

DOTS in China – removing barriers or moving barriers?

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In 1992, China initiated its modern National TB Control Programme (NTP) with DOTS strategy through a project funded by a World Bank loan. Key motives for the revised NTP-DOTS were to reduce financial barriers to patients by removing fee charges for diagnosis and treatment, and to address regressive suppliers' incentives for appropriate referrals. This study aims to assess to what extent China's NTP subsidies are achieving the objective of removing financial barriers to care in terms of patients' expenditure.

One county with NTP-DOTS – Jianhu – and one county without – Funing – were selected. A cohort of 493 tuberculosis patients newly diagnosed in 2002 was interviewed by questionnaire. The main outcome measure was tuberculosis patients' expenditure on medical care and transportation/accommodation from the onset of symptoms to treatment completion. During the follow-up period, Funing started implementing NTP-DOTS, which offered a possibility of longitudinal comparison both between counties and within county.

Ninety-four per cent (465/493) of subjects were followed-up. The mean total patient's expenditure on TB medical care and transportation/accommodation before TB diagnosis was higher in Jianhu than in Funing (715 vs. 256CNY), whereas it was higher in Funing (835 vs. 157CNY) after diagnosis. After implementing NTP-DOTS in Funing, expenditure after diagnosis decreased slightly whereas expenditure before diagnosis increased remarkably.

We found that the market incentive structures in the reformed health system appear to have a stronger regressive effect and may result in prolonged delays before effective treatment can be given. We believe that doctors adapt to new incentive structures, with bonus income being linked to the hospitals' fee-for-service revenue, and find new ways of keeping revenue at the old levels, which reduce or eliminate the intended effect of the subsidies. TB patients suffer a heavy economic burden even in counties where NTP-DOTS treatment is subsidized. The total patient expenditure was reduced only marginally, but shifted substantially from after diagnosis to before diagnosis. The shift could imply delays in diagnosis and treatment with an increased risk of infection transmission.

Key words: China, tuberculosis, control programme, expenditure, access, health care financing, poverty

Introduction

The World Health Organization (WHO) has called China's National Tuberculosis Control Programme (NTP) with the DOTS strategy 'one of the most successful DOTS-programmes in the world' (WHO 2004). The NTP was revised in 1992 and a project funded by a World Bank loan and by the Ministry of Health (MOH) has since been implemented, covering 68% of China's rural counties in 2002 (WHO 2002). The UN Millennium Project Secretariat recently pointed to the need to address health systems aspects in the attempts to meet the millennium goals in combating AIDS, tuberculosis (TB) and malaria (Ruxin et al. 2005). The China NTP-DOTS project not only includes the DOTS treatment strategy, but also partial system reform.

The key obstacles to successful implementation of the NTP-DOTS were identified as financial barriers to diagnosis and treatment for the patients and regressive provider incentives reducing the motivation for appropriate referrals (World Bank 1991). The programme provides free or subsidized TB diagnosis and treatment to infectious TB patients diagnosed and treated in a County TB Dispensary (CTD). A bonus should be paid to the doctor in a general hospital who refers a suspected TB patient to the CTD. The system is called the Convergence Management System under NTP (Ministry of Health 1999a). It implies that only the CTD is authorized to provide TB diagnosis, treatment and case management. In counties not covered by a subsidized NTP-DOTS project, TB patients can be diagnosed and treated both at township and county hospitals, as well as at the CTD. However, subsidized treatment is not available in the

general health care system, i.e. village health station, township and county hospital, which are more convenient to visit for patients. The referral bonus is not given to village doctors, only to hospital doctors.

The China NTP-DOTS project funded by the World Bank has been credited with successfully diagnosing, treating and curing more patients than any other DOTS programme to date (China Tuberculosis Control Collaboration 2004). The prevalence rates of pulmonary, culture-positive and smear-positive TB have fallen by 32%, 37% and 32%, respectively, from 1991 to 2000, more in NTP-DOTS areas than in non-DOTS areas. For culture-positive cases, an estimated 30% reduction of prevalence was directly attributable to the NTP-DOTS (China Tuberculosis Control Collaboration 2004).

Still, the case detection rate of smear-positive TB in China is only 54% (Chen et al. 2002) in the NTP area and 38% for the whole country (WHO 2003), far below the WHO target of 70%. Few studies have examined the patients' actual economic burden for TB care (Needham et al. 1998; Lonroth et al. 2001). No studies have been reported from China on the impact of the partially reformed system. It has remained an unchallenged assumption that subsidized diagnosis and treatment result in free access to TB diagnosis and care.

TB is a disease closely related to poverty (Waalder 2002; Davies 2003). In poor rural areas in China, the TB prevalence is twice as high as that in economically developed urban areas (rural areas $397/10^5$, urban areas $198/10^5$), and the mortality of TB is nearly three times as high as in rural areas compared with urban areas (Ministry of Health 2002).

The objectives of this study are to describe and compare TB patients' actual expenditure for diagnosis and treatment, transport and accommodation in two rural counties, and to assess to what extent the NTP-DOTS subsidies are contributing towards removing financial barriers to TB care.

Methodology

Study design

A cohort study was conducted in two counties of Jiangsu Province, East China: Jianhu County, with an ongoing NTP-DOTS project, and Funing County, which initially did not have an NTP-DOTS project. All newly diagnosed and registered TB patients in the study counties from 1 January 2002 to 31 December 2002 were included in the study and were followed up until the completion of the 6-month treatment course. The population in Jianhu and Funing numbered 797 000 and 1 060 000, respectively (2001). The two counties had similar average income levels at about 3500CNY per rural resident (US\$1 = 8.3CNY). The two counties are in the upper-middle income level compared with the national average for the

rural population (2002: 2366CNY) (National Statistics Bureau 2002).

Both counties have a CTD, in parallel with the well-organized three-tier health system, responsible for TB case registration and reporting. The NTP criteria (Ministry of Health 1999a) for TB diagnosis follow the guidelines recommended by WHO/IUATLD (Harries et al. 1996). The NTP-DOTS strategy has been implemented in Jianhu since 1996. WHO/WPRO funded a programme with free TB care for smear-positive TB cases in 1996-98, which was followed by the MOH partially subsidized TB control programme until the end of the first 9 months of the study period. In the MOH programme, patients obtained TB diagnosis in the CTD through self-referral or physician referral from a general hospital. Smear-positive patients paid 140CNY to the CTD for the 6-month TB treatment course, which covered both the anti-TB drugs and 3-4 smear tests and chest X-ray examinations (CXR).

No subsidized and CTD-centralized NTP-DOTS project was available in Funing before this study. Patients, except those covered by health insurance, paid full cost for all TB related medical care. TB diagnosis and treatment were available at township, county and higher level hospitals as well as at the CTD. Confirmation of TB diagnosis, using the same criteria as NTP-DOTS, was done quarterly in the CTD based on the patients' medical charts, CXR films and smear slides. The confirmed TB patients were registered in the CTD.

From 18 September 2002, both Jianhu and Funing were assigned by the Chinese Government to implement a Canadian International Development Agency (CIDA) co-funded NTP-DOTS project. Both the MOH project and the CIDA project build on the five key components: government commitment, infectious case detection using smear microscopy, directly observed standardized short-course chemotherapy, uninterrupted supply of TB drugs and an effective monitoring system. The CIDA project, however, provides free diagnosis and free TB treatment to diagnosed infectious TB cases, in contrast with the subsidized TB treatment in the MOH NTP-DOTS (patient fee: 140CNY).

In Jianhu, due to the ongoing project implementation, no major system change occurred during the period of the study. But in Funing, the referral system had to be introduced; capacity building in TB diagnosis, treatment and case management was required, and provision of free TB diagnosis and care to infectious TB cases was introduced. Although information on the CIDA project was disseminated to the hospitals and village health stations through meetings organized by the local health authority, it was not possible to have the NTP-DOTS fully functional within the remaining 3 study months, with the exception of the provision of free anti-TB drugs to patients who obtained a smear-positive TB diagnosis. However, neither the MOH nor the CIDA project provided financial subsidies to symptomatic patients before they obtained a smear-positive TB diagnosis.

The introduction of the CIDA project in Funing during the study period was not anticipated. The effect will, however, tend to reduce any differences between the counties, thus this change is not considered a threat to the validity of the findings.

Data collection

All the cases were subject to four interviews, in Jianhu at the CTD and in Funing at the department of internal medicine of the township/county hospitals or at the CTD. A structured questionnaire was used which covered general demographic and socio-economic characteristics, disease history, care-seeking history and TB expenditure of subjects before and after diagnosis. The first interview was at the time of TB diagnosis, when patients' retrospective care-seeking history and TB expenditure before TB diagnosis were collected. The other three interviews were at the end of the first, second and sixth months of treatment, when patients' TB care experience and expenditure after diagnosis were followed up. The interviews were done by physicians, who underwent a 2-day training course beforehand. Patients' TB expenditure in this paper includes the expenditure for diagnosis and treatment at different levels of health facilities, and for accommodation and transportation to and from health facilities. Expenditure for other items, extra nutrition and payments or gifts for doctors were also collected. Considering that patients may not consistently volunteer such information, it was not included in the analysis.

Data analysis

The means, standard errors, medians and quartiles were used to describe the expenditure. Student's *t*-test was applied to test for difference in each item of patients' expenditure. When the sample size was reduced in the

stratified analysis, logarithm transformation was employed, considering the skewed distribution of expenditures. The adjusted differences in patients' expenditure between counties were generated through the General Linear Model after adjusting the potential confounding from age, gender, occupation, education, family annual income, medical insurance, smear result and haemoptysis.

Ethical approval

This study was approved by the IRB of the School of Public Health, Fudan University, China and the Ethics Committee of the Karolinska Institute, Sweden.

Results

Among all 493 newly diagnosed TB cases, 465 (94%) subjects returned for treatment and were followed-up, 98% (183/187) in Jianhu and 92% (282/306) in Funing. Among the 465 subjects receiving anti-TB treatment, 88% (161/183) of patients in Jianhu and 41% (115/282) of patients in Funing were diagnosed smear-positive. The completion rate of the 6-month treatment course was 95% (173/183) in Jianhu and 91% (258/282) in Funing ($\chi^2 = 1.520$, $P = 0.518$). Socio-economic variables of the subjects from the two counties were similar except for a higher proportion of farmers in Jianhu (Table 1).

Patients' TB expenditure in Jianhu and Funing County

The mean total patient's TB expenditure in Jianhu was 872CNY (median 460CNY), ranging from 0CNY (one patient directly obtained free TB care from CTD with no transportation expenditure after the implementation of the free CIDA-NTP) to a maximum expenditure of 12 206CNY. In Funing, the mean total expenditure was

Table 1. General characteristics of the subjects

Characteristics	Jianhu County		Funing County		<i>P</i> ^c	
	No.	%	No.	%		
Diagnosed	Before CIDA-NTP ^a	110	60.1	235	83.3	<0.0001**
	After CIDA-NTP	73	39.9	47	16.7	
Age	<15	0	0.0	5	1.8	0.182
	15~	70	38.3	93	33.0	
	40~	83	45.4	142	50.4	
	65~	30	16.4	42	14.9	
Gender	Male	136	74.3	198	70.2	0.336
	Female	47	25.7	84	29.8	
Occupation ^b	Farmer	136	74.4	178	63.1	0.008**
	Working away	29	15.8	80	28.4	
	Non-farmer	18	9.8	24	8.5	
Medical insurance	Insured	9	4.9	18	6.4	0.509
	Uninsured	174	95.1	264	93.6	
Average household income (CNY)		5238.3		5881.6	0.177	
Average individual income (CNY)		1422.9		1492.6	0.627	

^aCanadian International Development Agency (CIDA)-funded NTP-DOTS project.

^bOccupation was grouped as farmer (farming work on land only), working away (both farming work on land and physical work away from hometown), and non-farmer (no farming work on land).

^c*P* value from χ^2 tests or Student's *t*-test.

***P* < 0.01.

1091CNY (median 865CNY), ranging from 77CNY to 10 697CNY. In Jianhu, 82% (mean 715CNY) was spent before getting TB diagnosis, while in Funing 76% (mean 835CNY) was spent after TB diagnosis (Figure 1).

Table 2 shows the items of expenditure for TB patients before and after obtaining TB diagnosis. Expenditure after TB diagnosis includes expenditure from the point in time when TB diagnosis was obtained and thereafter. Before TB diagnosis, a higher total expenditure was reported in Jianhu (mean 715 vs. 256CNY, $P < 0.0001$), whereas it was significantly higher in Funing after TB diagnosis (mean 835 vs. 157CNY, $P < 0.0001$). The transportation/accommodation cost accounted for 42% in Jianhu and 16% in Funing of the total expenditure after TB diagnosis. The higher transportation/accommodation expenditure in Jianhu could be expected since patients have to travel to the CTD. Considering the NTP-DOTS subsidized TB care in Jianhu was only available to the smear-positive TB patients, patients' expenditure

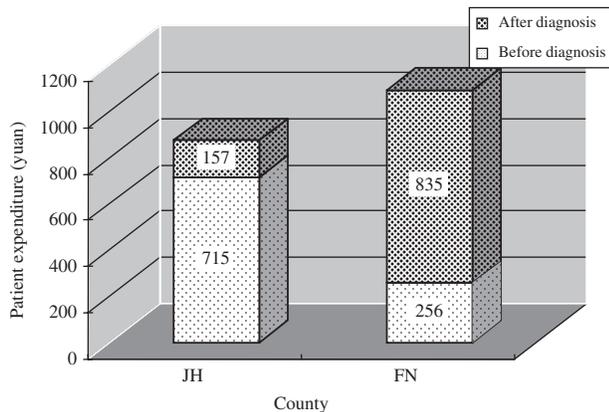


Figure 1. Mean patient TB expenditure (CNY) for medical care and transportation/accommodation before and after obtaining TB diagnosis in Jianhu and Funing

Table 2. Patients' TB expenditure before and after TB diagnosis (CNY)

Expenditure	County	All patients		
		m ± s	25%, median, 75%	P value ^b
Before obtaining TB diagnosis				
Medical	Jianhu	686 ± 1396	80, 270, 630	<0.0001**
	Funing	245 ± 486	77, 135, 247	
T & A ^a	Jianhu	29 ± 121	0, 4, 20	0.049*
	Funing	11 ± 36	0, 0, 4	
Total	Jianhu	715 ± 1466	89, 280, 680	<0.0001**
	Funing	256 ± 507	77, 144, 259	
After obtaining TB diagnosis				
Medical	Jianhu	90 ± 87	0, 146, 146	<0.0001**
	Funing	704 ± 819	380, 567, 806	
T & A ^a	Jianhu	66 ± 95	32, 55, 80	<0.0001**
	Funing	131 ± 164	45, 99, 160	
Total	Jianhu	157 ± 127	54, 171, 226	<0.0001**
	Funing	835 ± 923	482, 690, 931	

^aTransportation and accommodation.

^bP value from Student's *t*-test in difference between counties.

* $P < 0.05$; ** $P < 0.01$.

was further compared between smear-positive and smear-negative patients. There was no statistically significant difference in the items of expenditure between smear-positive and smear-negative patients in Jianhu. In Funing, the medical expenditure before diagnosis was higher for smear-positive patients than for smear-negative patients (mean 358CNY vs. 168CNY, $P = 0.006$).

After adjustment for age, gender, occupation, education, medical insurance, household income, haemoptysis and sputum smear results using the General Linear Model, the mean patient's expenditure was 357CNY higher ($P = 0.001$) in Jianhu than in Funing before TB diagnosis, and 727CNY less in Jianhu ($P < 0.0001$) after TB diagnosis. The total mean patient's expenditure was 371CNY less in Jianhu ($P = 0.006$).

Patients' expenditure on medical care and transportation before and after diagnosis were compared with regard to the implementation of the CIDA NTP-DOTS project (Table 3). Sixty per cent (110/183) of patients in Jianhu and 83% (253/282) in Funing were recruited before the CIDA NTP-DOTS project started. Before the project was implemented, patients' expenditure on medical care and transportation/accommodation before TB diagnosis were significantly higher in Jianhu. After implementation of the CIDA project, the difference between the counties was no longer significant, with a trend of rising expenditure in Funing for both medical care (mean 204 vs. 451CNY, $P = 0.026$) and total expenditure (mean 213 vs. 471CNY, $P = 0.026$). After TB diagnosis, all items of expenditure in Jianhu were significantly lower than those in Funing; the mean patients' expenditure on medical care in Jianhu was significantly reduced from 148CNY before the CIDA project to 4CNY after project implementation ($P < 0.0001$) since most of the subjects (66 of 73 patients) were smear-positive, whereas the mean expenditure in Funing was still a high 508CNY after implementation. Yet, the decrease in Funing from before the CIDA

project in mean medical expenditure after TB diagnosis was significant. The reduction was due to provision of free treatment to the smear-positive cases (23 of 47 patients).

The mean patient's expenditure before diagnosis varied at different levels of health facility (Table 4). The highest payment was found at county (tertiary) level, 821CNY in Jianhu and 655CNY in Funing with approximately 50CNY for transportation and accommodation in both counties. The expenditures at township (secondary) hospitals and village health stations (primary) were considerably less. Only four patients visited the CTD directly in each county.

Financial burden from TB expenditure

Sixty per cent of the subjects had an annual household income of less than 5000CNY, 90% had an income of less than 10 000CNY. Fifty per cent of the patients paid more

than 650CNY and 22% paid more than 1000CNY for TB medical care. The mean patient expenditure on TB medical care and transportation during the whole period accounted for 21.8% (range 2–244%) of the household income in Jianhu and 34.4% (range 2–744%) in Funing.

We found three patients who had suffered extremely high medical expenditure, more than 8000CNY. One was from Jianhu, the other two from Funing. The Jianhu patient was a farmer, with a total household income of about 5000CNY/year. He suffered haemoptysis and spent 12 000CNY before TB was diagnosed. One patient from Funing was a farmer with a household income of only 2000CNY. He spent 48CNY before diagnosis and 8328CNY during the treatment. The second person from Funing had formal employment with medical insurance coverage. His medical expenditure before and after diagnosis was 91 and 8756CNY, respectively.

Table 3. Patients' TB expenditure (CNY) in different TB care stages before and after implementation of CIDA NTP-DOTS project

Expenditure	County	Before CIDA NTP-DOTS		After CIDA NTP-DOTS		<i>P</i> value ^b
		<i>m</i> ± <i>s</i> (median)	<i>P</i> value ^a	<i>m</i> ± <i>s</i> (median)	<i>P</i> value ^a	
Before obtaining TB diagnosis						
Medical	Jianhu	672 ± 1500 (265)	0.010**	708 ± 1232 (300)	0.671	0.082
	Funing	204 ± 282 (130)		451 ± 994 (150)		0.026*
T & A ^c	Jianhu	34 ± 153 (2)	<0.0001**	21 ± 37 (8)	0.333	0.285
	Funing	9 ± 31 (0)		20 ± 53 (0)		0.096
Total	Jianhu	706 ± 1570 (270)	0.006**	729 ± 1248 (304)	0.573	0.770
	Funing	213 ± 294 (140)		471 ± 1037 (165)		0.026*
After TB diagnosis						
Medical	Jianhu	148 ± 64 (146)	<0.0001**	4 ± 20 (0)	<0.0001**	<0.0001**
	Funing	743 ± 882 (565)		508 ± 309 (580)		0.023*
T & A ^c	Jianhu	65 ± 42 (60)	<0.019*	69 ± 141 (48)	<0.0001**	0.692
	Funing	126 ± 173 (90)		155 ± 105 (150)		0.156
Total	Jianhu	213 ± 74 (206)	<0.0001**	73 ± 145 (50)	<0.0001**	<0.0001**
	Funing	869 ± 998 (660)		663 ± 320 (735)		0.145

^a*P* value from Student's *t*-test with logarithm transformed patients' expenditures in difference between counties.

^b*P* value from Student's *t*-test with logarithm transformed patients' expenditures in difference between before and after implementation of CIDA NTP-DOTS in each county.

^cTransportation and accommodation.

P* < 0.05; *P* < 0.01.

Table 4. Patients' mean itemized expenditure at different levels of health facilities before TB diagnosis (CNY)

Health facility	No.	Payment for			
		Diagnosis	Treatment	T & A ^a	Total
Jianhu County					
County	85	272.06	498.78	49.74	820.58
Township	124	62.65	239.01	8.52	310.18
VHS [†]	79	5.06	262.96	0.25	268.27
Others	9	111.11	55.56	2.00	168.67
Funing County					
County	31	169.16	435.10	51.00	655.26
Township	95	42.17	156.85	12.32	211.34
VHS ^b	213	11.69	122.40	0.38	134.47
Others	64	8.52	39.63	3.80	51.95

^aTransport and accommodation.

^bVillage health station.

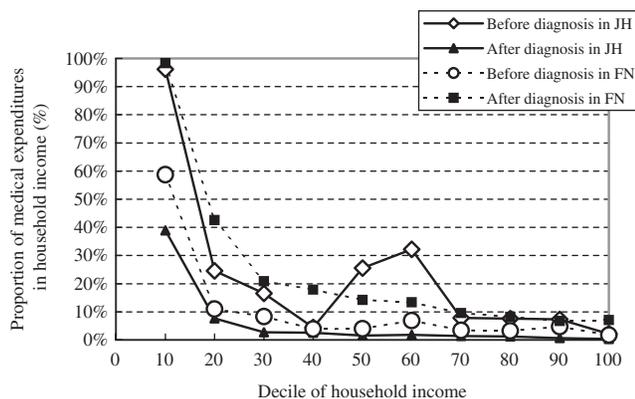


Figure 2. Patients' expenditure on TB medical care before and after diagnosis as a proportion of household income for income deciles in Jianhu and Funing (Correlation before TB diagnosis: $r = -0.213$, $P = 0.007$ in Jianhu; $r = -0.234$, $P < 0.0001$ in Funing. Correlation after diagnosis: $r = -0.382$, $P < 0.0001$ in Jianhu; $r = -0.277$ in Funing, $P < 0.0001$.)

The mean patient expenditure for TB medical care as a proportion of the household income decreased as the income increased in both Jianhu and Funing, both before and after TB diagnosis. A negative correlation with household income was found (Figure 2). The poorest group (the 10% with lowest income) spent, on average, more than the whole annual household income on TB medical expenditure. The households with the least ability to pay and the highest risk of TB infection thus suffered the highest cost of medical care as a proportion of their income. On average, 96% of the household income was consumed by expenditure before TB diagnosis in Jianhu and 98% of the household income after TB diagnosis in Funing.

Discussion

The results reflect a triangulation of research design, a natural experiment with longitudinal comparisons retrospectively and prospectively. We have to be modest in drawing conclusions, considering that the study was based on observations from only two of China's more than 2000 counties. Nevertheless, the findings are startling as they may provide an indication to why, in spite of the successful implementation of the NTP-DOTS, the prevalence targets of reducing smear-positive TB by 60% to a prevalence below $70/10^5$ have not been achieved and drug resistance remains a serious problem in rural China (Ministry of Health 1999b).

A main aim of the revised NTP-DOTS was to improve poor people's access to TB care. We were surprised to find a high mean expenditure for TB medical care and transportation/accommodation in both counties, 872CNY in Jianhu and 1091CNY in Funing. The economic burden of TB care was heavy, especially for the poorest decile, whether or not NTP-DOTS subsidies were available. Although TB patients in Jianhu did benefit from the subsidized anti-TB treatment after they were

diagnosed as smear-positive TB cases (mean 835 vs. 157CNY, $P < 0.0001$), patients' expenditure for medical care before TB diagnosis was much higher in Jianhu (mean 715 vs. 256CNY, $P < 0.0001$). In Funing, the introduction of the CIDA-funded NTP-DOTS was accompanied by a trend of rising mean medical expenditure before diagnosis, from 204CNY to 451CNY ($P < 0.05$), while the mean medical expenditure after diagnosis still amounted to more than 500CNY.

Our results indicate that the revised NTP-DOTS did not substantially remove the financial barriers; it has merely moved the barriers from expenditure after diagnosis to expenditure before diagnosis and treatment, leading to an increased risk of infection transmission.

An obvious disadvantage of the vertical NTP-DOTS system is that the CTD is a centralized specialty clinic, not conveniently visited by all rural residents. The regular three-tier health care system, on the other hand, is accessible and used conveniently by the rural population. Unless a physician in a general hospital issues a referral, the patient is not likely to visit the CTD directly. In this study, only four patients in each county visited the CTD directly. Considering the aspects of acceptance and the geographical accessibility, we believe the resources of the regular three-tier health system should be mobilized to strengthen TB control in China.

In the last 20 years, along with the country's economic development, the Chinese health system has gone through reforms proliferating user fees, revenue-related bonus systems, privatization and decentralization of hospital management (Bogg 1995; Lazarus 2004). The reforms have been linked to supplier-induced demand and increased medical charges to patients. The yearly increment of outpatient and inpatient medical expenditure was 26% and 24%, respectively, from 1991 to 1995, and 15% and 11%, respectively, from 1996 to 2000 (Ministry of Health 2003). The annual per capita medical expenditure for rural residents increased from 42.5CNY to 96.6CNY between 1995 and 2001 (Lazarus 2004). Although China's GDP has increased five times during 1990–2001, there are still 32 million rural people (2000) living in poverty (National Statistics Bureau 2001). The collapse of the rural Cooperative Medical Scheme worsened access to health care for the rural poor (Fang et al. 1995). In 1998, only 4.7% of the poorest quintile of the rural population was covered by any kind of medical insurance (Gao et al. 2002).

The deterioration of poor people's access to health care in China in recent years has gone hand in hand with an increased hospital dependence on fee-for-service revenue. The health system reforms have granted financial independence to the hospitals, with decentralization and marketization. Rural health services are now almost entirely provided by fee-for-service providers. Consequently, hospitals use more drugs and high technology diagnostics in order to maximize their profits

(Hsiao 1995). Based on a MOH report, the proportion of government subsidies, user fees and drug sales in the financing of public hospitals in 1980 was 21%, 20% and 38%, respectively, changing to 9%, 40% and 47%, respectively, in 2000.

The health care financing system and related incentives in China have been shown to influence both the type and quantity of prescribed antibiotics, indicating a risk of inappropriate prescriptions (Dong et al. 1999). Inappropriate use of antibiotics by infectious TB patients will result in cure delays and increased risk of transmission and drug resistance. In Jianhu and Funing, all the hospitals are financed mainly by user fees. The NTP-DOTS in China aims to reduce poor patients' economic burden by providing free or subsidized TB care, but the vertical nature of the TB control system means it cannot reach the poor if it is not integrated with the general health system. Before TB patients are referred to the CTD, they have usually been subjected to various examinations and treated with several kinds of antibiotics and symptom-targeted drugs. Our findings indicate that the economic burden of TB care was shifted from after to before TB diagnosis. Each referral of a smear-positive case should yield a 20CNY bonus for the referring doctor in the revised NTP. Yet, the gap between loss and gain is obvious. In this study, the implementation of the CIDA project in Funing implied a loss of revenue from TB patients in the general hospitals, which could explain the trend of increasing patients' expenditure on medical care before TB diagnosis. The 'moral hazard' of health providers adds to the financial burden of TB patients and is a risk factor for diagnosis delay and under-detection of TB (Xu et al. 2004). A study on the diagnostic delay of TB patients in these two counties reported that the mean of the duration from TB patients' first hospital visit to being diagnosed with TB was longer in Jianhu than in Funing (31 vs. 10 days) (Xu et al. 2005).

This study was carried out in a relatively prosperous rural area of China. It is reasonable to assume that access to TB care in the poorer areas of China will be worse, given a similar vertical system which is not integrated in the general health system. The 4th National TB survey reported that the average income of TB patients was as low as 941CNY, and the mean expenditure for TB medical services was 1165CNY, with 98% of patients paying out-of-pocket (Ministry of Health 2002). To address the TB patients' economic burden under NTP-DOTS, the Social Assessment of TB Control in four provinces of China is ongoing now and will be carried out in most of the DOTS-covered provinces.

Although the implementation of the CIDA NTP-DOTS project in the last 3 months of the study allows the researchers to compare patients' expenditure both between counties with and without NTP-DOTS and within counties before and after the implementation of NTP-DOTS, it has to be noted that the management system for NTP-DOTS was not well implemented in Funing before the end of the study, and further that the

sample size in Funing in the latter quarter of the study was relatively small. Longer observation periods will be required to assess the shift of patients' economic burden under NTP-DOTS.

Conclusion

Ninety-four per cent of the TB patients in Funing and 95% in Jianhu had no medical insurance coverage. The total TB expenditure accounted for a high proportion of income in both counties, especially for the lowest income group. The China National Tuberculosis Control Programme introduced financial incentives for providers to refer smear-positive patients. However, we found that the market incentive structures in the reformed health system appear to have a stronger regressive effect and may result in prolonged delays before effective treatment can be given. We suggest that it is vital to perform further studies both to confirm or refute our findings and to assess the impact of alternative systems of financing and organizing rural health care. We believe that our findings provide arguments for studies on how to integrate the NTP with the general health system and how to address the regressive financial incentives. It appears that doctors adapt to new incentive structures and find new ways of keeping revenue at the old levels.

TB patients suffer a heavy economic burden in counties whether or not TB care subsidized by NTP-DOTS is available. The total patient expenditure was not reduced considerably by NTP-DOTS, but shifted from after diagnosis to before diagnosis. The shift could imply delays in diagnosis and treatment with an increased risk of infection transmission.

The study was undertaken in two rural counties in East China. Since the observed incentive structures are to be found in other rural counties in China, perhaps also in other countries in the region, we believe that the findings may have wider validity.

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