Brief Report

The role of village doctors on tuberculosis control and the DOTS strategy in Shandong Province, China

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Summary **This study aims to assess the knowledge, attitudes, and practices of village doctors based on current national policies and to explore factors determining their roles in the directly observed therapy, short course (DOTS) strategy and tuberculosis (TB) control in rural China. In this cross-sectional study conducted in Shandong Province, we interviewed a total of 1,824 village doctors from 36 villages using a semi-structured questionnaire that included demographic characteristics, knowledge of TB treatment and current policies related to TB prevention and control, attitudes towards TB patients, and practices of educating rural residents, detection of TB cases, and supervision of patients. Results indicated that most village doctors underwent a training program and were willing to receive additional training while almost half recognized that their current knowledge was insufficient to meet the demands of their work. Village doctors implemented health education regarding TB control in a variety of forms for rural residents. Some practices of village doctors were inappropriate and remain so. In conclusion, this study revealed the need to provide sufficient, practical, and feasible training programs in order to administratively regulate the practices of village doctors and the need to enrich the content of incentives with increased financial subsidies.**

Keywords: Tuberculosis, DOTS, Village doctors, Management, Health education, China

1. Introduction

China has the second highest incidence of tuberculosis worldwide. Approximately one-third of the total population has been infected with Mycobacterium Tuberculosis. Among the infected population, 10% will develop the disease. The prevalence of smear-positive and infective tuberculosis (TB) is reported to be 121.6/100,000 and 157.8/100,000, respectively. According to a news release from the Ministry of Health of China, active TB patients number 450 million, of which 150 million are infective cases, and about 13 million annually die from the disease (*1*). The drug resistance rate is as high as 28%. Moreover, in terms of geography and socioeconomics, 85% of TB patients live in rural areas, where the prevalence of smear-positive and infective TB is much higher than in urban areas. TB is the first attributor to the vicious circle of illness and poverty among rural residents. Therefore, TB control in rural areas is an urgent priority for China.

Since the 1990s, the Chinese government has launched a series of projects directed at TB involving the use of directly observed therapy, short course (DOTS). The government provides free treatment for patients. DOTS coverage has reached 100%, and the case detection and treatment success rate has surpassed the goal of 70% and 85% at the global level (*2,3*). On the other hand, however, there is still a gap between national policies and actual practices. Because of the long duration of treatment, patients tend to discontinue that treatment, resulting in failure to cure the disease.

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In the DOTS strategy, village doctors are responsible for implementing health education in the community in order to promptly detect symptomatic TB patients and provide direct referral to an appropriate facility and in order to supervise and manage the drug use and treatment of patients in rural areas. They have to promptly report inappropriate drug use, discontinuation, and side effects occurring in patients to attending physicians at higher level health care facilities. In order to improve patients' adherence to treatment and improve the attitudes of village doctors, economic incentives such as bonuses for case detection and patient supervision have been introduced as part of the current national policies. The management by village doctors and effects of incentives in their work need to be systematically investigated in order to assist policymakers with their decision-making. The objectives of this study are to assess the knowledge, attitudes, and practices of village doctors based on current national policies and to explore factors determining their roles in the DOTS strategy and TB control.

2. Methods

A cross-sectional study was conducted from October to November 2007 in Shandong Province. A stratified-cluster random sampling was used to recruit participants, *i.e.* village doctors. First, based on GDP per capita, 17 districts in Shandong Province were divided into three categories, well-developed, middle developed, and less developed, and one district was selected from each category. Then, two counties from each district were selected for a total of six villages from each county. All registered village doctors in the 36 villages that were ultimately selected were interviewed with a structured questionnaire. The sample size was 1,824 in total. The content of the questionnaire included demographic characteristics, knowledge of TB treatment and current

Table 1. Demographic characteristic of the surveyed village doctors (n = 1,824)

		Frequency	%
Age	20 ~ 35	601	32.9
	35 ~ 50	723	39.6
	50 ~ 65	482	26.4
	65 ~ 80	18	1.0
Gender	Male	1,483	81.3
	Female	341	18.7
Education	Middle school and below	259	14.2
	High school or technical school	267	14.6
	Secondary medical school	1,229	67.4
	Junior medical college and above	69	3.8
Working years	0 ~ 10	640	35.1
	10 ~ 20	588	32.2
	20 ~ 30	311	17.1
	30 ~ 40	244	13.4
	40 ~ 50	41	2.2
Position level	Village doctor	235	12.9
	Assistant doctor	846	46.4
	Doctor and above	743	40.7
Major	Clinical medicine	1,655	90.7
	Public health	59	3.2
	Nursing	32	1.8
	Others	78	4.3
Income per month	Less than 1,000 RMB	1,465	80.3
	1,000 ~ 2,000 RMB	340	18.6
	2,000 ~ 3,000 RMB	19	1.0
Training experience	Yes	1,479	81.1
	No	345	18.9
Knowledge meeting the needs in the work	Yes	976	53.5
	No	848	46.5
Willingness for further training	Yes	1,463	80.2
	No	361	19.8
Free treatment for TB patients	Yes, I know	1,551	85.0
	No, I don't know	273	15.0
Incentive policy	Yes, I know	1,366	74.9
	No, I don't know	458	25.1

policies related to TB prevention and control, attitudes towards TB patients, and practices of educating villagers, TB case detection, and supervision of patients.

Interviewers were trained, a pilot study was conducted, and a guideline for field work was drafted ahead of time in order to coordinate experts from the Shandong Province Tuberculosis Prevention Center in the field work. Questionnaire development and data entry checking were also done in order to ensure the quality of the study.

Descriptive analysis, univariate tests including a Chi-square test and Kruskal-Wallis H test, was performed and a logistic regression model was constructed with SPSS 13.0 for Windows in order to determine factors influencing the village doctors' practices related to TB prevention and treatment in the rural community, including health education of rural residents, TB case detection, and supervision & management of TB patients. $p < 0.05$ was considered to indicate statistical significance.

Shandong University approved this study and ethical permission was obtained. All participants were informed about the study procedures and the study was conducted after their informed consent was obtained

3. Results and Discussion

3.1. *Demographic characteristic, training, and knowledge of related policies*

Table 1 is a summary of demographic characteristics, training and knowledge of related policies of the village doctors surveyed. The average age of village doctors was 42.14 years. Most participants (71.2%) had an educational background of secondary medical school or higher. Average work experience was 17.88 years, and 87.1% of village doctors were an assistant doctor or above. Of all of the village doctors, 90.9%

Table 2. Factors associated with health education provision (n = 1,824)

		Yes	No	Proportion of health education provision (%)	Univariate analysis[a]	Multivariate analysis[b]
Age	20 ~ 35	526	75	87.5	< 0.001	0.003
	35 ~ 50	567	156	78.4		
	50 ~ 65	407	75	84.4		
	65 ~ 80	14	4	77.8		
Education	Middle school and below	190	69	73.4	< 0.001	NS
	High school or technical school	230	37	86.1		
	Secondary medical school	1,031	198	83.9		
	Junior medical college and above	63	6	91.3		
Working years	0 ~ 10	545	95	85.2	0.001	0.002
	10 ~ 20	458	130	77.9		
	20 ~ 30	260	51	83.6		
	30 ~ 40	216	28	88.5		
	40 ~ 50	35	6	85.4		
Position level	Village doctor	219	16	93.2	< 0.001	NS
	Assistant doctor	703	143	83.1		
	Doctor and above	592	151	79.7		
Major	Clinical medicine	1,389	266	83.9	< 0.001	NS
	Public health	32	27	54.2		
	Nursing	21	11	65.6		
	Others	72	6	92.3		
Income per month	Less than 1,000 RMB	1,217	248	83.1	NS	
	1,000 ~ 2,000 RMB	284	56	83.5		
	2,000 ~ 3,000 RMB	13	6	68.4		
Training experience	Yes	1,372	107	92.8	< 0.001	< 0.001
	No	142	203	41.2		
Knowledge meeting the needs in the work	Yes	837	139	85.8	0.001	NS
	No	677	171	79.8		
Willingness for further training	Yes	1,285	178	87.8	< 0.001	< 0.001
	No	229	132	63.4		
Free treatment for TB patients	Yes, I know	1,326	225	85.5	< 0.001	0.013
	No, I don't know	188	85	68.9		
Incentive policy	Yes, I know	1,246	120	91.2	< 0.001	< 0.001
	No, I don't know	268	190	58.5		

[a] Chi-square test; [b] Multiple logistic regression test; NS = no significant.

specialized in clinical medicine. Average monthly income was 856.66 RMB (approximately 128 US dollars). Regarding occupational training in TB control and treatment, 81.8% of village doctors underwent a training program while nearly half recognized that their current knowledge was insufficient to meet the demands of their work. Most village doctors were familiar with national policies such as free treatment for TB patients and economic incentives for case detection, management, and supervision. Nonetheless, most participants were still willing to receive additional training in the future. The fact that almost half considered their current knowledge to be insufficient for their work represents an obstacle to providing adequate health care services to patients. According to the interviews, most participants were willing to improve their knowledge of prevention, early detection, and management of TB cases. Improving their knowledge of TB is crucial to increasing direct referrals to TB specialists and promptly detecting symptomatic TB patients (*4*).

3.2. *Role of village doctors in health education, case detection, and supervision*

Of village doctors surveyed, 83.0% provided an educational program on TB prevention for patients and rural residents. The main methods of education included distribution of pamphlets, verbal announcements, village broadcasts, and bulletins. Among those 1,514 village doctors, 86.5% informed rural residents of the typical symptoms of TB, 82.3% informed them of national policies such as free diagnosis and treatment, 70.1% informed them of correct practices for sterilization, 69.4% informed them about quarantines, 56.6% informed them of clinical practices for treatment, and 42.5% informed them of methods and times for sputum sample collection.

Table 3. Factors associated with TB case finding (n = 1,824)

		Yes	No	Proportion of TB case finding (%)	Univariate analysis[a]	Multivariate analysis[b]
Age	20 ~ 35	157	444	26.1	< 0.001	< 0.001
	35 ~ 50	343	380	47.4		
	50 ~ 65	177	305	36.7		
	65 ~ 80	8	10	44.4		
Education	Middle school and below	119	140	45.9	0.007	NS
	High school or technical school	108	159	40.4		
	Secondary medical school	431	798	35.1		
	Junior medical college and above	27	42	39.1		
Working years	0 ~ 10	204	436	31.9	< 0.001	< 0.001
	10 ~ 20	267	321	45.4		
	20 ~ 30	117	194	37.6		
	30 ~ 40	81	163	33.2		
	40 ~ 50	16	25	39.0		
Position level	Village doctor	53	182	22.6	< 0.001	< 0.001
	Assistant doctor	328	518	38.8		
	Doctor and above	304	439	40.9		
Major	Clinical medicine	587	1,068	35.5	< 0.001	NS
	Public health	42	17	71.2		
	Nursing	15	17	46.9		
	Others	41	37	52.6		
Income per month	Less than 1,000 RMB	549	916	37.5	0.03	NS
	1,000 ~ 2,000 RMB	129	211	37.9		
	2,000 ~ 3,000 RMB	7	12	36.8		
Training experience	Yes	528	951	35.7	0.001	NS
	No	157	188	45.5		
Knowledge meeting the needs in the work	Yes	373	603	38.2	NS	
	No	312	536	36.8		
Willingness for further training	Yes	573	890	39.2	0.004	0.001
	No	112	249	31.0		
Free treatment for TB patients	Yes, I know	625	926	40.3	< 0.001	< 0.001
	No, I don't know	60	213	22.0		
Incentive policy	Yes, I know	502	864	36.7	NS	
	No, I don't know	183	275	40.0		

[a] Chi-square test; [b] Multiple logistic regression test; NS = no significant.

Of 1,824 village doctors, 685 had detected TB cases or quasi-cases since 2006. They identified a total of 1,331 cases, of which 1,212 were referred to a higher health care facility and 834 cases were definitively diagnosed. Among these 685 village doctors, 90.9% referred cases or quasi-cases to a specialized TB dispensary, 6.7% referred them to a hospital, 0.6% treated the case themselves, and 1.8% took other measures.

Of all of the village doctors surveyed, 660 had supervised patients since 2006. The average duration of that supervision was 11 days per case. Regarding the site of supervision, 25.3% supervised patients at a village health care center, 74.1% at the patient's home, and 0.6% at another location. Only 31.7% of these village doctors had charged for drugs or inappropriately ordered the family or other individuals to keep the drugs. A total of 1,012 patients had been supervised since 2006, of which 19% failed to continue to adhere to the course of the treatment ordered.

Factors associated with provision of educational programs, case detection, and supervision by village doctors were input into a logistic regression model. Independent factors contributing to practices were identified as age, work experience (in years), training, willingness to receive further training, and knowledge of free treatment for TB patients, suggesting that adequate training programs will help these village doctors to provide adequate services in a rural community (Tables 2-4).

Since DOTS coverage has quantitatively reached 100%, the new issue for policymakers is the provision of quality TB care. The role of village doctors is crucial to the improvement of DOTS quality and TB control in rural areas. Most participants provided health education in various styles in the community. However, this study also found inappropriate practices in terms of patient referrals after case detection and supervision of patient

Table 4. Factors associated with supervision and management (n = 1,824)

		Yes	No	Proportion of supervision & management (%)	Univariate analysis[a]	Multivariate analysis[b]
Age	20 ~ 35	151	450	25.1	< 0.001	< 0.001
	35 ~ 50	329	394	45.5		
	50 ~ 65	172	310	35.7		
	65 ~ 80	8	10	44.4		
Education	Middle school and below	118	141	45.6	0.002	NS
	High school or technical school	106	161	39.7		
	Secondary medical school	412	817	33.5		
	Junior medical college and above	24	45	34.8		
Working years	0 ~ 10	197	443	30.8	< 0.001	< 0.001
	10 ~ 20	254	334	43.2		
	20 ~ 30	121	190	38.9		
	30 ~ 40	71	173	29.1		
	40 ~ 50	17	24	41.5		
Position level	Village doctor	45	190	19.1	< 0.001	NS
	Assistant doctor	319	527	37.7		
	Doctor and above	296	447	39.8		
Major	Clinical medicine	561	1094	33.9	< 0.001	NS
	Public health	40	19	67.8		
	Nursing	18	14	56.2		
	Others	41	37	52.6		
Income per month	Less than 1,000 RMB	524	941	35.8	NS	
	1,000 ~ 2,000 RMB	129	211	37.9		
	2,000 ~ 3,000 RMB	7	12	36.8		
Training experience	Yes	514	965	34.8	0.008	0.003
	No	146	199	42.3		
Knowledge meeting the needs in the work	Yes	367	609	37.6	NS	
	No	293	555	34.6		
Willingness for further training	Yes	560	903	38.3	< 0.001	< 0.001
	No	100	261	27.7		
Free treatment for TB patients	Yes, I know	602	949	38.8	< 0.001	< 0.001
	No, I don't know	58	215	21.2		
Incentive policy	Yes, I know	482	884	35.3	NS	
	No, I don't know	178	280	38.9		

[a] Chi-square test; [b] Multiple logistic regression test; NS = no significant.

drug use that negatively affected the quality of DOTS. Those practices should be corrected and improved by effective training programs and administrative directives.

3.3. *Incentives*

The purpose of introducing economic incentives as part of the current policy is to enhance the role of village doctors in rural TB control and detection and management of patients. However, this study failed to confirm that knowledge of economic incentives had a significant impact on case detection and supervision (Tables 3 and 4), suggesting that economic incentives did not affect village doctors as expected. In the interviews, most participants mentioned that while the current national policy on economic incentives was welcome the actual implementation in some counties was worrisome, which may hinder their attitude towards their work. Some participants felt that economic incentives should be increased with financial investment from the government and they also cited the importance of non-economic incentives as well. In that regard, non-economic incentives should be diverse, including individual awards, team or facility awards, promotions, more training opportunities, and commendations from the county or higher authorities. Based on the findings of this study, the government must seek to develop appropriate financial measures to enhance the role of village doctors since a shortage of financial subsidies accompanying the decentralization of health financing and lack of skill, equipment, and incentives causes a delay in case detection and prompt referral (*5*).

In conclusion, this study revealed the need to provide adequate and practical training programs to village doctors in order to administratively regulate their practices and the need to enrich the content of incentives for those doctors with increased financial subsidies and feasible models.

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