usually do

	Cases		Control	
	N	%	N	%
Do you wash your hands before eating?*				
Yes	45	*35*	63	*76*
Sometimes	72	*56*	18	*22*
No	12	*9*	2	*2*
Do you eat from the same dish with others?*				
Yes	11	*9*	8	*10*
Sometimes	86	*67*	28	*33*
No	32	*25*	47	*57*
Do you drink from the same glasses/bottles with others?*				
Yes	7	*5*	9	*11*
Sometimes	92	*71*	35	*42*
No	30	*23*	39	*47*
Do you wash your hands after blowing?*				
Yes	25	*19*	40	*48*
Sometimes	69	*53*	32	*39*
No	35	*27*	11	*13*
Do you work when you are unwell?				
Yes	23	*18*	25	*30*
Sometimes	78	*60*	40	*48*
No	28	*22*	18	*22*

*Significant difference between the cases and the controls ($\rho < 0.05$, χ^2 test).

Table 6. Multiple logistic regression analysis using case/control as the dependent valuable and living status as determinants

	Comparison	Reference	Odds	P	(95 % CI)	
Occupation						
	Workers	Farmers	0.05	<0.01	0.00	0.20
	Others	Farmers	0.05	0.01	0.00	0.54
Close contact with TB patients						
	No	Yes	0.00	0.02	0.00	0.49
BCG						
	Yes	Don't know	0.04	<0.01	0.00	0.32
Smoking						
	No	Yes	0.14	0.04	0.01	0.92
Income ($/Mo)						
	100-150	<100	0.05	<0.01	0.00	0.33
	100-150	>150	0.08	0.04	0.01	0.89
Person/room						
	1	≥3	0.00	<0.01	0.00	0.35
	2	≥3	0.00	<0.01	0.00	0.27
Wash hands before eating						
	Yes	Sometimes	0.06	<0.01	0.01	0.32
Wash hands after blow						
	Sometimes	No	0.06	0.01	0.01	0.46
Work when unwell						
	No	Yes	0.09	0.02	0.00	0.66
Floor						
	Ceramics	Soil	0.06	0.04	0.00	0.90
Sunlight in the house						
	Yes	No	0.06	0.02	0.00	0.67
Ventilation in the house						
	Yes	No	0.02	<0.01	0.00	0.24

Source of TB information (multiple answer) was excluded because this information was modified by consultation of the cases to the health center. Among determinants, age class, gender, education, pet, share the dishes, drink from the same bottle/glass, location of kitchen, fuel for cooking, open the window everyday, and humidity in the house were not selected.

Table 7. Differences in the opinion against TB between the cases and controls

	Cases		Controls	
	N	%	N	%
Do you think that TB is serious?				
Yes	91	*71*	67	*81*
No	2	*2*	3	*4*
Don't know	36	*28*	15	*18*
Do you think that TB is serious at work places?				
Yes	46	*36*	34	*41*
No	14	*11*	10	*12*
Don't know	69	*53*	39	*47*
Does TB affect your work performance?				
Yes	51	*40*	43	*52*
Not always	60	*47*	29	*35*
No	18	*14*	11	*13*
Do you be ashamed of having TB?				
Yes	49	*38*	22	*27*
No	53	*41*	35	*42*
Don't know	27	*21*	26	*31*
Do you want to hide having TB?*				
Yes	14	*11*	10	*12*
Not always	74	*57*	30	*36*
No	41	*32*	43	*52*
Does TB affect relationship with others?*				
Yes	20	*16*	36	*44*
Not always	72	*56*	35	*42*
No	37	*29*	12	*14*
Does TB affect family responsibilities?				
Yes	58	*45*	41	*49*
Not always	53	*41*	35	*42*
No	18	*14*	7	*8*
Will you want to live isolated due to having TB?*				
Yes	5	*4*	12	*14*
Not always	43	*33*	25	*30*
No	81	*63*	46	*55*
How do you feel about the person with TB?				
Desire to help	94	*73*	59	*71*
Want to stay away	28	*22*	20	*24*
No particular feeling	7	*5*	4	*5*
Is TB treatment very costly?*				

Yes	32	*25*	42	*51*
Not always	44	*34*	21	*25*
No	53	*41*	20	*24*
Do you think that HIV positive people should concern about TB?*				
Yes	23	*18*	39	*47*
Not always	79	*61*	30	*36*
No	27	*21*	14	*17*
Do you think that TB is hereditary				
Yes	30	*23*	24	*29*
No	79	*61*	47	*57*
Don't know	20	*16*	12	*14*

*Significant difference between the cases and the controls ($\rho < 0.05$, χ^2 test).