Effect of a comprehensive programme to provide universal access to care for sputum-smear-positive multidrug-resistant tuberculosis in China: a before-and-after study

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Summary

Background China has a quarter of all patients with multidrug-resistant tuberculosis (MDRTB) worldwide, but less than 5% are in quality treatment programmes. In a before-and-after study we aimed to assess the effect of a comprehensive programme to provide universal access to diagnosis, treatment, and follow-up for MDRTB in four Chinese cities (population 18 million).

Methods We designated city-level hospitals in each city to diagnose and treat MDRTB. All patients with smear-positive pulmonary tuberculosis diagnosed in Center for Disease Control (CDC) clinics and hospitals were tested for MDRTB with molecular and conventional drug susceptibility tests. Patients were treated with a 24 month treatment package for MDRTB based on WHO guidelines. Outpatients were referred to the CDC for directly observed therapy. We capped total treatment package cost at US$4644. Insurance reimbursement and project subsidies limited patients' expenses to 10% of charges for services within the package. We compared data from a 12 month programme period (2011) to those from a retrospective survey of all patients with MDRTB diagnosed in the same cities during a baseline period (2006–09).

Findings 243 patients were diagnosed with MDRTB or rifampicin-resistant tuberculosis during the 12 month programme period compared with 92 patients (equivalent to 24 per year) during the baseline period. 172 (71%) of 243 individuals were enrolled in the programme. Time from specimen collection for resistance testing to treatment initiation decreased by 90% (from median 139 days [IQR 69–207] to 14 days [10–21]), the proportion of patients who started on appropriate drug regimen increased 2·7 times (from nine [35%] of 26 patients treated to 166 [97%] of 172), and follow-up by the CDC after initial hospitalisation increased 24 times (from one [4%] of 23 patients to 163 [99%] of 164 patients). 6 months after starting treatment, the proportion of patients remaining on treatment increased ten times (from two [8%] of 26 patients to 137 [80%] of 172), and 116 (67%) of 172 patients in the programme period had negative cultures or clinical–radiographic improvement. Patients' expenses for hospital admission after MDRTB diagnosis decreased by 78% (from $796 to $174), reducing the ratio of patients' expenses to annual household income from 17·6% to 3·5% (p<0·0001 for all comparisons between baseline and programme periods). However, 36 (15%) patients did not start or had to discontinue treatment in the programme period because of financial difficulties.

Interpretation This comprehensive programme substantially increased access to diagnosis, quality treatment, and affordable treatment for MDRTB. The programme could help China to achieve universal access to MDRTB care but greater financial risk protection for patients is needed.

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Introduction

Multidrug-resistant tuberculosis (MDRTB; defined as tuberculosis resistant to both isoniazid and rifampicin) is a global public health problem.[1] In 2009, the World Health Assembly (WHA) passed a resolution urging countries by 2015 to provide all patients with tuberculosis with appropriate care to prevent, diagnose, and treat the disease.[2] In 2014, the WHA adopted this resolution as part of WHO's post-2015 tuberculosis control strategy.[3] However, only a handful of countries seem on track to achieve universal access to MDRTB care by 2015.[4] The gap to achieve universal access is especially large in India and China, two countries with nearly half of the world's MDRTB cases.[4] Among the barriers to the scale-up of care for MDRTB are the low number of patients diagnosed, poor quality of treatment, high cost of treatment, and inadequate financing for scale-up.[5–8] Unless these barriers are addressed in a comprehensive manner, countries are unlikely to achieve universal access to care by 2015.

Although China has achieved impressive reductions in tuberculosis prevalence and mortality during the past

20 years, MDRTB has become a serious issue, with more than 100 000 cases developing each year—roughly a quarter of the world's total.[9,10] In 2011, only 3% of estimated new MDRTB cases were diagnosed and reported and 2% were placed on quality treatment programmes.[3] Many patients with tuberculosis, including those with MDRTB, are treated in China's public hospital system. However, these patients are often given non-standard drug regimens,[11] resulting in poor treatment outcomes, amplification of drug resistance, and opportunities for further transmission to other individuals. Furthermore, in view of the low protection from financial risk resulting from illness in China,[12] patients with MDRTB almost certainly experience catastrophic health expenses, although this occurrence has not been documented.

Against this backdrop are new opportunities to improve access to care for MDRTB in China. New molecular diagnostics, which have simplified testing for drug resistance, are now available.[13,14] More importantly, China's health reform efforts aim to improve access to quality health care and increase protection from financial risk. These reforms, including expansion of health insurance coverage, strengthening of primary health care and public health, and reform of public hospitals, have the potential to improve quality of care for MDRTB and provide the financing needed for universal access to care.[12,15]

Under the guidance of the Chinese Ministry of Health (now known as the National Health and Family Planning Commission [NHFPC]), we developed a comprehensive programme to provide universal access to care for MDRTB. In an uncontrolled before-and-after study, we aimed to evaluate access to diagnosis, access to quality treatment, and affordability of treatment for MDRTB after implementation of this programme.

Methods

Study design and participants

We selected four medium-size, third-tier cities in China (based on their economic development) to implement our programme. The cities are Hohhot (Inner Mongolia, northern China), Kaifeng (Henan, central China), Lianyungang (Jiangsu, eastern China), and Yongchuan (Chongqing municipality, western China); further details are provided in the appendix. Their size, economic development, and geographic spread make them fairly representative of the situation throughout the country. In 2011, the four cites had a total population of 18 million people residing in 15 urban districts and 17 rural counties. For our programme, we grouped Chongqing's Yongchuan County with four surrounding counties and categorised them as a city unit because Yongchuan is the referral centre for patients with tuberculosis from these other counties, and is one of the larger counties in Chongqing.

See Online for appendix

All cities have implemented the WHO-recommended directly observed therapy strategy for several years as part of the Chinese National Tuberculosis Control Program. The baseline period was from Jan 1, 2006, to Oct 31, 2009. The comprehensive programme started at different timepoints between Jan 1, 2011, and May 1, 2011. We included patients with multidrug-resistant or rifampicin-resistant tuberculosis who were consecutively diagnosed in a 12-month period after the programme began in each of the cities.

The study was reviewed and approved by the Tuberculosis Operational Research Ethics Review Committee of the Chinese Ministry of Health. For the comprehensive programme, all patients signed informed consent before the start of treatment.

Programme

We developed a comprehensive programme to expand access to diagnosis, quality treatment, and affordable treatment of MDRTB. Table 1 shows the details of this programme along with information about the previous programme. In each city, we designated one city-level hospital to be responsible for the diagnosis and treatment of MDRTB and other complicated forms of tuberculosis. We equipped the laboratories in these hospitals with rapid molecular testing for isoniazid and rifampicin resistance with the Genechip (Capitabio, Beijing, China), which is only approved for testing of smear-positive or culture-positive specimens. We trained staff in these hospital laboratories to do molecular tests and conventional drug susceptibility tests (for both first-line and second-line tuberculosis drugs).[16] We established collaborative mechanisms between the hospital, the Center for Disease Control and Prevention (CDC), and community health-centre systems to ensure that patients, clinical specimens, and patients' information were not lost as they moved between these systems.

We used a pre-payment mechanism to finance a standard package of services for MDRTB on the basis of WHO guidelines (table 1).[17] The total cost of the clinical package was capped at US$4644. We used government insurance funding, supplemented by project funding, to limit patient expenses to 10% of package costs. We also developed a public health package of services to better ensure all patients obtained diagnosis and treatment follow-up. These measures included transportation of specimens, free rapid testing for resistance, cash transfer to patients for transportation costs and nutritional supplements, and subsidy for provision of directly observed therapy. We provided roughly $100 000 in project funding to each city for this package of services and for laboratory equipment, laboratory renovation, staff training, and supervision activities.

Procedures

For the comprehensive programme, we prospectively collected data about patients' characteristics, diagnosis, treatment, follow-up during treatment, treatment outcome, reason for failure to start or continue treatment,