We created a comprehensive set of health-system performance measurements for China nationally and regionally, with health-system coverage and catastrophic medical spending as major indicators. With respect to performance of health-care delivery, China has done well in provision of maternal and child health services, but poorly in addressing non-communicable diseases. For example, coverage of hospital delivery increased from 20% in 1993 to 62% in 2003 for women living in rural areas. However, effective coverage of hypertension treatment was only 12% for patients living in urban areas and 7% for those in rural areas in 2004. With respect to performance of health-care financing, 14% of urban and 16% of rural households incurred catastrophic medical expenditure in 2003. Furthermore, 15% of urban and 22% of rural residents had affordability difficulties when accessing health care. Although health-system coverage improved for both urban and rural areas from 1993 to 2003, affordability difficulties had worsened in rural areas. Additionally, substantial inter-regional and intra-regional inequalities in health-system coverage and health-care affordability measures exist. People with low income not only receive lower health-system coverage than those with high income, but also have an increased probability of either not seeking health care when ill or undergoing catastrophic medical spending. China’s current health-system reform efforts need to be assessed for their effect on performance indicators, for which substantial data gaps exist.

Introduction

Is China’s health system doing well? Existing published work has been mixed so far. On the one hand, with China’s economy growing at an annual rate of 9.7% from 1978 to 2006 and lifting more than 210 million people from poverty, Chinese people now have improved nutrition, drinking water, housing conditions, and health care.1 Not surprisingly, the health status of China’s people, measured by broad population health indicators, has continuously improved. Life expectancy at birth increased from 67.9 years in 1981 to 71.4 years in 2000. From 1991 to 2005, the infant mortality rate fell from 50.2 to 19.0 per 1000 livebirths, and the maternal mortality rate declined from 88.9 to 47.7 per 100,000.2

On the other hand, self-reported morbidity rate and bedridden days increased remarkably from 1993 to 2003, according to China’s three national household health surveys done in 1993, 1998, and 2003.1 Furthermore, the mismatch between increasing demand for and inadequate supply of safe and effective health care, escalating medical costs, and absence of insurance coverage made the general public identify the problem of “too difficult to see a doctor” and “too expensive to see a doctor” as one of the key public policy issues in China’s opinion polls.3 In 1998, for example, only 12% of patients living in urban areas and 7% of those living in rural areas were dissatisfied with the inpatient services they received. By 2003, hospital dissatisfaction rate in patients living in urban and rural areas increased to 61% and 54%, respectively.4 To answer people’s mounting demand for policy actions to reform China’s health system, the State Council Health-Care Reform Leading Group, involving 14 ministries, was formed in September, 2006, to develop new policies aiming to establish a more effective and equitable health-care system. The package of new health-system reform policies is likely to be announced late 2008.5-8

However, because health-care reform is a means to an end and not an end in itself, several crucial questions can be raised: how has China’s overall health-system performance been? In what particular areas has China done well or not well? Will China’s reform efforts improve health-system performance nationally and sub-nationally? How can we assess health-system performance? Despite vigorous discussions among China’s major stakeholders about different reform strategies and approaches, little attention has been paid to the issue of how to monitor health-system reform initiatives and to measure their success and failures in China.9 Comprehensive analysis of health-system performance sub-nationally (eg, in provinces) is absent. This is a crucially important unit of analysis, if not more important than the country-wide analysis, because of China’s decentralised fiscal system.10 Furthermore, because substantial disparities exist in China’s many socioeconomic dimensions, the issue of how China’s health system performs differently for different groups of people needs to be addressed. Therefore, as indicated by experiences in Mexico and other countries, the measurement of a country’s (or region’s) performance of health-care system is crucially important for monitoring progress, providing evidence-based assessment of reform policies, identifying determinants of success and failure, and fostering a culture of accountability.11,12

Measurement issues

Initiatives by WHO, Organisation of Economic Co-operation and Development, World Bank, and other organisations in the past 15 years have generated worldwide interests in performance measurement of...
health systems between countries and within coun-
tries.13–16 Even though health systems can be defined in
many ways, a consensus that has emerged is on the two
fundamental approaches to measurement of how a
health system performs.

First is the measurement of health-system coverage.
The defining goal of any health system is generally
accepted to be to improve health. However, because
health is determined by many factors, including non-
health-care factors such as environmental pollution, we
cannot merely attribute changes in health status to the
performance of a health system. Therefore, a measure of
health-system performance should focus on the delivery
of health interventions to individuals in need, because it
is a key process through which health systems can
contribute to improvement of population health and
reduction of health inequalities. Shengelia and
colleagues17 argued that provision of health services can
improve population health and is a key process through which health systems can
perform.

Second is the measurement of health-care affordability.
Besides improvement of health, another intrinsic goal of
a health system is to reduce financial barriers to health
care, especially protection of households from incurring
catastrophic medical expenditures. Financial hardship
caused by out-of-pocket payments has been measured in
different ways in published studies. Measurement of the
impoverying effect: if the income of a household has
falled below the poverty line after out-of-pocket payments
for health care, then this household would be defined as
being medically impoverished.18,19 Measurement of so-
called catastrophic spending: if household's out-of-pocket
payments for health care are equal or greater than 30–
40% of the household’s capacity to pay (disposable income
minus food expenditure),20–22 then that household would be defined as having
undergone catastrophic spending.

Here, we mainly adopt WHO’s framework of effective
coverage and catastrophic spending (30% of household
capacity to pay) to measure China’s health-system
performance. We also measure people’s foregone health
care due to cost concerns.

**Indicators of health-system coverage**

We identified four major types of health interventions:
(1) curative interventions to treat different diseases (eg,
tuberculosis treatment and hypertension control); (2) pre-
ventive interventions (eg, immunisations); (3) behav-
ioral interventions (eg, smoking cessation); and
(4) intersector public-health interventions (eg, safe

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Population in need</th>
<th>Definition of indicator</th>
<th>Year of survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet</td>
<td>Access to sanitary toilets</td>
<td>All households</td>
<td>Percentage of households with access to a sanitary toilet</td>
</tr>
<tr>
<td>Cessation</td>
<td>Smoking cessation</td>
<td>Smokers</td>
<td>Percentage of smokers who either quit smoking or tried to quit in the year before the survey</td>
</tr>
<tr>
<td>Antenatal</td>
<td>Antenatal care</td>
<td>Expectant mothers</td>
<td>Percentage of expectant mothers who received any antenatal visit in the year before the survey</td>
</tr>
<tr>
<td>Delivery</td>
<td>Hospital delivery</td>
<td>Women who gave birth in a specific period</td>
<td>Percentage of women who gave birth, delivering their baby in a hospital in the year before the survey</td>
</tr>
<tr>
<td>Postnatal</td>
<td>Postnatal care</td>
<td>Women who gave birth in a specific period</td>
<td>Percentage of women who gave birth in the year before the survey, who received any postnatal visit by medical staff</td>
</tr>
<tr>
<td>Vaccine</td>
<td>Immunisation</td>
<td>Children aged 0–1 years</td>
<td>Percentage of children younger than 1 year who were immunised for all of the following: BCG, DTP3, Hep B, measles, and OPV</td>
</tr>
<tr>
<td>TB examination</td>
<td>Examination of suspected TB cases</td>
<td>Population with self-reported symptoms of TB (coughing or coughing up blood for 3 weeks)</td>
<td>Ratio of people who reported having gone through formal clinical examination to people who reported having TB-like symptoms</td>
</tr>
<tr>
<td>TB DOTS</td>
<td>Treatment of confirmed TB cases</td>
<td>TB patients</td>
<td>Percentage of confirmed TB patients who self-reported having completed the whole treatment protocol</td>
</tr>
<tr>
<td>Hypertension treatment</td>
<td>Treatment of hypertension</td>
<td>Hypertension patients</td>
<td>Percentage of hypertensive people who reported having taken control measures in the past year</td>
</tr>
<tr>
<td>Hypertension effectiveness</td>
<td>Effective treatment of hypertension</td>
<td>Hypertension patients</td>
<td>Percentage of hypertensive people who reported having taken control measures and whose blood pressure was normal during the survey period</td>
</tr>
</tbody>
</table>

Table 1: Indicators and associated measurement strategies
Panel: Data sources

**China National Health Services Survey**
Since 1993, the Chinese Ministry of Health has done a national household interview survey every 5 years. A four-stage stratified random sampling procedure was used to select the households for interview to represent China’s urban and rural populations. In the first stage, urban cities and rural provinces were selected after they were grouped into three urban types (big, middle-sized, and small cities) and four rural types (ranging from the richest to the poorest counties). In the second stage, five streets in every city and five towns in every county were randomly chosen. In the third stage, two residential committees and villages in every selected street and town were chosen. Finally, 60 households were randomly identified in every residential committee and village. The total number of households sampled in 1993, 1998, and 2003 were 50,700, 50,690, and 57,023, respectively. In addition to demographic and socioeconomic data (including self-reported income and expenditure), the interviewers, who are trained medical professionals, also obtained comprehensive information about self-reported health status, health-care utilisation, and behavioural factors, such as smoking and drinking. Informed consent was obtained from every person before being interviewed. The response rate has been on average more than 90%.

**2004 China Adult Chronic Diseases Risk Factors Surveillance Survey**
Because of the increasing prevalence of chronic diseases, China did the first Adult Chronic Diseases Risk Factors Surveillance Survey in 2004, and is planning to do one every 3 years. The survey is done by the China Centre for Disease Control, which is in the process of completing the second survey. The sample was selected on the basis of the adjusted National Disease Surveillance Points (DSPs), which included 154 counties, representing China in terms of, for example, geographical and demographic distribution, and socioeconomic development status. The survey adopted a multistage stratified random sampling framework, with a final sample size of 32,760 households. From every household, an adult (18–69 years of age) was randomly selected. The contents of the survey included two parts: a structured questionnaire and a physical examination. The structured questionnaire asked questions about the person’s demographic characteristics, self-reported health status, chronic diseases, and relative risk factors (such as smoking, drinking, diet, and exercise), and health-service utilisation. The physical examination included measurement of height, weight, waist and sternum, and blood pressure.

**China Statistics Digest**
The State Statistics Bureau publishes a China Statistics Digest every year, which gives a comprehensive set of information about China’s demographic, economic, and social characteristics nationally and provincially. We drew from this dataset information about province variables that might explain variations in effective coverage and occurrence of household catastrophic health-care spending.

drinking water). To measure the effective coverage of health interventions in China, we selected those that represent these four major types of interventions and that are relevant for China’s major health problems. Ideally, we should have a comprehensive list of indicators for all the major interventions that target the most common diseases and their risk factors in China. On the basis of a review of all available data, only 11 interventions could be measured for all provinces for at least one period during the 10 years of investigation (from 1993 to 2003) (table 1).

A composite measure of coverage was constructed with simple averages from the 11 interventions to help to summarise the overall pattern of service delivery at national and provincial levels. This set of interventions, even though not exhaustive or ideal, is the basis of the national and provincial levels. This set of interventions, summarise the overall pattern of service delivery at simple averages from the 11 interventions to help to

**Table 1. Effective coverage of selected interventions in China in 2004**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to sanitary toilets</td>
<td>99%</td>
<td>96%</td>
</tr>
<tr>
<td>Antenatal care</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Hospital delivery</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Childhood vaccinations</td>
<td>99%</td>
<td>99%</td>
</tr>
</tbody>
</table>

In 2003, China’s health system seemed to do well in terms of access to safe drinking water, antenatal care, hospital delivery, and childhood vaccinations, as indicated by the high coverage of these interventions. Coverages of these interventions were 99%, 96%, 93%, and 95% for urban areas, and 80%, 86%, 62%, and 85% for rural areas, respectively. However, concerns may arise about access to sanitary toilets for rural households (only 21%), the low rate of examination of suspected tuberculosis (36% for urban and 28% for rural areas), and low effective coverage of hypertension in 2004 (only 12% and 7% for urban and rural areas, respectively). Because China’s high rate of cigarette smoking (45% of urban and 50% of rural male adults were regular smokers in 2003) and the associated disease burden, we find it particularly troublesome to see such a low smoking cessation rate (only about 6% of the smokers have tried to quit).
Furthermore, we noticed remarkable inter-regional inequalities in health-system coverage. Except for the effective coverage of tuberculosis treatment, differences between urban and rural coverage rates and inter-provincial differences were all significant. On average, coverage in urban areas (61%) was 15% higher than in rural areas (46%) (table 2). Figure 1 maps composite coverage of different provinces. The geographical distribution of health-system coverage is remarkable, with the southeast regions having the best performance indicator, followed by the northern, central, and western regions. This pattern corresponds almost perfectly with China’s different economic development in these regions (China’s eastern provinces tend to have higher economic development level than the central provinces, which in turn are better than their western counterparts).10

<table>
<thead>
<tr>
<th>Water</th>
<th>Toilet</th>
<th>Cessation</th>
<th>Antenatal</th>
<th>Delivery</th>
<th>Postnatal</th>
<th>Vaccine</th>
<th>TB examination</th>
<th>TB DOTS</th>
<th>Hypertension treatment</th>
<th>Hypertension effectiveness</th>
<th>Catastrophic medical expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>85.8 (0.2)</td>
<td>40.1 (0.2)</td>
<td>6.1 (0.2)</td>
<td>87.7 (0.3)</td>
<td>68.2 (0.5)</td>
<td>53.2 (0.5)</td>
<td>86.3 (0.8)</td>
<td>30.6 (0.8)</td>
<td>57.0 (3.3)</td>
<td>26.7 (0.5)</td>
<td>89.0 (0.3)</td>
</tr>
<tr>
<td>Urban</td>
<td>99.2 (0.1)</td>
<td>86.5 (0.3)</td>
<td>6.9 (0.5)</td>
<td>95.6 (0.4)</td>
<td>97.2 (0.6)</td>
<td>59.6 (1.1)</td>
<td>94.5 (1.3)</td>
<td>36.3 (1.5)</td>
<td>48.9 (7.3)</td>
<td>31.6 (0.8)</td>
<td>117.0 (1.6)</td>
</tr>
<tr>
<td>Rural</td>
<td>80.2 (0.2)</td>
<td>20.7 (0.2)</td>
<td>5.8 (0.3)</td>
<td>85.5 (0.4)</td>
<td>61.5 (1.6)</td>
<td>51.5 (0.6)</td>
<td>84.7 (0.9)</td>
<td>28.2 (0.9)</td>
<td>59.3 (2.1)</td>
<td>21.8 (0.6)</td>
<td>7.0 (0.4)</td>
</tr>
</tbody>
</table>

**Table 2:** Performance indicators of health-system coverage in 2003 and 2004 by region

With respect to the income-related inequality in coverage, the rate difference in composite coverage between the highest and lowest income quintile groups ranged from 12% to 27%. For urban populations, the greatest income-related inequality was in access to sanitary toilets, with the rate difference between rich and poor groups being as high as 40% in 1998. For rural populations, income-related inequality was most pronounced in hospital delivery rate, with the rate difference between the highest and poorest income quintile being as high as 43% in 1998. The hospital delivery rate for the poorest women living in urban areas was 88%, which was even higher than that for the richest women living in rural areas (78%). China’s urban healthcare system has done better than the rural system on almost all the coverage indicators, except for coverage of tuberculosis treatment. A small percentage (36% for the urban and 28% for the rural samples) of interviewed people, who reported tuberculosis-like symptoms, underwent formal testing for tuberculosis (including radiographic and smear examination). Therefore, China’s ability to detect tuberculosis cases remains questionable despite recent progress in tuberculosis control. Once diagnosed, however, a high percentage of patients received treatment, which was provided free of charge at government-run facilities. The overall percentage of confirmed patients with tuberculosis who received treatment was 90% for urban and 97% for rural patients in 2003. A higher percentage of tuberculosis patients living in rural areas (59% vs 49% of patients living in urban areas) completed the whole treatment episode. The higher effective coverage of tuberculosis treatment in rural China might be explained, in part, by the fact that rural populations are less mobile than their urban counterparts, and thus patient compliance issues in rural areas may be easier to manage. Other studies showed that, although tuberculosis drugs are free in China, patients still had to pay for other related medicines and diagnostic tests during the course of their treatment, a reason that may also explain why many patients failed to complete the appropriate treatment.

How did coverage and its distribution change between 1993 and 2003? Both urban and rural sectors have overall improved coverage of all major interventions (table 3). However, changes seemed to have been non-linear and unstable during the 10 years.

Although inter-provincial inequalities in coverage seemed reduced between 1993 and 2003, as indicated by the decreased coefficient of variation, income-related inequality in composite coverage in terms of rate difference between the lowest and highest income quintile increased only slightly in the urban and rural areas between 1993 and 2003 (table 3). Even though coverage of hospital delivery for women living in rural areas increased from 1993 to 2003, income-related inequality also increased (table 3), showing that serious inequity problems persisted in China, especially in rural China. Moreover, our findings strongly suggest that attention should be paid to China’s inadequate disease prevention programmes. Rates of coverage of immunisation in children aged 0–1 years living in urban and rural areas fell between 1998 and 2003 (table 3), mainly because of rate reduction in the poorest populations. This finding shows a widespread challenge to China’s public-health system in terms of how to provide equitable access to those health interventions that are cost effective, yet non-profitable, to the fee-for-service health-care providers.

Furthermore, the rate of smoking cessation is low and the rate of smoking in men living in rural areas remains high, especially in the poor population. As previously shown, smoking control is not only an important public-health issue for China, but also a poverty-reduction issue. The fact that, in 2004, only 42% and 27% of individuals living in urban and rural areas, respectively, with high blood pressure were aware of their condition draws attention to the absence of health literacy.

We did a multivariate regression analysis to understand which provincial characteristics could explain the differences across provinces in terms of coverage. Explanatory variables included population size, gross domestic product (GDP) per head, dependency ratio (ie, the ratio of the number of dependants [aged 0–14 years and >65 years] to the total working-age population [aged 15–64 years]), urbanisation index, illiteracy rate, healthcare supply, and insurance coverage. We showed that only GDP per head was a significant predictor of both hospital delivery and composite coverage. Another significant predictor (of composite coverage only) was insurance coverage. Figure 2 illustrates the relation between a province’s GDP per head and its hospital delivery rate for the poorest women living in urban areas increased from 1993 to 2003, income-related inequality also increased (table 3), showing that serious inequity problems persisted in China, especially in rural China. Moreover, our findings strongly suggest that attention should be paid to China’s inadequate disease prevention programmes. Rates of coverage of immunisation in children aged 0–1 years living in urban and rural areas fell between 1998 and 2003 (table 3), mainly because of rate reduction in the poorest populations. This finding shows a widespread challenge to China’s public-health system in terms of how to provide equitable access to those health interventions that are cost effective, yet non-profitable, to the fee-for-service health-care providers. Furthermore, the rate of smoking cessation is low and the rate of smoking in men living in rural areas remains high, especially in the poor population. As previously shown, smoking control is not only an important public-health issue for China, but also a poverty-reduction issue. The fact that, in 2004, only 42% and 27% of individuals living in urban and rural areas, respectively, with high blood pressure were aware of their condition draws attention to the absence of health literacy.

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Series

These results support the claim that a strong relation between economic development of a province and its health system coverage exists, which clearly suggests China’s absence of transfer payments to provinces by central government. An article in this Lancet Series by Hu and colleagues provides a detailed discussion about the inadequate and inequitable government financing in China.

Indicators of health-care affordability in China
On the basis of Xu and colleagues’ publications,20,21 we defined a household as having incurred catastrophic medical spending if the family’s total reported out-of-pocket medical expenditure in the past year exceeded 30% of the family’s yearly non-subsistence spending, which equals total household spending minus subsistence food expenditure. Unfortunately, the national health-service survey in 1993 did not obtain information on total household expenditures. Therefore, we were not able to include the data from 1993 in our time analysis on financial risks.

Financial effect of out-of-pocket payments for households cannot be fully captured by measuring catastrophic spending. Because of inability to pay, some people may choose not to seek health care when ill. To identify those individuals who cannot afford health care, we used questions from the China Health Services Survey in 1998 and 2003 on the reasons for: (1) not seeking health care when ill; (2) foregoing admission to hospital recommended by doctors; and (3) self-discharging from the hospital against medical advice. Here, we classify individuals as having affordability problems if they cited inability to pay as the major reason for not seeking health care.

We showed variation of the rate of catastrophic medical spending between rural and urban settings (table 2).
Besides the difference in income, the urban–rural rate difference is also related to the differential insurance coverage of the two populations, with the urban populations having a substantially higher insurance coverage than their rural counterparts. We also showed a wide variation of the rate of catastrophic medical spending in different provinces (table 2). Notably, poor provinces do not always have higher rates of catastrophic medical spending, as one might expect. For example, in Beijing, despite being a high-income city, the rate of catastrophic medical spending is high, whereas in Guizhou, despite being a low-income province, the rate is low. This result is not wholly unexpected, because the extent of catastrophic medical spending is dependent on utilisation rate and price, in addition to income. Low-income regions may have low health-care utilisation rates and low average medical prices, both of which might cause a low probability of catastrophic medical spending.

How did catastrophic medical spending change between 1998 and 2003 in China? The average rate of catastrophic medical spending increased but this rise is entirely attributable to the increased rural rate, because the rate in urban households declined (table 4). Although all income groups in rural China had an increasing rate of catastrophic medical spending, the poorest rural group was the hardest hit. The fraction of rural households in the lowest income quintile that incurred catastrophic medical spending increased from 21·5% in 1998 to 25·7% in 2003.

Although the inter-province inequality in catastrophic spending seemed to have narrowed from 1998 to 2003 (the coefficient of variation decreased), the income-related inequality for rural households increased. Therefore, all indicators point to a worsening financial risk protection for the rural population.

Table 5 shows rates of foregone medical care (outpatient and inpatient) and early hospital discharge due to cost concerns. In 1998, less than 1% of urban and rural residents reported feeling ill during the 2 weeks before interview but did not seek health care because of cost concerns. This trend leads to an estimated yearly rate of 14% for urban and 19% for rural populations. Furthermore, around 1% of the interviewed urban and rural residents reported having refused to be admitted to hospital against medical advice in the year before the interview because of cost concerns. Inability to pay was cited by less than 1% of urban and rural residents for their decision to discharge themselves ahead of schedule in 1998. Overall, 16% of urban and 20% of rural residents reportedly had financial difficulties in accessing health care in 1998. Although urban rate of foregone medical care decreased to 15% in 2003, the rural rate rose to 22% in the same year, explained by 5% increase in foregone outpatient care and 25% rise in early hospital discharge from the rural rate in 1998.

We also showed that the poorest income groups had not only a higher rate of foregone medical care than their better-off counterparts, but also a higher probability of attributing their decision to inability to pay. For example, in 2003, 75% and 83% of poor urban and rural patients who refused to be admitted cited inability to pay as the
Indicators of health and coverage in selected countries and areas in WHO member states

Data are numbers (indicator ranking in all WHO member states), unless otherwise stated. PPP = purchasing power parity. Int $ = the international dollar is a hypothetical unit of currency that has the same value among all WHO member states. Data source: 2007 World Health Statistics.

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Data are numbers (indicator ranking in all WHO member states), unless otherwise stated. PPP = purchasing power parity. Int $ = the international dollar is a hypothetical unit of currency that has the same purchasing power that the US dollar has in the USA at a specific time. DTP3 = diphtheria-tetanus-pertussis vaccine. DOTS = directly observed therapy. TB = tuberculosis. *Data are percentages (indicator ranking among all WHO member states). Data source: 2007 World Health Statistics.

Table 6: Indicators of health and coverage in selected countries and areas in WHO member states

major reason for foregone inpatient care. The income-related inequality in foregone health care and early hospital discharge due to inability to pay had increased for urban residents from 1998 to 2003, whereas it increased only for foregone outpatient care for rural residents during the same period. During 1998 and 2003, however, the rural rate was consistently higher than the urban one.

Discussion

We have done a comprehensive measurement of China’s health-system performance, considering two major variables: health-care delivery (addressing the basic question of whether people in need of certain health interventions receive them), and health-care financing (addressing the basic issue of whether households can afford to pay for the health care they need).

We showed that China’s health system did well for some indicators (eg, delivering maternal and child health services), but not so well for others. For example, the increases in antenatal visit and hospital delivery rates for women living in urban areas between 1993 and 2003 approached the performance of Mexico for skilled birth attendance.13 These rates also increased for women living in rural areas; however, indicators that capture specific quality measures showed that big gaps exist between crude and effective coverage. For example, even though most urban and rural confirmed tuberculosis cases underwent some treatment, only about half of urban and almost 60% of rural patients completed the treatment protocol. Effective control rate of patients with hypertension is even lower: only 12% and 7% of patients with hypertension living in urban and rural areas had their blood pressure lowered to normal values as a result of treatment. China’s future health-system reform programmes should not only aim to expand access to more health-care services, but also ensure and enhance quality of these services.

Indicators of both China’s health status and health-system coverage are not international outliers because of their income (table 6). However, according to a recent study of 23 selected countries that account for around 80% of the total burden of chronic-disease mortality in developing countries, death rates for chronic respiratory disease are highest in China.32 Increasing evidence exists about the cost-effectiveness of tobacco control measures, salt reduction, and use of multidrug regimens for patients at high risk of cardiovascular diseases.33 In this respect, China’s health system seems to be far less advanced than that of other developing countries. For example, in the examination survey only 42% and 27% of people living in urban and rural areas, respectively, with high blood pressure knew about their condition. Moreover, although 45% and 50% of men living in urban and rural areas, respectively, with high blood pressure knew about their condition.

According to our analysis, these inequalities are mainly related to income differentials. Indeed, our multiple regression analysis showed that the only significant predictor of provincial health-system coverage is GDP per head. This finding not only emphasises the fundamental role of wealth in health development, but also indicates a serious absence of effective transfer payment mechanisms between provinces in the health sector on the part of the central government.
With respect to affordability, we measured the rate of both catastrophic medical spending and foregone health care due to inability to pay. According to WHO’s definition (ie, 30% of a household’s capacity to pay), 14% of urban and 16% of rural households incurred catastrophic medical spending in 2003. In other words, catastrophic medical spending affected about 184 million Chinese people—a record that puts China’s health-system performance for financial risk protection among the poorest in the world. A recent study of 89 countries showed that the rate of catastrophic medical spending ranged from zero in the Czech Republic, Slovakia, and the UK to more than 10% in Brazil and Vietnam.

Furthermore, on the basis of the proportion of residents reported having either foregone medical care (outpatient or inpatient) or early hospital discharge due to cost concerns in 2003, we can extrapolate that about 438 million Chinese people had affordability difficulties in 2003. The fact that many people were affected by financial access difficulties might explain both people’s high dissatisfaction rate with the services they received and erosion of trust in the system, as Tang and colleagues discussed in a report about health equity in China. Moreover, the low-income groups were the hardest hit because they had a higher probability not only of not seeking health care when ill, but also of incurring catastrophic medical spending when seeking medical care.

Our analysis has several limitations, which need to be taken into consideration in the interpretation of the findings. First, analysis of the provincial health-system performance is based on four sets of nationally representative survey data, which, although large in terms of sample size, are not always representative of every province. Therefore, our results on benchmarking provinces should be interpreted with caution, and considered as an illustrative example of what can and should be done if more data were available. Second, in most cases we are able to provide only crude rather than effective coverage indicators. For many indicators in this analysis, either no information or only proxies were available to capture the quality of the intervention being delivered. Third, our analysis is based on cross-sectional surveys that are done only every 5 years. Finally, the selection of indicators used in the coverage estimation is opportunistic and does not mirror the changing epidemiological profile of the Chinese population. No information exists on the coverage of interventions for most chronic diseases. Therefore, our measure of coverage is only the first step towards benchmarking performance and needs to be re-estimated once information about coverage of other important interventions becomes available.

We have shown the urgent need for China to construct a more comprehensive nationally and regionally representative dataset (whether a cohort or repeated cross-sections) to be able to monitor and assess health-policy changes properly. In particular, China needs to obtain information on non-personal, public-health interventions, such as seatbelt use and mental-health services. Future studies should also establish a more comprehensive understanding of the major underlying determinants of the health-system performance.

Contributors
YL conceptualised and coordinated analyses and preparation of the paper. EG was mainly responsible for methods and accurate interpretation of data analysis results. KR and JW were primarily responsible for data analysis and tabulation of results. All authors contributed to the final version of the manuscript.

Conflict of interest statement
We declare that we have no conflict of interest. JW served as a Takemi fellow at Harvard School of Public Health (HSPH, MA, USA), funded by the HSPH China Initiative.

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