

Poverty and the economic effects of TB in rural China

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SUMMARY

OBJECTIVE: To investigate the economic effects of illness on individual tuberculosis (TB) cases in rural China and to use a case-control study to show a strong TB-poverty link.

SETTING: In 2002–2004 we studied 160 new smear-positive pulmonary tuberculosis (PTB) cases and 320 age- and sex-matched controls living in neighbouring houses in four rural counties of Henan Province.

DESIGN: Cases and controls were interviewed 1–3 months after patients were diagnosed. We used matched multivariate logistic regression to compare cases with controls for poverty status using household income, household assets and relative wealth within the village. We conducted follow-up interviews of patients 10–12 months later to assess economic effects by collecting data on treat-

ment costs, income losses, coping strategies and treatment completion.

RESULTS: Poverty is strongly associated with TB incidence even after controlling for smoking and other risk factors. Excluding income losses, direct out-of-pocket treatment costs (medical and non-medical) accounted for 55.5% of average annual household income, and most TB cases fell into heavy debt. The DOTS cure rate was 91%. When DOTS was incomplete or not done, mortality was high.

CONCLUSIONS: Poverty is both a cause and a devastating outcome of TB. Ongoing poverty reduction schemes in China must also include reducing TB.

KEY WORDS: tuberculosis; economics; China; DOTS; poverty; cost of illness

CHINA has the second highest number of tuberculosis (TB) cases in the world, with 4.5 million patients.¹ According to the 2000 national TB survey, the infection rate was 44.5% of the total population of 1292 million and the active pulmonary tuberculosis (PTB) prevalence rate was 367 per 100 000 population.² In 2003, the reported TB incidence rate was 52.4/100 000.²

Every year about 130 000 Chinese die from TB, which remains a devastating killer despite China's gross domestic product (GDP) growth rate, averaging 9.4% annually during the period 1979–2003.³ Unfortunately, this growth has not benefited everyone. In 2003, 30 million people's annual income fell below China's official poverty line, which is equivalent to US\$80 per person per year, or 22 cents per day.⁴

The association of TB with poverty is well established at the population and neighbourhood level, usually in relation to socio-economic disadvantage and associated ethnicity or class.^{5–12} The economic effects of TB are usually considered from two perspectives:¹³ the first is estimating the cost of illness aggregated, at the national level, from the spending of health care providers at various government levels.^{14,15} The second is from the patients' perspective of direct and indirect costs of illness and income loss.^{16,17} We report

on both the TB-poverty link and the economic effects from the patients' perspective; published evidence is limited on these aspects of TB in China.

China's health system has two distinctly separate parts—rural and urban. Rural health care has three levels of provision—county, township and village. Under the post-1979 economic reforms, rural health financing has been decentralised so that each county government funds its own general hospitals and county TB clinics, each township government funds its township health centres,¹⁸ and health workers, known as village doctors, charge out of pocket, while also receiving payment from the government for supervising TB treatment. Government funding in China's total health expenditure has declined, and hospitals and health centres rely on user fees to cover their running costs.

China adopted the DOTS strategy in 1992. After 2002, the Chinese government greatly expanded the DOTS programme, supported by a loan from the World Bank/UK Department for International Development (DFID) and Japanese aid. The four counties in our study therefore also came under the World Bank project. DOTS requires sputum microscopy for case detection and standardised short-course treatment of new cases for 6–8 months.¹ In China, intermittent

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observed chemotherapy is given to confirmed smear-positive cases using the four drugs isoniazid (H), rifampicin (R), pyrazinamide (Z) and ethambutol (E) for 2 months followed by two drugs (HR) for 4–6 months. Patients suspected of TB should be referred to the county TB clinics for diagnosis and organisation of treatment. Smear-positive patients registered with the county TB clinic receive, free of charge, one chest X-ray (CXR), TB drugs for 6 months, and nine sputum smears to monitor treatment success. Patients live at home and are required to take every dose of chemotherapy observed by their village doctor.

METHODS

Study design

This is a community-based case-control and case follow-up study in four counties of Henan Province, where the DOTS strategy is universally applied for TB treatment. We chose cases from the economically productive age group (25–60 years) and restricted study entry to new cases until we reached the target of 40 patients per county (total 160 cases). All cases conformed to the international case definition¹ of two or more acid-fast bacilli (AFB) positive sputum smears or one sputum smear AFB-positive plus radiographic evidence of active PTB as determined by the treating medical officer. We obtained approval from China's Ministry of Health and the Provincial Health Bureau before the funding application to the World Health Organization (WHO), and both patients and controls signed consent forms.

During the period October 2002–February 2005 (interrupted by the Severe Acute Respiratory Syndrome [SARS] outbreak in 2003), we prospectively collected data from 160 new smear-positive PTB patients registered at county TB clinics. Each case was matched by two controls of the same sex and age group living in left and right neighbouring houses—a total of 320 controls.

Cases and their neighbouring controls were interviewed in their homes by the same TB specialists to ensure that controls had not ever acquired active TB. If more than one person fulfilled the selection criteria (this rarely occurred), the control was randomly chosen. To study TB-poverty links, we interviewed the cases and controls 1–3 months after the patients began treatment. We then held follow-up interviews 10–12 months after the first interview for cases only, to investigate treatment completion and economic effects of TB.

The four counties (Gongyi, Linying, Zhenping and Yuzhou) represented a range of economic conditions and geographic locations. Each had a large population of more than 700 000, and 80% were farmers. The reported incidence of active PTB was between 26 and 75/100 000 (China's average was 52.4/100 000 in 2003) and reported incidence of smear-positive PTB was between 9 and 36/100 000 (Table 1).

Table 1 Comparison of demographic indicators of four study counties in China, 2002–2003

| County statistics | Gongyi | Linying | Zhenping | Yuzhou |
|---|---------|---------|----------|-----------|
| Population | 790 000 | 710 000 | 950 000 | 1 190 000 |
| Farmers, percentage of population | 82 | 83 | 88 | 87 |
| Average net annual income of rural residents, yuan* | 3 725 | 2 749 | 2 468 | 3 007 |
| Per capita GDP, yuan | 15 602 | 8 212 | 8 888 | 8 958 |
| Birth rate per 1000 population | 9.54 | 9.0 | 9 | 8 |
| Death rate per 1000 population | 5.2 | 4.0 | 7 | 5 |
| Male: female ratio | 103:100 | 117:100 | 131:100 | 137:100 |
| Reported incidence of active PTB per 100 000 population | 26 | 42 | 47 | 75 |
| Reported incidence of smear-positive PTB per 100 000 population | 9 | 15 | 18 | 36 |

* US\$1 = 8 yuan.

Sources: County statistical yearbooks and Henan Provincial TB Institute. GDP = gross domestic product; PTB = pulmonary tuberculosis.

Household economic status

We used three household economic status (HES) indicators to estimate the relative risk linking TB to poverty comparing cases to controls (Table 2):

- Household incomes given by patients and controls were calculated in monetary value of net farm produce plus monetary wages of family members
- Household assets were consumer durable goods owned by households (furniture, television, electric appliances), a visible indication of consumption
- Relative wealth within the village was how respondents described their families' socio-economic ranking within the village.

Data analysis

Annual household income (multiples of the Chinese poverty line), household assets (ranked in quarters) and relative wealth within the village (ranked in thirds) were each assessed, in three separate models, as determinants of TB using conditional (matched) logistic regression to calculate the odds ratio (OR) and 95% confidence interval (CI). We controlled for confounding by including in each of the three models unmatched factors found to be significant univariate predictors of TB (smoking, marital status and off-farm migration), and noted on multivariable analysis to change the OR substantially for the economic variable of interest. Occupation, rank within the household, number of rooms in the house, number of dependants and education were found not to be potential confounders.

Explanation of costs

We measured direct and indirect costs of treatment (Table 3) from a patient's first visit to the county TB

Table 2 Comparison of household economic status among 160 patients (before TB illness) and 320 controls, China, 2002–2003

| | Case <i>n</i> (%) | Control <i>n</i> (%) | OR* (95%CI) | Adjusted OR* (95%CI) |
|--------------------------------------|----------------------|-------------------------|------------------|-------------------------|
| Annual household income [†] | | | | |
| <poverty line | 47 (29.4) | 72 (22.5) | Reference | Reference |
| 1–2 times poverty line | 68 (42.5) | 137 (42.8) | 0.70 (0.43–1.15) | 0.67 (0.39–1.14) |
| 3 or more times poverty line | 45 (28.1) | 111 (34.7) | 0.44 (0.22–0.87) | 0.54 (0.26–1.12) |
| Household assets [‡] | | | | |
| Lowest quarter | 50 (31.3) | 64 (20.0) | Reference | Reference |
| Second quarter | 43 (26.9) | 83 (25.9) | 0.62 (0.36–1.07) | 0.74 (0.41–1.32) |
| Third quarter | 34 (21.3) | 85 (26.6) | 0.50 (0.28–0.87) | 0.52 (0.28–0.94) |
| Highest quarter | 33 (20.6) | 88 (27.5) | 0.42 (0.23–0.78) | 0.48 (0.25–0.92) |
| Relative wealth within village | | | | |
| Lower third | 74 (46.3) | 63 (19.7) | Reference | Reference |
| Middle and upper third | 86 (53.8) | 257 (80.3) | 0.22 (0.14–0.36) | 0.2 (0.1–0.4) |

* Cases and two controls matched for neighbourhood, sex and 5-year age group. The effect of each economic indicator was modelled separately: matched univariate analyses (first OR column) were adjusted (next OR column) with multi-variable models including smoking, marital status and off-farm migration.

[†] Household poverty line estimated as 2563 yuan/household/year (based on average household size); 1–2 times poverty line = 2563–5126; ≥ 3 times poverty line = ≥ 5126 . (US\$1 = 8 yuan).

[‡] Household assets were calculated from average market prices in yuan in study counties: lowest quarter 0–16 699; second quarter $\geq 16 700$ – $< 21 077$; third quarter $\geq 21 077$ – $< 28 780$; highest quarter $\geq 28 780$.

TB = tuberculosis; OR = odds ratio; CI = confidence interval.

clinic for diagnosis until treatment was completed. We collected information at the first and follow-up interviews.

Direct costs were medical and non-medical costs paid for out of pocket by cases for visits to county TB clinics, general hospitals and private doctors. Medical

costs were payment for examinations, laboratory tests, TB medicines, non-TB medicines and traditional medicines. Non-medical costs were travel and food for patients and companions, and nutritious foods taken by patients. Indirect costs comprise lost income for patients and companions.

Table 3 Direct and indirect costs of TB, incurred out of pocket, by 144* patients from time of initial diagnosis in county TB clinics to treatment completion

| Cost items | Average cost, yuan [†] | Average total cost, yuan [†] | Percentage of average total cost |
|--|---------------------------------|---------------------------------------|----------------------------------|
| Medical costs in county TB clinic | | | |
| Drugs HRZE (the four standard TB drugs) [‡] | 445.00 | | |
| Other TB drugs | 86.10 | | |
| Other prescribed non-TB drugs | 476.30 | | |
| Sputum tests | 18.90 | | |
| X-rays | 96.50 | | |
| Blood tests | 55.20 | | |
| Urine tests | 2.20 | | |
| Total medical cost in county TB clinic | | 1180.10 | 16.0 |
| Direct medical costs | | | |
| 1 Total medical cost in county TB clinic | | 1180.10 | 16.0 |
| 2 Total medical cost in general hospital or private clinic | | 567.30 | 7.7 |
| 3 Total medical cost in TB clinic above county level | | 75.50 | 1.0 |
| 4 Self-medication (traditional medicine) | | 117.30 | 1.6 |
| Direct non-medical costs | | | |
| 5 Travel for tests/drugs for patients and companions | | 92.90 | 1.3 |
| 6 Food during travel for patients and companions | | 32.60 | 0.4 |
| 7 Nutritious foods taken by patients | | 706.00 | 9.6 |
| Indirect costs | | | |
| 8 Patients' income loss | | 4559.40 | 62.0 |
| 9 Companions' income loss | | 36.00 | 0.5 |
| a Average total cost (sum of items 1–9) | | 7366.90 | 100 |
| b Average total direct medical costs (items 1–4) | | 1940.20 | |
| c Average total direct costs (items 1–7) | | 2771.70 | |
| d Average total indirect costs (items 8 and 9) | | 4595.40 | |

* After 10–12 months 11 people had died and five could not be located.

[†] US\$1 = 8 yuan.

[‡] Standard treatment consists of four drugs (HRZE) for the first 2 months, followed by two drugs (HR) for the next 4 months; drugs are taken three times per week, i.e., 2H₂R₃Z₃E₃/4H₂R₃.

TB = tuberculosis; H = isoniazid; R = rifampicin; Z = pyrazinamide; E = ethambutol.

RESULTS

Demographic profiles of cases and controls

Our 160 new smear-positive cases were detected sequentially over 2 years. They conformed to the sex and age distribution of incident TB in rural Henan: 77% were male and 38% were aged 25–39 years (Table 4). Overall, 72% of the 160 TB cases and 76% of the 320 non-TB controls were household heads ($\chi^2 = 0.79$, $P = 0.37$); 15% of cases and 6% of controls ($\chi^2 = 10.7$, $P = 0.001$) had no spouses (unmarried, widowed or divorced). Educational differences between cases and controls were small: more than 45% had junior high school education.

Cases were more likely than controls to have smoked (71% vs. 55%; $\chi^2 = 11.2$, $P < 0.001$) and out-migrated (off-farm migration) for work in the last 3 years (47% vs. 29%; $\chi^2 = 14.3$, $P < 0.001$). Over half (55%) of TB out-migrants worked in construction, factories and mining, 80% worked >8 h per day (7.8% worked 13–18 h) and 80% did not have the obligatory weekly rest day. Nearly half slept in shared dormitories.¹⁹

TB and household economic status

Household income

According to our estimated household poverty line at 2563 yuan/year (US\$1 = 8 yuan) (Table 2), 29% of the case households lived in absolute poverty com-

pared to 23% of the controls ($Z = 1.65$, $P = 0.05$). The average annual household income of the 160 TB cases (4994 yuan) was lower than that of the controls (5604 yuan), but the difference was not statistically significant ($t = 1.3$, $P = 0.17$).

Household assets and wealth ranking

The average value of household assets for TB cases was 21 812 yuan, significantly less than the 24 489 yuan among controls ($t = 2.55$, $P = 0.01$). Household assets of one third of the cases were in the lowest quartile (0–16 699 yuan) compared to one fifth of the controls. Wealth ranking within the village was also lower for cases than controls. Nearly half of the cases self-ranked in the lowest third compared to one fifth of the controls ($Z = 6.08$, $P < 0.001$).

Univariate matched logistic regression showed that higher HES carried less risk of TB. Using the poorest group as reference for the three HES indicators, we found that the OR of being a TB case declined as household income and assets improved (Table 2). For each of the three HES variables, we conducted multivariate logistic regressions adjusted for the influence of other important exposure variables (smoking, marital status, off-farm migration) to produce an adjusted OR with 95% CI. Both 'household assets' and 'relative wealth within village' significantly correlated with TB incidence.

Economic effects of TB

Although smear-positive patients received a number of free items for treatment, costs were still incurred by individuals. During treatment, some patients prefer to consult private clinics or hospitals for drug side effects or injections, believing them to be better than TB medicines, thereby incurring extra costs. For 144 patients, total out-of-pocket payment averaged 1940 yuan for total direct medical costs, and 832 yuan for total non-medical costs (Table 3). Patient income loss averaged 4559 yuan. Average total cost incurred by patients (items 1–9) was 7367 yuan (US \$921).

Most patients had little capacity to pay for treatment. Coping strategies of TB households were: 66% borrowed from relatives and friends, 8.3% borrowed from banks, and 45% sold productive assets, e.g., tractors, draft animals.

Treatment completion

The mean duration of treatment for the 144 cases was 8.5 months, with no significant difference between men and women, and 71% returned to work after treatment completion. There were official treatment records for 159 cases. Of the 136 (86%) cases who officially completed treatment, 124 were cured (91%), 9 were not cured (7%), 1 died, and 2 had unknown outcomes, having left the area. Of the 18 cases (11% of 159) who received partial treatment, 14 (78%) were not cured, 2 died and 2 had unknown outcomes. Of the

Table 4 Comparison of socio-demographic characteristics among 160 patients and 360 matched controls, China, 2002–2003

| Characteristics | Cases (<i>n</i> = 160) <i>n</i> (%) | Controls (<i>n</i> = 320) <i>n</i> (%) |
|--------------------------------------|--|---|
| Sex | | |
| Male | 123 (76.9) | 246 (76.9) |
| Female | 37 (23.1) | 74 (23.1) |
| Age, years | | |
| 25–29 | 19 (11.9) | 38 (11.9) |
| 30–34 | 22 (13.8) | 43 (13.4) |
| 35–39 | 19 (11.9) | 38 (11.9) |
| 40–44 | 13 (8.1) | 28 (8.8) |
| 45–49 | 26 (16.3) | 51 (15.9) |
| 50–54 | 31 (19.4) | 61 (19.1) |
| 55–60 | 30 (18.8) | 61 (19.1) |
| Marital status | | |
| Married | 136 (85.0) | 301 (94.1) |
| Household head | | |
| Yes | 115 (71.9) | 242 (75.6) |
| Outside work history* | | |
| Yes | 75 (46.9) | 94 (29.4) |
| Education | | |
| Nil | 11 (6.9) | 17 (5.3) |
| Primary (6 years) | 54 (33.8) | 99 (30.9) |
| Junior high (3 years) | 75 (46.9) | 151 (47.2) |
| Senior high and above (3 years plus) | 20 (12.5) | 53 (16.6) |
| Smoking history | | |
| Yes | 113 (70.6) | 175 (54.7) |

*The study participant had out-migrated outside the village for paid work within the last 3 years.

5 cases (3% of 159) too poor to begin treatment, 4 died and 1 remained uncured.

DISCUSSION

Our methodology of interviewing cases and controls in their homes to collect data was logistically difficult. We visited 160 locations, whereas other studies, such as those in Thailand¹⁶ and India,¹⁷ were done centrally at various health care facilities. Our advantage is better accuracy due to direct observation of the HES of respondents in their own environment, and the ability to verify information of cases with their village doctors.

By matching the place of residence for both cases and controls, we could prevent confounding by neighbourhood effects yet still provide strong evidence of TB-poverty links. Our cases were poorer than controls for all economic indicators, despite the restriction of socio-economic variation due to matching. Thus, the TB-poverty link may be even stronger than we have been able to detect in this study.

TB-poverty link

Our three economic indicators show different aspects of HES. Annual household income represents short-term status but does not indicate savings from past incomes. For this purpose, we used household assets, a more reliable measurement of HES. Relative wealth within the village as perceived by TB cases is subjective but useful overall, and reveals that TB has differential effects according to poverty differentials within the village that may not be apparent to casual observers. Our analyses showed that a higher HES is consistently associated with reduced TB risk even though we always compared one TB person with nearby neighbours in the same village. Our case-control study showed that poverty posed a high risk for incident TB disease, even after adjusting for other important factors (smoking and off-farm migration).

Limitations of HES indicators

This study was constrained by several factors. Relative wealth was self-assessed and thus subjective. However, it was easier to measure than other wealth indicators and may be no less accurate, as all indicators have problems. Income cannot be captured accurately, as many components may be difficult to recall or to calculate. Household assets are also problematic, as they may vary in current value and represent the outcome of past decisions on disposable income. Despite these limitations, our results showed that poverty was strongly associated with TB in rural China both as a risk factor for incidence and as a consequence of occurrence.

Off-farm migration

One important finding is the large number of cases who out-migrated for work compared to controls.

Extreme poverty had driven most of the 75 migrant cases to leave their villages for waged work because 89% of them came from households with annual incomes below the international poverty line of 7000 yuan (US\$847). We found evidence of long hours, harsh working conditions and crowded dormitories; there is public concern for the plight of migrant workers.²⁰

Economic effects of TB

As we do not have information on patient costs before their diagnosis in county TB clinics, our calculations are likely to be an underestimate. Direct and indirect costs of treatment from the patient's perspective remain high despite a number of free TB services. Doctors in our study were likely to prescribe non-tuberculosis drugs and services outside the listed free items. Like other studies in Jiangsu and Shandong Provinces, we found that TB clinics tended to over-prescribe and over-service.^{21,22} The problem is that there is inadequate government funding for disease control and that salaries and running costs are now mostly covered by user payments,²³ the health budget's share in total government expenditure having fallen from 4.2% in 1980 to 3.9% in 2002. A problem specific to the World Bank project is that rural counties are now expected to match provincial TB funding. Poor counties struggle to find funds, while others fail to give TB top priority. Serious delays in funding occur in some county TB clinics that have to find ways to meet running costs, salaries and other expenses.

Some analysts have defined treatment costs as catastrophic when out-of-pocket payment equals or exceeds 40% of household capacity to pay.²⁴ Among our cases, direct total costs (medical and non-medical) averaged 2772 yuan, equivalent to 55.5% of average annual household income. The cost of illness impoverished many households in our study through income loss and debt and sale of productive farm assets, like the household level study found in Thailand.¹⁶ For the 160 cases, the opportunity cost of not working due to TB averaged 4559 yuan, accounting for 91% of the average annual household income, and TB cases were household heads in 115 households. To those 30% of cases already below the Chinese poverty line, TB brought further impoverishment.

Treatment completion

Despite their poverty and relatively expensive treatment, most of our cases showed a strong determination to get well. Their cure rate, at 91%, was comparable to China's 90% national rate.¹ For those who did not take or complete TB treatment or who died, poverty was a major factor in determining this outcome.

CONCLUSION

Patients badly need financial help because of income loss and debts due to TB illness. There are negative

externalities with risks of transmission to others, especially those who are already poor. More government intervention is warranted,²⁵ particularly now that more financial assistance is affordable in the present situation of China's economic growth. As poverty is both an important cause and a devastating consequence of TB, control of this disease will help alleviate poverty in China.

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References

- 1 World Health Organization Global tuberculosis control: surveillance, planning, financing. WHO Report 2005. WHO/HTM/TB/2005.349. Geneva, Switzerland: WHO, 2005.
- 2 China tuberculosis control collaboration. The effect of tuberculosis control in China. *Lancet* 2004; 364: 417–422.
- 3 China statistical yearbook 2004. Beijing, China: China Statistics Press, 2004.
- 4 Alleviation Poverty Office of the China State Council. Press Release 16 July 2004. www.qianlong.com Accessed March 2005.
- 5 Spence D P, Hotchkiss J, Williams C S, Davies P D. Tuberculosis and poverty. *Brit Med J* 1993; 307: 759–761.
- 6 Cantwell M F, McKenna M T, McCray E, Onorato I M. Tuberculosis and race/ethnicity in the United States: impact of socio-economic status. *Am J Respir Crit Care Med* 1998; 157: 1016–1020.
- 7 Elender F, Bentham G, Langford I. Tuberculosis mortality in England and Wales during 1982–1992: its association with poverty, ethnicity and AIDS. *Soc Sci Med* 1998; 46: 673–681.
- 8 Hawker J I, Bakhshi S S, Ali S, Farrington C P. Ecological analysis of ethnic differences in relation between tuberculosis and poverty. *Brit Med J* 1999; 319: 1031–1034.
- 9 Barr R G, Diez-Roux A V, Knirsch C A, Pablos-Mendez A. Neighborhood poverty and resurgence of tuberculosis in New York City, 1984–1992. *Am J Pub Health* 2001; 91: 1487–1493.
- 10 Grange J, Story A, Zumla A. Tuberculosis in disadvantaged groups. *Curr Opin Pulm Med* 2001; 7: 160–164.
- 11 Holtgrave D R, Crosby R A. Social determinants of tuberculosis case rates in the United States. *Am J Prev Med* 2004; 26: 159–162.
- 12 Paluzzi J E. A social disease/social response: lessons in tuberculosis from early 20th century Chile. *Soc Sci Med* 2004; 59: 763–773.
- 13 Walker D, Stevens W. The economics of TB control in developing countries. *Expert Opin Pharmacother* 2003; 4: 359–368.
- 14 Antioch K M, Waters A, Brown S, Carter R C. Disease costs of tuberculosis and syphilis in Australia. Canberra, Australia: Australian Government Publishing Service, 1993.
- 15 Kamolratanakul P, Hirsansuthikul N, Singhadong N, Kasetjaroen Y, Akksilp S, Lertmaharit S. Cost analysis of different types of tuberculosis patient at tuberculosis centers in Thailand. *Southeast Asian J Trop Med Public Health* 2002; 33: 321–330.
- 16 Kamolratanakul P, Sawert H, Kongsin S, et al. Economic impact of tuberculosis at the household level. *Int J Tuberc Lung Dis* 1999; 3: 596–602.
- 17 Rajeswari R, Balasubramanian R, Muniyandi M, Geetharamani S, Thresa X, Venkatesan P. Socio-economic impact of tuberculosis on patients and family in India. *Int J Tuberc Lung Dis* 1999; 3: 869–877.
- 18 Jackson S, Sleigh A C, Li P, Liu X L. Health finance in rural Henan: low premium insurance compared to the out-of-pocket system. *The China Quarterly* 2005; 181 (March): 137–157.
- 19 Jackson S, Sleigh A C, Wang G J, Liu X L. Household poverty, off-farm migration and pulmonary tuberculosis in rural Henan, China. In: Sleigh A C, Chee H L, Phua K H, Safman R, Yeoh B, eds. *Population dynamics and infectious diseases in Asia*. London, UK: World Scientific, 2006.
- 20 Wang S. Migrant workers' plight causes concern. *China Daily*, 7 March 2005.
- 21 Meng Q, Li R, Cheng G, Blas E. Provision and financial burden of TB services in a financially decentralized system: a case study from Shandong, China. *Int J Health Plan Manage* 2004; 19 (Suppl): S45–S62.
- 22 Zhan S, Wang L, Yin A, Blas E. Revenue-driven in TB control—three cases in China. *Int J Health Plann Manage* 2004; 19 (Suppl): S63–S78.
- 23 Meng Q, Shi G, Yang H, Gonzalez-Block M, Blas E. Health policy and systems research in China. Geneva, Switzerland: UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR), 2004.
- 24 Xu K, Evans D B, Kawabata K, Zeramdini R, Klavus J, Murray C J L. Understanding household catastrophic health expenditures: a multi-country analysis. In: Murray C J L, Evans D B, eds. *Health systems performance assessment: debates, methods and empiricism*. Geneva, Switzerland: World Health Organization, 2003.
- 25 Jack W. The public economics of tuberculosis control. *Health Policy* 2001; 57: 79–96.

RÉSUMÉ

OBJECTIF : Investiguer les conséquences économiques de la maladie sur les cas individuels de tuberculose (TB) en Chine rurale et utiliser une étude cas-contrôle pour démontrer un lien étroit entre TB et pauvreté.

CONTEXTE : Pendant la période 2002–2004, nous avons étudié dans quatre comtés ruraux de la Province de Henan, 160 nouveaux cas de TB pulmonaire à bacilloscopie positive et 320 contrôles appariés pour l'âge et le sexe vivant dans des maisons voisines.

SCHÉMA : Les cas et les contrôles ont été interviewés de 1 à 3 mois après le moment du diagnostic porté chez les patients. Nous avons utilisé une régression logistique multivariée appariée pour comparer les cas et les contrôles en ce qui concerne l'état de pauvreté en utilisant

les revenus du ménage, les biens du ménage et la richesse relative au sein du village. Nous avons mené des interviews de suivi chez les patients 10 à 12 mois plus tard pour évaluer les conséquences économiques en recueillant les données sur les coûts du traitement, les pertes de revenu et les stratégies utilisées pour y faire face et finalement les achèvements de traitement.

RÉSULTATS : Il existe une association étroite entre l'incidence de la TB et la pauvreté, même après contrôle pour le tabagisme et d'autres facteurs de risque. Si l'on exclut les pertes de revenu, les coûts directs du traitement encourus par le patient (médicaux et non-médicaux) s'élèvent à 55,5% du revenu moyen du ménage et la plupart des cas de TB s'endettent considérablement. Le taux de

guérison du DOTS a été de 91%. La mortalité a été élevée en cas de DOTS incomplet ou inexistant.

CONCLUSIONS : La TB est provoquée par la pauvreté

qui, elle aussi, constitue un résultat dévastateur de la TB. Les schémas actuels de réduction de la pauvreté en Chine doivent également inclure la lutte contre la TB.

RESUMEN

OBJETIVO : Investigar las repercusiones económicas de la enfermedad en casos individuales de tuberculosis (TB) en zonas rurales de China, y mediante un estudio de casos y testigos demostrar una asociación fuerte entre pobreza y TB.

CONTEXTO : Entre 2002 y 2004 se llevó a cabo un estudio de 160 casos nuevos de TB pulmonar con baciloscopia positiva y de 320 testigos emparejados con respecto a la edad y al sexo y que habitaban en casas vecinas de cuatro zonas rurales de la provincia Henan.

MÉTODO : Se entrevistaron los casos y los testigos entre 1 y 3 meses después del diagnóstico de los pacientes. Se realizó un análisis de regresión logística multifactorial con datos emparejados, a fin de comparar los casos y los testigos con respecto a su condición económica, analizando los ingresos y el patrimonio del hogar, los recursos económicos y su riqueza relativa dentro de la localidad. Para el seguimiento se entrevistaron los pacientes 10 a 12 meses más tarde con el fin de evaluar las reper-

cusiones económicas de la enfermedad, recogiendo datos sobre los costos del tratamiento, pérdidas de ingresos, estrategias de compensación y la finalización del tratamiento.

RESULTADOS : Se observó una alta correlación entre pobreza e incidencia de TB, incluso después de ajustar factores como el tabaquismo y otros factores de riesgo. Si se excluyen las pérdidas de ingresos, los gastos menores directos del tratamiento (médicos y extramédicos) correspondieron al 55,5% del ingreso promedio de los hogares y la mayoría de los individuos con TB incurrieron en endeudamiento considerable. La tasa de curación de DOTS fue del 91%. Cuando la aplicación de DOTS fue incompleta o no se llevó a cabo, la mortalidad fue elevada.

CONCLUSIONES : La TB origina pobreza y esta constituye otro desenlace devastador de la enfermedad. Las estrategias de reducción de la pobreza en China deben tener en cuenta la disminución de la TB.
